

REGIONAL STRATEGIES

Regional strategies are applicable across the region, may be led by a county or state entity, and/or likely benefit from ongoing coordination of different entities within the region. Within the regional strategies, the project team has identified priority actions that should be implemented in the near-term.

The strategies identified within the preferred scenario span three overarching approaches, which each entail one or more strategy type:

Policy and governance actions to promote more resilient development and improve coordination across levels of government. Relevant strategy types include:

- Governance and continued coordination
- Zoning and land use policy

Implementable **physical and nature-based infrastructure strategies** such as flood barriers, stormwater infrastructure, and wetland restoration. Relevant strategy types include:

- Adapt or protect critical facilities
- Resilient mobility systems
- Stormwater management
- Coastal resilience
- Resilient transformation of contaminated sites and brownfields

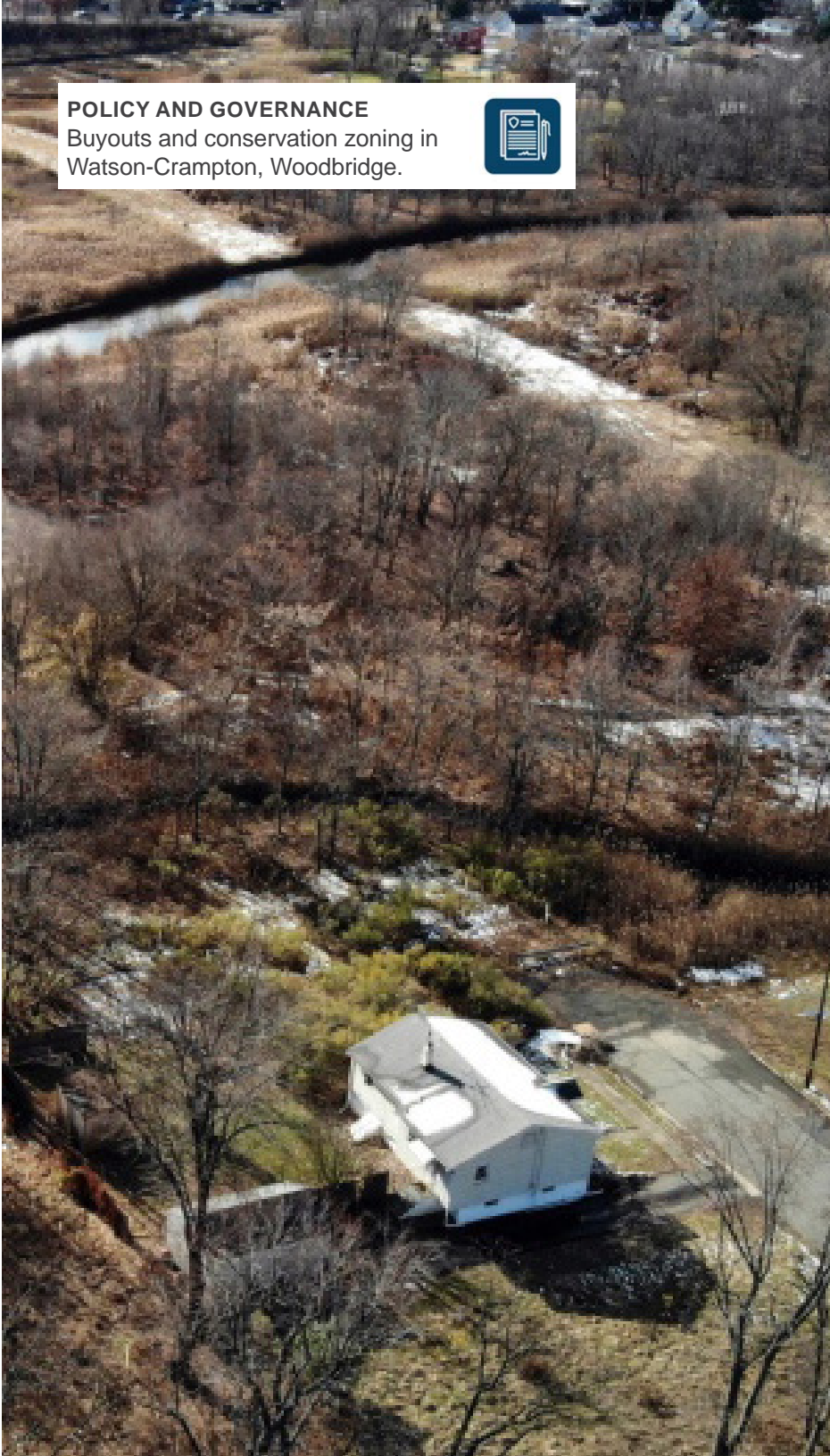
Outreach, education, and capacity building programs to improve flood risk awareness and promote community adaptation. Relevant strategy types include:

- Flood awareness outreach campaigns
- Technical support for property owners

For each strategy type, this Action Plan details the following:

- **Connection to Resilience** – Describes the issues it seeks to address and how strategies of this type generally work towards the regional vision and realize specific protections, risk reductions, and resilience building for flooding and other hazards once implemented
- **Strategies** – Describes specific, actionable strategies within the strategy type and how they can be applied throughout the region
- **Key Considerations** – Provides an overview of environmental, maintenance, regulatory, and other feasibility considerations
- **Co-Benefits** – Describes elements of the strategy type that complement and improve the effectiveness of other strategies and/or realize benefits in addition to flood risk reduction
- **Funding Opportunities** – Lists likely funding and financing sources. *Appendix G* provides a full description of potential funding sources
- **Priority Actions by Lead Entity** – Identifies priority actions and who would be responsible for the implementation and maintenance of each. Priority actions were identified based on stakeholder feedback and immediate resilience needs in the region.

POLICY AND GOVERNANCE
Buyouts and conservation zoning in Watson-Crampton, Woodbridge.



PHYSICAL AND NATURE-BASED INFRASTRUCTURE
Ernest L. Oros Preserve, Woodbridge



OUTREACH, EDUCATION AND CAPACITY BUILDING PROGRAMS
YMCA Perth Amboy





AERIAL VIEW OF PERTH AMBOY AND RARITAN BAY
Image Credit: Via Adobe

POLICY AND GOVERNANCE



A suite of regional policy and governance actions will play a vital role in helping the region transition toward a more resilient and sustainable future, while enabling implementation of coordinated large-scale protect, restore, and transition strategies well into the future.

These types of strategies can serve to minimize growth in highly at-risk areas through strategic buyouts and zoning changes; promote resilient development through updating codes and policies; strengthen lower-risk areas near transit through zoning changes; and promote regional watershed coordination among municipalities and the county. Many of these strategies respond to the concern expressed by residents and other stakeholders about how new development should be consistent with an approach to flood risk management. Policy and governance offer many co-benefits, such as improving public spaces and ecosystems, while also setting a foundation for a more resilient and sustainable long-term growth trajectory.



Connection to Resilience

Within the RRBC region, the vast majority of floodplain management and flood risk reduction is done at the local level. However, flooding does not stop at municipal boundaries. Currently, policies, programs, and projects are led by individual municipalities, are often reactive instead of proactive, and often do not address cross-jurisdictional floodplain management and resilience needs. Community feedback collected throughout the planning process indicated a desire for increased coordination to proactively build resilience across the region. By recognizing and addressing the interdependence of actions across municipalities, the management of floodplains and resilience could be improved. The table below provides examples of potential benefits of coordination at the regional or watershed scale.

The region currently lacks an organized governance framework for advancing policies, programs, and projects that effectively, proactively manage flood risk at a watershed or regional scale. The strategies described below explore ways that various levels of government within RRBC can work together to implement the *Action Plan* effectively and efficiently.

ACTIVITY	POSSIBLE BENEFITS
COORDINATED DEVELOPMENT OF POLICIES AND PROGRAMS	<ul style="list-style-type: none">Consistent application and benefit of floodplain management and resilience policies and practicesPlanning and zoning for equitable upstream and downstream distribution of flood riskCumulative assessment of flood impact of proposed development or rezoningFloodplain ordinance higher standards coordinated across jurisdictions
FLOOD PROTECTION PLANNING AND DESIGN	<ul style="list-style-type: none">Coordinated/participatory planning of federal and state flood management projects and programsNegotiation of cost sharing agreementsEquitable sharing of benefits of floodplain management policies and programs
MAINTENANCE OF FLOOD PROTECTION AND REGIONALLY SIGNIFICANT INFRASTRUCTURE	<ul style="list-style-type: none">Equitable and efficient distribution of costs across benefitting partiesJoint financing of maintenance and improvement projects
WATERSHED/RIVER BASIN FLOOD ANALYSIS AND MAPPING	<ul style="list-style-type: none">Consistent assumptions across and within watersheds for future-condition analysis and mappingGreater certainty related to the effects and benefits of actions in the watershedGreater prediction capabilityAbility to leverage information to improve flood risk reduction

Strategies

Governance is the system by which public entities are directed and controlled. In the RRBC region, governance structures and processes can be optimized to help implement all strategies included in the preferred scenario and proactively reduce risk.

There are several ways different levels of government (local, county, state, regional) can work together within a shared governance structure. In New Jersey, like elsewhere in the country, resilience is a shared responsibility across multiple levels of government. Decisions around floodplain management, land use, and resilience are subject to a hierarchy of rules and regulations at various scales of jurisdiction. The table on page 101 summarizes current responsibilities as they relate to floodplain management, land use, and resilience.

To better understand how alternative governance frameworks could be leveraged to support implementation of the preferred scenario, the project team explored four different courses of action. These courses of action are largely based off case studies of watershed-based planning approaches implemented in other places. They vary in terms of level of effort to implement and allocation of responsibilities among participating entities. *Appendix K* includes a summary of the process undertaken to develop the strategies described below and provides additional detail about each potential course of action.

GOVERNANCE FRAMEWORKS FOR FLOODPLAIN MANAGEMENT

Level Of Effort To Implement

#0 NEW ENTITY

Raritan River and Bay Resilience Commission

High

- Delaware River Basin Commission – like approach
- Continuation and expansion of RNJ initiative
- Established through legislation, new regulatory authority

#1 STATE-LED

NJDEP

Medium

- Louisiana Watershed Initiative – like approach
- Existing and/or expanded regulatory authority

#2 COUNTY-LED

Middlesex County Flood Resilience District

Medium

- King County Flood Control District – like approach
- Special purpose district established through county ordinance

#3 MUNICIPAL-LED

Assorted Approaches

Low

- Formal inter-municipal cooperation
- Memorandum of Understanding, Inter-municipal Agreement, Joint Service Agreement, etc



Although this planning process did not lead to consensus around which course of action should be pursued in RRBC, it did identify broad goals for coordinated regional or watershed-scale governance moving forward. These goals are focused on reducing flood risk, improving resilience through enhanced coordination, building capacity, and empowering communities. Priority actions identified later in this section are near-term steps that can be taken to increase opportunities for coordination and work towards these goals while the discussion around regional or watershed scale governance continues to evolve.

Key Considerations

Each potential course of action has different benefits and challenges. Regardless of the course of action ultimately pursued, the following should be considered to fully realize the potential benefits of a regional or watershed scale governance approach:

- **Political Will** – Political will is critical to the success of any watershed or regional scale governance or coordination. Committed support is required of each participating entity.
- **Core Floodplain Management Responsibilities** – The approach must account for all existing core floodplain management responsibilities. Floodplain management is broadly applied in this context to reflect efforts that reduce flood risk, manage water, and build resilience. These include funding, planning, flood insurance coordination, regulatory authority, technical support & capacity building, project execution, analysis, data and information management, outreach and engagement, and monitoring and

evaluation. The approach should also consider new or expanded floodplain management responsibilities necessary to build resilience in the region.

- **Stormwater Management** – A regional or watershed-scale governance approach may also yield a number of benefits for stormwater management including existing water quantity issues, existing water quality issues, or water quality and quantity issues that may be caused by future development. Regional stormwater management and planning can result in regulations and recommendations that are tailored to meet the needs of a region, watershed, or drainage area. NJDEP developed guidance for regional stormwater management planning which is available [here](#). The guidance emphasizes the importance of collaboration in the development of a successful regional approach. Regional or watershed-scale governance in RRBC could be leveraged to address floodplain management, stormwater management, or both.
- **Implementation** – There should be a clear rationale or impetus for entities to participate. Goals and metrics for success should be developed to guide the watershed or regional approach. The structure of the governance framework applied should follow its desired function and efficiently distribute the identified floodplain management responsibilities. There should be a robust understanding of how the new framework either supports or supersedes existing roles and responsibilities.
- **Enforcement and Compliance** – Action on the watershed or regional scale may require enabling legislation or policy. There should

be a clear understanding of which entity or entities are responsible for enforcement and compliance. Penalties for non-compliance and benefits for compliance can be used to encourage active participation.

- **Accountability and Authority** – A single entity should be identified as responsible for coordination on the watershed or regional approach. Responsibilities for each participating entity should be clearly defined and reflect an established hierarchy of authority.
- **Resources and Funding** – Established source(s) for funding, resources, staff, and staff time should be identified. Allocation of funding and other resources among participating entities should be transparent.
- **Maintenance** – As the needs of the region and understanding of future hazards evolve, coordination efforts and governance frameworks should as well. Coordination efforts and related policies should be regularly evaluated and updated to ensure that they are meeting the needs of the region.

Co-benefits

There is the potential for coordination to benefit all subsequent strategies recommended in this plan. Further, there is a benefit to continued coordination of the Resilient NJ RRBC Steering Committee, regardless of whether a formal watershed or regional scale governance approach is undertaken. Co-benefits, or benefits that are not directly related to flood risk reduction, include:

- Tackling flood risk at a regional scale can realize efficiencies of scale. This may result in

more funding and other resources to address other issues within the region

- Enhanced open space networks and improved water quality
- Capacity building and information and resource sharing between entities
- A watershed or regional scale governance approach can be leveraged to meet ongoing data needs to advance resilience. This may include improved mapping of inland creeks not covered by FEMA or NJDEP and/or development of regional future-condition analysis and mapping

Funding Opportunities

- **Federal Emergency Management Agency (FEMA) Building Resilient Infrastructure & Communities (BRIC)** – FEMA's annual grant program funds capability and capacity building activities such as evaluating and adopting updated building codes, partnership network analysis, partnership development activities, and other planning activities.
- **NJDEP Water Quality Restoration Grants, Nonpoint Source Pollution** – State funding is available for water quality and watershed planning.

Priority Actions

Actions below are priority actions that can be taken in the near- or MID TERM to advance governance and coordination. For a full list of recommended actions, see the *Implementation Roadmap* section.

STATE	<ul style="list-style-type: none">• Regular follow-up regarding implementation progress and opportunities for State support• Expanded resilience resources available to counties and municipalities• Coordinate with State agencies on implementing projects identified in the plan• Track progress of recommendations to state agencies• Communicate flood risk and evolving climate science, in partnership with NGOs
RESILIENT RRBC	<ul style="list-style-type: none">• Prioritize <i>Action Plan</i> recommendations• Identification of priority collective action to demonstrate proof of concept and benefits of coordination• Track progress of recommendations for county and municipal actions• Support ongoing regional coordination on plan implementation
LOCAL- ALL MUNICIPALITIES	<ul style="list-style-type: none">• Provide comments on NJPACT rules• Provide updates on implementation of projects recommended in the plan• Identify opportunities for inter-municipal agreements
YMCA's / OTHER NGOs	<ul style="list-style-type: none">• Partner with the academic community and community-based organizations to conduct localized studies and public health screenings of present-day vulnerabilities to and impacts of extreme heat and poor air quality

HOW TO INTEGRATE ADDITIONAL CLIMATE HAZARDS INTO GOVERNANCE

Depending on the governance framework and course of action undertaken for a watershed-based approach, there are many ways to build additional climate hazards into these structures. Most of the below strategies would benefit most from implementation at a statewide or regional scale, though many could also be implemented at a county or municipal level. Some of these solutions also include partnerships with regional environmental and community-based organizations and/or academic and research organizations.

- **Enhance regional planning and coordination around additional hazards.** This could include regional coordination around large-scale ecosystem-based adaptation projects; regional goals to support local planning for accessible, equitable public and multi-modal transportation infrastructure; programs associated with reclaimed water for beneficial reuse (RWBR); development of a regional drought early warning system (DEWS) that includes New Jersey; updating the Strategic Management Plan for Invasive Species to reflect best-available data on climate change-related impacts; and identifying key stakeholders and advancing ocean acidification initiatives.
- **Partner with the research community to gather best-available, publicly accessible regional data and develop models and projections of future risk for additional hazards to aid in decision-making.** High priority data gathering needs include a current water table elevation map for the region, a comprehensive contaminant source inventory that details depth and water-solubility of contaminants, a database of household access to and lack of air conditioning data, asthma prevalence data (in coordination with the CDC), an inventory of wildfire fuel sources, and data on water losses and efficiency (i.e., via physical and financial audits). High priority regional modeling and projections needs include projected future changes in depth-to-groundwater with sea level rise, additional groundwater modeling where high-risk conditions exist to help forecast contamination plumes, projections of future high-risk Lyme disease contraction areas and West Nile Virus risk areas, High Resolution Rapid refresh 48-hour severe weather and PM2.5 transport plume forecasting, and ocean acidification monitoring with projected changes in ocean carbon cycles and changes in regional marine species populations and habitat.
- **Work with environmental justice groups to initiate an accessible, regional program to incentivize mitigating and sustainable practices.** Such programs can be used to incentivize widespread private action to

address a multitude of additional climate hazards, ranging from large businesses and landowners to small residential property owners. These programs can include incentives for heat-mitigating strategies, such as green roofs, cool (high albedo) roofs, façades and glass glazing with low U-values (e.g., triple-pane or triple-glazed glass), and sun control and exterior shading features; outdoor heat mitigation and landscaping features; actions that would reduce vehicular emissions, such as car-sharing and private investment in vehicle charging stations; residential and commercial indoor and outdoor water conservation retrofits and practices, such as water audits, low-flow fixture and plumbing retrofits, limitations on irrigable acreage, and water-efficient appliances; encouraging rainwater collection practices; hazardous site remediation efforts that include elimination of stagnant water sources and/or maintenance and drainage of surface water to prevent development of adult mosquitoes; cost-sharing and technical assistance to private landowners for forest stand improvement practices and wildlife habitat improvements; and installation of noncombustible screens (e.g., over attic vents), safe storage of propane tanks, and access to water for firefighters to address wildfire risk.

- **Initiate universal public programs to distribute risk-mitigating resources and technical assistance.** This could involve distribution of air conditioners; clean energy technology and transportation subsidies; distribution of residential water quality test kits and emergency at-home water filtration systems; provision of soil moisture or rain sensors and smart controllers for irrigation efficiency for agricultural workers; distribution of bug sprays, window and door screen protections, and tickscape resources; and installation assistance. Minimizing barriers to access by implementing unconditional programs ensures such programs will reach the highest-priority populations—environmental justice communities and other under-resourced populations. This could be paired with a public health hotline for extreme heat, poor air quality, and poor water quality.
- **Investigate tying water conservation rate structures to water utilities.** Water conservation rate structures would be tied to public water utilities based on the amount of water volume consumed as a method of reducing water demand during (or preempting) droughts to mitigate the risk of water shortages. This could be seasonal and be based on allowances/thresholds or involve decoupling water utility sales from earnings/profits, as recommended in the 2017-2022 NJ Water Supply Plan. Any such structure must be equitable and be designed to not burden low-income households.



GARDEN STATE PARKWAY OVER RARITAN RIVER
Image Credit: Ungvar Via Adobe



Connection to Resilience

There are many ways in which land use tools, such as zoning, planning, and development ordinances can be used to promote resilience to flooding. One of the most important tools is to incorporate consideration of climate change into existing standards and codes at the federal, state, and local scale. These standards are important to promote the design of new construction that is safe for residents, minimize flood damage to property, and minimize flood impacts on adjacent sites.

The Federal Emergency Management Agency (FEMA) sets national minimum floodplain construction standards for communities that participate in the National Flood Insurance Program, however the maps these standards are based on do not incorporate climate change, nor do they include mapping of smaller inland waterbodies, or urban stormwater flooding. FEMA also administers the Community Rating System (CRS), which provides insurance discounts in communities that adopt higher floodplain management standards.

At the state level, the Department of Environmental Protection (NJDEP) develops and enforces rules relating to permitting regulated activity in environmentally sensitive areas, including floodplains. NJDEP promulgates model stormwater management and flood damage prevention ordinances and develops statewide floodplain construction standards. These are incorporated into statewide construction codes. NJDEP is in the process of reviewing these standards to incorporate consideration of climate change—an important step in promoting more resilient new construction.

Local municipalities are required to adopt local floodplain management and stormwater management ordinances. While each municipality must comply with statewide standards, municipalities can also go above and beyond statewide standards to promote more resilient development and receive lower flood insurance rates through the CRS, as described above. Land use is regulated by local municipalities through development of master plans, zoning, and redevelopment plans.

In addition to codes and standards that apply to all new construction regardless of location, land use policies and tools like zoning can be used to manage the location and use of new development to align with resilience goals. The suitable approach for each area will vary depending on land use and environmental characteristics, as well as community desires and goals. Zoning can be used to direct growth away from areas of high flood risk and towards areas of lower flood risk. Limiting density in high hazard areas can lead to less risky future development, which reduces the impact of future flood events. Limiting density may not always be feasible or desirable in some areas at-risk that are already substantially built up and have existing infrastructure—and in fact concentrating growth in areas where there is good transit access can have a positive impact on mitigating climate change. In areas where there is substantial flood risk, particularly from future inundation from daily tides, and where it is consistent with other land use goals, limiting future density through zoning and other tools is an important tool to promote more resilient land use patterns over time. This strategy is particularly effective when paired with buyouts and the reuse of buyout properties for open space and passive recreation—as shown by the case

study of the Watson and Crampton neighborhood in Woodbridge.

After Hurricane Sandy, hundreds of properties in the region were bought out through the NJDEP Blue Acres Program. The program was particularly popular in the South River Watershed and Woodbridge. Feedback from South River and Sayreville has been that many of the homes that were most vulnerable were bought out with a few remaining. Post-Hurricane Sandy, the scale of the devastation made property buyouts politically feasible. However, absent the reactive disaster response situation, buyouts may be more difficult to execute and may not have robust political support. In a proactive situation where the flood risk is seen as more hypothetical than actual, it may be difficult to even consider substantial property buyouts. The modeling work that the Resilient NJ team has done shows that additional properties will likely be subject to inundation in the future with rising sea levels and changing precipitation patterns. Some of these properties may not have a history of flood damage and may not appear to be in danger today. However, with a longer time horizon, it may be beneficial to consider proactive approaches to easing structures and development out of the future inundation zones.

For other areas within the region at-risk from flooding, a resilient land use strategy can include the use of redevelopment to set higher standards for new development and incorporate resilience infrastructure into the redevelopment areas for the benefit of the new development as well as surrounding neighborhoods.

Before developing new local ordinances to restrict development, incorporating resilience into a redevelopment plan, or increasing density

outside the floodplain, municipalities should explore these issues as part of a Master Plan Reexamination Report and a Land Use Element update with the required climate change and resilience assessments. The Master Plan process can establish a basis for rezonings, and the new climate change assessment requirements can potentially support zoning recommendations.

AGENCY

CURRENT RESPONSIBILITIES

FEDERAL



- Creates maps of current flood risk and sets national minimum floodplain construction standards
- Administers the National Flood Insurance Program (NFIP), through which people in participating municipalities can purchase flood insurance. Reduced rates are available through the Community Rating System (CRS) for municipalities that adopt higher construction standards

STATE



- Develops floodplain construction standards and stormwater management model local ordinances
- Develops and enforces statewide construction codes
- Maps watershed management areas
- In process of updating rules and regulations to address climate change (NJPACT)

COUNTY



- Site plan and subdivision standards for development that impacts County assets

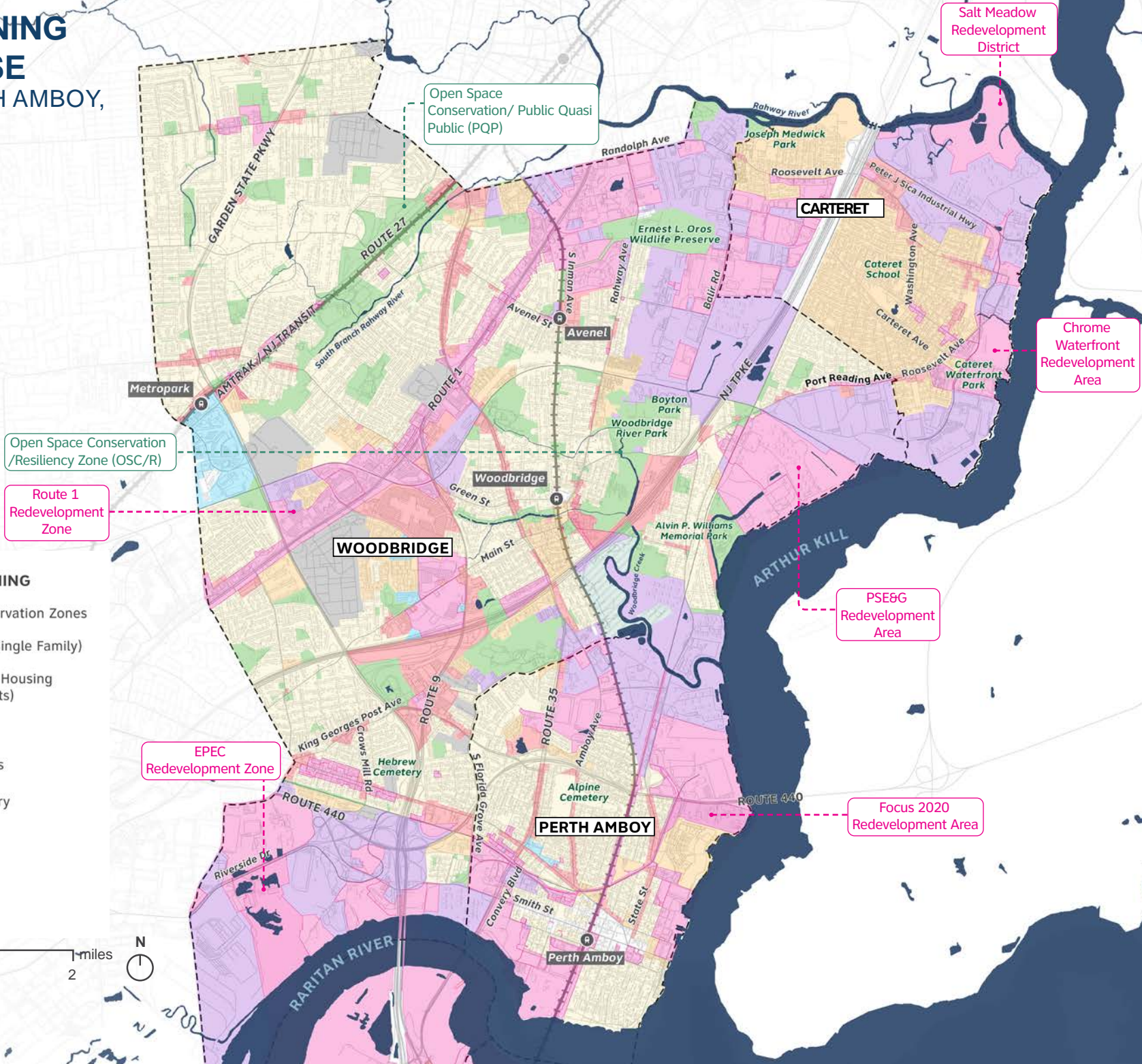
LOCAL

- Local zoning and ordinances
- Master plans
- Redevelopment plans
- Required to have Flood Damage Prevention Ordinances and Municipal Separate Storm System (MS4) “Stormwater Management” plans

EXISTING ZONING
AND LAND USE
CARTERET, PERTH AMBOY,
WOODBIDGE

BASEMAP - EXISTING ZONING

- Open Space and Conservation Zones
- Low Density Housing (Single Family)
- Medium - High Density Housing (Multi-family, apartments)
- Commercial
- Institutional and Offices
- Light and Heavy Industry
- Redevelopment Areas
- Water bodies
- Municipal Boundary



EXISTING ZONING
AND LAND USE
SAYREVILLE, SOUTH AMBOY,
SOUTH RIVER, OLD BRIDGE

Parks, Open Space, Recreation & Conservation District (PR)

Parks, Open Space, Recreation & Conservation District (PR)

Environmentally Sensitive/Recreation (ER)





Strategies

There are many opportunities, some complex and some straightforward, to use zoning and land use policy tools to promote a more resilient region over the long-term. This includes continuation of existing tools to preserve natural systems and features that contribute to reducing regional flood risk, offering additional voluntary buyouts in areas of high flood risk, and using zoning and redevelopment tools to direct growth as part of a strategy to increase resilience.

» Protect and preserve open space

While many sections of the region are substantially built out, the RRBC region still possesses undeveloped open space, including forests and wetlands, that should continue to be preserved into the future. Wetlands serve as important buffers to coastal storms and serve as critical habitats. Green spaces in general can also help offset urban heat island effects.

Open space can be preserved through zoning ordinances (as discussed below), as well as through the acquisition of privately owned properties. The NJ Green Acres program managed by NJDEP provides funding for municipalities to acquire and improve open space for preservation purposes.

» Limit Development and Reduce Density in High Risk Areas

Zoning designations, such as Woodbridge’s Open

Space Conservation/Resiliency Zoning (OSC/R), can be expanded into other areas throughout the region to reduce density in areas with high flood risk, and where there is community support for growth limitations.

In South River, a patchwork of properties was bought out through the Blue Acres program following Hurricane Sandy, though there are a few pockets of properties remaining south of Causeway St. near the South River, as well as along Maple St. north of Reid Street. Existing zoning in these areas leaves some potential for future development and redevelopment. Portions of these neighborhoods will be impacted by future daily tidal flooding and are at risk from storm surge and heavy rainfall flooding. Extension of OSC/R zoning into these areas can help limit future growth. The area near Causeway St. and along the South River should also allow for marinas and other small or temporary structures to promote waterfront access.

On the Sayreville side of the South River, dozens of homes were also bought out through the Blue Acres program along MacArthur and Weber. While there is not significant interest in additional buyouts in the area at this time, future buyouts may make sense in this area. Extension of OSC/R zoning into this neighborhood can help limit future growth on sites that were not bought out but have a similar risk profile to those that were.

In both Sayreville and South River, sites that were bought out through Blue Acres have had minimal improvements beyond regular mowing. Pursuing grants to improve these areas as passive recreational space or community gardens could enhance the sites as amenities for residents and visitors.

Critical Area Ordinance

Another zoning tool to limit density to reduce flood risk and preserve natural features is the use of critical area ordinances. Critical area ordinances define sensitive environmental features as critical areas and exclude them from density, building coverage, impervious coverage, and other calculations. Critical areas may include wetlands, wetland transition areas, steep slopes of 15% or greater, threatened and endangered species habitat, flood hazard areas, riparian areas, and other locally significant measures.

An example in practice: A 10-acre parcel is encumbered by 2 acres of flood hazard area. In the zoning district 50% impervious coverage is permitted, and 25% building coverage is permitted. Rather than calculate the permissible coverage based on the entire 10-acre parcel, the 2 acres of “critical areas” are removed and the calculations are conducted using the remaining 8 unencumbered acres (10 acres x 50% Impervious coverage = a maximum impervious coverage of 5 acres; when the critical area ordinance is applied, 8 acres x 50% = a maximum impervious coverage of 4 acres).

In addition, portions of Woodbridge near the South Branch of the Rahway River and the Pumpkin Patch Brook may benefit from extensions of the Township’s OSC/R Zoning in response to recent flooding events.

» Incorporate resilience into redevelopment plans

Redevelopment plans are powerful tools that municipalities can use to set specific design controls within an area experiencing redevelopment. They can be used to incorporate higher standards for floodplain construction and/or stormwater management and require the construction of resilience infrastructure such as stormwater storage, green infrastructure, and coastal protection.

The waterfront portions of South Amboy, Perth Amboy, Woodbridge, and Carteret are largely occupied by redevelopment areas. Portions of the Arthur Kill area have been built-out with new redevelopment projects, many of which have incorporated resilience measures. For the areas across the region that have not yet been redeveloped, including properties that may become future redevelopment areas, the following should be considered:

Incorporation of coastal protection and drainage improvement into all redevelopment projects. Where area-wide projects are planned, dedication of land and pro-rata contributions from redevelopers should be considered to facilitate these efforts.

- Perth Amboy currently requires that property be provided as part of redevelopment projects to create a contiguous waterfront walkway along the Arthur Kill. Where feasible, similar requirements can be incorporated into other redevelopment plans within the region.
- In some areas, particularly in Woodbridge, there may be security or safety concerns about providing waterfront public access, so

a walkway may not be appropriate. However, requiring that space be set-aside for future infrastructure improvements may be a beneficial tool in the redevelopment process.

- In Old Bridge, potential redevelopment planning for the Laurence Harbor Area should consider ensuring that sufficient space is provided for flood storage, and that more intense land uses, such as higher density residential, are concentrated outside the flood hazard area.
- The Chrome Waterfront Redevelopment Area in Carteret may benefit from review and amendment to provide space around the mouth of Noe’s Creek for flood mitigation and resilience projects.

» Create development opportunities in low-risk areas

This region is growing as demand for new housing and commercial spaces, especially warehousing, is high. Directing this growth as much as possible to areas with lower flood risk will improve the long-term safety and resilience of the region. Areas identified below are outside of the areas identified as exposed to a future coastal storm and with minimal localized flooding from a future heavy rainfall event, with some specific vulnerabilities noted below.

In Carteret, there are existing development opportunities available through the Federal Boulevard Redevelopment Plan which encompasses a mix of parcels that have been redeveloped for warehousing, distribution, or light industrial uses, and parcels that still have

redevelopment potential. This area can support additional development in lower risk areas.

In Old Bridge, there are existing development opportunities available under existing zoning in the Browntown/Brownville Town Center Districts at the junction of County Routes 516 and 687 near Route 9. A tributary of Tennent Brook runs through this area, and any new development should be located on higher ground set back from the brook. There are additional opportunities for growth under existing zoning north along Route 9 with minimal flood risk, such as near Perrine and Poor Farm Roads, and at Schulmeister Road. There are also longer-term opportunities that would require zoning changes along Route 9—redevelopment of the Park and Ride at Ivernerness Road to structured parking with additional uses, and full or partial redevelopment of the Acme Shopping Center at Route 9 and Ferry Road. Depending on the long-term vitality of the commercial office market, portions of the existing office and retail developments may be appropriate for mixed-use redevelopment near exit 120 of the Garden State Parkway.

In Sayreville, the Riverton development represents the largest current development opportunity within the Borough. While portions of the development site are vulnerable to coastal flooding, the site is being significantly elevated. Preliminary approvals are in place. There are longer-term opportunities for growth along the Route 35 Corridor north of the Cheesequake Creek outside the flood hazard area—the current B-3 Zoning and development patterns have created a patchwork of uses and lot sizes along the corridor. Several new development projects have been approved, but future targeted redevelopment and potential lot consolidation could



provide additional development potential along the highway and relatively close to the South Amboy train station.

In Perth Amboy, the 2nd Street Corridor represents an opportunity for transformation from auto-oriented and light-industrial uses to mixed-use or residential development near the train station. The zone was identified in the Focus 2020 Redevelopment Plan. Longer term, there are potential opportunities for growth around the train station, including the several substantial surface parking lots and under-utilized parcels in the C-2 Business District. The C-1 Business District on the west side of the train tracks may be able to support additional transit-oriented development potential.

In Woodbridge, there are existing development opportunities under existing zoning in the Rehabilitation Areas near the Woodbridge Train Station. Redevelopment planning is also underway for the Metro Park Area. Introducing a mix of uses can capitalize on the train station and improve the overall vitality of the area. Long-term, office market trends may lead to additional redevelopment possibilities. Development here, however, should be set back as much as possible from the tributary of the South Branch of the Rahway River that intersects the area, and development should be elevated above projected flood levels. The Route 1 corridor in Woodbridge is also a potential opportunity for increased density over the long term. Large commercial and office strips may become appropriate for mixed-use redevelopment as trends evolve. Residential uses have been introduced at Woodbridge Center Mall and behind some of the Route 1-fronting commercial properties near the Garden State Parkway. Evolution of the corridor may reveal additional redevelopment opportunities.

» Update local codes and standards

Local and state codes should be updated to increase design standards for both floodplain management and stormwater management. New development in flood-prone areas should be required to mitigate and minimize flood risk.

All municipalities in the region should amend their flood damage prevention ordinances to reflect the 2021 release of the new “code compliant” model. Municipalities should also explore incorporating higher standards such as:

- Requiring elevation certificate prior to issuing a Certificate of Occupancy.
- Requiring disclosure of flood hazard to renters as part of property registration.
- Requiring disclosure of flood hazard during property transfer through a recorded deed notice.
- Limiting outdoor storage of materials in flood hazard areas (unenclosed and/or hazardous materials)
- Setting specific standards for cumulative substantial improvements, and/or lower substantial improvement threshold.
- Requiring application of the standards in the 0.2% annual chance, or 500-year, floodplain.

Each municipality’s stormwater management ordinance is up to date with the most recent state model code. However, municipalities should explore incorporating higher standards such as:

- Lowering the threshold for “major development.” Major developments are currently defined as the disturbance of one or more acres, the creation of one-quarter acre

or more of “regulated impervious surface,” the creation of one-quarter acre or more of “regulated motor vehicle surface” or a combination of regulated surfaces that totals one-quarter acre or more. The thresholds could be modified at the local level to require stormwater management for smaller projects such as one-half acre of disturbance (instead of one acre) or 5,000 square feet of regulated impervious surface (instead of one-quarter acre, which equals 10,890 square feet).

- Creating minor development definition to help mitigate the cumulative impacts of smaller developments
- Modifying the water quality or water quantity criteria to require additional treatment and/or storage
- Redefining pre-construction condition to recognize historical green spaces
- Implementing a green-first best management practice (BMP) hierarchy. A BMP hierarchy could be created to specify certain practices that must be used to the maximum extent practicable prior to using other types of practices. For example, a green-first hierarchy would have vegetated practices in the first tier, while other non-vegetated practices are in lower tiers. The practice hierarchy should be accompanied by detailed criteria on how applicants demonstrate that practices in higher tiers were used to the maximum extent.

In addition, zoning tools could be explored to improve stormwater management, such as minimum green area ratios, requirements for green/solar roofs, or blue roofs. Sewer connection permits can also be used to set maximum allowable discharge rates along with requirements for green infrastructure to meet requirements.

TRANSFER OF DEVELOPMENT RIGHTS (TDR)

A Transfer of Development Rights (TDR) program is one strategy that can be used to distribute growth away from one area and towards another. The Municipal Land Use Law authorizes municipalities to establish TDR programs. The law states: the State is “faced with the challenge of accommodating vital growth while maintaining environmental integrity [and] preserving natural resources.”

Municipalities can create a TDR program within their borders that establishes sending areas (sensitive environmental or natural areas where land will be conserved, and development rights “sent” elsewhere) and receiving areas (locations that can accommodate additional growth or density of development that can “receive” the development potential from the sending areas.) Inter-municipal programs are also authorized whereby multiple towns can jointly establish TDR sending and receiving areas.

The only inter-municipal TDR programs in effect in NJ today are in the Pinelands and Highlands regions. Separate regional bodies administer the programs and facilitate the transfer of development credits and the accompanying preservation and density increases. An inter-municipal program outside of these established planning regions will have governance challenges. Another regional entity, such as the County could be assist with facilitation, but there is no formal statutory basis for such a governance model. The most logical approach could be coordination through a state-level agency to facilitate the synchronization of various municipal plans and the structure of the TDR model. While such a program could be beneficial to this region as way to direct growth away from higher risk areas and towards lower risk areas; there are several challenges to implementing such a program:

- Resources to undertake the foundational work. A great deal of planning and analysis needs to be undertaken to implement a TDR program.
- Difficulty identifying appropriate receiving zones within the municipalities. Generally, towns are already zoned for a mix of growth and conservation.
- A region-wide approach would be best for the program, as TDR is easier to implement over a larger area, but the distribution of tax ratables and the potential shifting of affordable housing obligations would make the program difficult to design and likely hard to support politically.
- Statewide, the best example of a mature and active TDR program is in the Pinelands where 50+ towns are involved, there are established sending and receiving zones, a bank structure facilitates the transfer, and municipalities cannot opt-out of the regional Comprehensive Management Plan. The mandated participation and region-wide level of control present in the Pinelands does not currently exist elsewhere.
- A regional TDR program was discussed as potential tool with the steering committee but more discussion and analysis is needed to determine sending and receiving zones.



Case Study: Pinelands Region

The TDR program within the Pinelands Region is a mandatory part of the Comprehensive Management Plan that defines region-wide sending and receiving areas. The Pinelands Development Credit program has preserved over 55,000 acres of land as of mid-2021. The Pinelands Development Credit Bank, a separate entity with offices at the Pinelands Commission headquarters is responsible for administering the program. From January 2021 through April 14, 2022, 156 “development rights” were sold with a total value of \$2,517,200. The program remains a viable means to preserve land and allocated development in areas that can support it throughout the Pinelands Region.



WOODBIDGE CREEK & WATSON CRAMPTON NEIGHBORHOOD, WOODBRIDGE NJ
Image Credit: Associated Press

Case Study: Woodbridge Watson-Crampton Neighborhood Buyouts and Rezoning

Woodbridge, NJ

Following the devastation from Hurricane Sandy in 2012, the Woodbridge of Township was designated a community in need of Blue Acres Program assistance. The Blue Acres Program provides an option for willing homeowners to sell their Sandy-damaged homes. The homes are demolished, and the land is permanently preserved as open space. Within the Watson-Crampton neighborhood, nearly 150 homeowners participated in the program and the township has been in the process of removing roads and restoring the land to provide open space and habitat. The township has planted native grasses and trees and developed a walking trail throughout the area.

Woodbridge rezoned the area from residential to an open space conservation/resiliency zone, where the only permitted uses are unimproved open space and existing residential structures. New construction is not permitted. The intent is to encourage the removal of all structures from the area and to return the zone to a natural state with resilience enhancements. The following building design standards apply whenever demolition, addition, reconstruction, renovation, sale, or conveyance of the property, or change in tenancy takes place, with exemptions for “ordinary maintenance” as defined in the Zoning Ordinance.

1. Structures shall be elevated to FEMA standards. The top of the lowest floor must be elevated at least one foot above the base flood elevation.
2. All structures must be properly anchored to resist collapse, flotation, and lateral movement.
3. Homes can be elevated on perimeter foundation walls, or on piles, piers, or columns.
4. Valves shall be placed on the building’s sewage line to prevent backflow during storm events.
5. Flood vents are required for foundation walls.

6. Utilities including mechanical equipment such as generators, HVAC systems, electrical, heating, air-conditioning equipment, plumbing, etc. shall be located above the base flood elevation.
7. Basements are not permitted. Enclosed areas below elevated structures (below lowest floor) are permitted to be used only for parking, building access, and storage.
8. Flood damage-resistant construction materials shall be used below the base flood elevation.

The Ordinance also includes requirements to reduce the width of existing roadways in the open space conservation/resiliency zone, landscaping according to the Floodplain Restoration Plan, and registration of properties with the Township.



Buyouts and conservation zoning in Watson-Crampton neighborhood, Woodbridge.



Key Considerations

The zoning and land use policy proposals in this *Action Plan* are based on assessment of flood risk, investigation of existing land uses, and input from local officials and residents. However, any zoning or policy change requires additional investigation and stakeholder outreach. Land use changes specifically should be considered as part of a master planning process that takes into account a wide array of land use concerns and integrates input from involved stakeholders and residents who will be impacted. Beyond flood risk, the following considerations should be part of any decision on policy changes.

- **Implementation Process** – Regulatory changes require adoption by state or local legislative bodies. Before adoption, it is necessary to develop proposed rules, get stakeholder feedback, and, if necessary, make modifications. This process can be time consuming and politically challenging, particularly if there is resistance to proposed changes. Doing outreach to explain the intent behind the changes and how they will work in practice is important to offset any concerns.
- **Ease of Interpretation and Enforcement** – Regulations need to be clearly understandable to those responsible for meeting them, and for those enforcing them. Information on applicable standards needs to be readily available to practitioners. There must also be mechanisms for enforcing all aspects of a regulation.
- **Costs of Higher Standards** – Research has shown that higher standards do not present significant incremental costs to development.

Co-benefits

- Increasing density outside of the floodplain can have numerous co-benefits including economic development and meeting housing demand.
- Limiting density and buying out properties also has numerous co-benefits including improving ecology, protecting habitats, improving water quality, and creating recreational opportunities. Increased green space can also reduce the impact of urban heat island.
- Incorporating higher standards into development can reduce flood insurance premiums for property owners and adopting higher standards can qualify municipalities for increased rating under the Community Rating System. Through this system, municipalities can lower the flood insurance rates for property owners within their town.

Funding Opportunities

- **NJDEP Blue Acres** – State-run, voluntary buyout program of homes subject to repeated flooding or heavily. Homes are demolished and the property can be used as open space or flood storage
- **NJDEP Green Acres** – State administered program dedicated to protecting open space and providing outdoor recreational facilities through land acquisition and funding to local governments and nonprofits.
- **Federal Emergency Management Agency (FEMA) Building Resilient Infrastructure & Communities (BRIC)** – Through NJOEM, FEMA offers grants for building code updates that enhance resilience
- **Garden State Commercial Property Assessed Clean Energy (C-PACE)** – with guidance expected in Summer 2022, this program will provide financing of eligible commercial renewable energy, water efficiency projects in participating municipalities
- **US Department of Energy, Energy Efficiency and Renewable Energy** – Bipartisan Infrastructure Law funded competitive grant program to enable States or regional partnerships to provide sustained, cost-effective implementation of updated building energy codes to save customers money on their energy bills.

Priority Actions

Actions below are priority actions that can be taken in the near- or MID TERM to advance implementation of more resilient zoning and land use. For a full list of recommended actions, see the *Implementation Roadmap* section.

STATE	<ul style="list-style-type: none">• Update state codes and standards to reflect climate change (NJPACT)• Communicate code changes to municipalities, developers, and residents• Expand State technical assistance to support local code changes and Community Rating System (CRS) participation• Advocate for improved flood disclosure laws statewide
RESILIENT RRBC	<ul style="list-style-type: none">• Provide expanded technical assistance to support local code changes and CRS participation (e.g., continuation of CRS user group)• Provide comments on NJPACT rules
LOCAL (ALL MUNICIPALITIES)	<ul style="list-style-type: none">• Provide comments on NJPACT rules• Update the Flood Hazard/ Flood Damage prevention ordinance to incorporate best practices in the latest NJDEP Model Ordinances. Explore opportunities to include higher standards such as requirement of an elevation certificate, limited outdoor storage of materials in flood hazard areas, standards for cumulative substantial improvements and/or lower substantial improvement threshold, and/or application of standards in the 0.2% annual chance floodplain.• Incorporate higher standards into stormwater management ordinance including lowering the threshold for “major development,” defining “minor development” to mitigate the impacts of smaller projects, redefine “regulated impervious surface,” require more distribution of stormwater management best management practices throughout developments by lowering maximum contributory drainage areas, require enhanced on-site groundwater recharge

RESILIENT ZONING AND LAND USE
CARTERET, PERTH AMBOY, WOODBRIDGE

See Summary Table of Recommended Actions starting on page 223 for additional details on all actions.

LEGEND

POTENTIAL ZONING AND LAND USE

1. Protect and preserve open space and natural features that reduce flood risk

Preserve existing Open Space / Conservation Zones, Green and Blue Acres properties)

2. Manage growth & limit development in flood-prone areas

Expand local conservation/open space zones and ordinances (ER, OSCR, OS-C/OS-R, PR)*

Strategic buyouts in high risk areas

3. Set resilient redevelopment standards in flood-prone areas

Resilient waterfront redevelopment areas - light industrial use and warehousing

Resilient waterfront redevelopment areas - mixed-use residential

4. Create development opportunities in low flood risk areas

Enable greater density/floor area in low flood risk areas near transit

* ER - Environmentally Sensitive/Recreation
OS-C/R - Open Space Conservation/Resiliency Zone
POP - Open Space Conservation/Public Quasi Public
PR- Parks, Open Space, Recreation & Conservation

BASEMAP - EXISTING ZONING

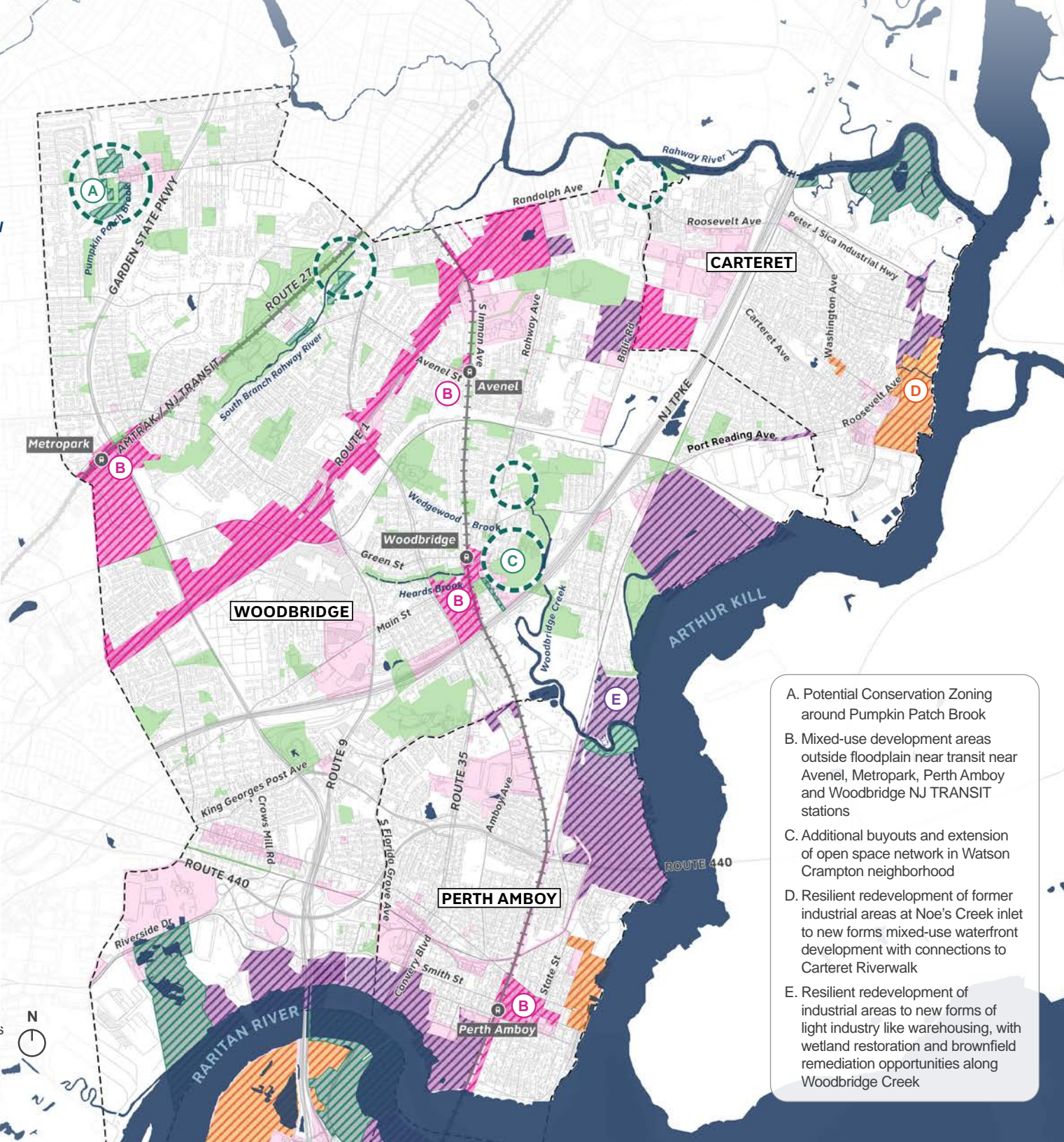
Open Space and Conservation Zones

Redevelopment Areas

Water bodies

Municipal Boundary

0 0.5 1



- A. Potential Conservation Zoning around Pumpkin Patch Brook
- B. Mixed-use development areas outside floodplain near transit near Avenel, Metropark, Perth Amboy and Woodbridge NJ TRANSIT stations
- C. Additional buyouts and extension of open space network in Watson Crampton neighborhood
- D. Resilient redevelopment of former industrial areas at Noe's Creek inlet to new forms mixed-use waterfront development with connections to Carteret Riverwalk
- E. Resilient redevelopment of industrial areas to new forms of light industry like warehousing, with wetland restoration and brownfield remediation opportunities along Woodbridge Creek

RESILIENT ZONING AND LAND USE
SAYREVILLE, SOUTH AMBOY, SOUTH RIVER, OLD BRIDGE

See Summary Table of Recommended Actions starting on page 223 for additional details on all actions.

LEGEND

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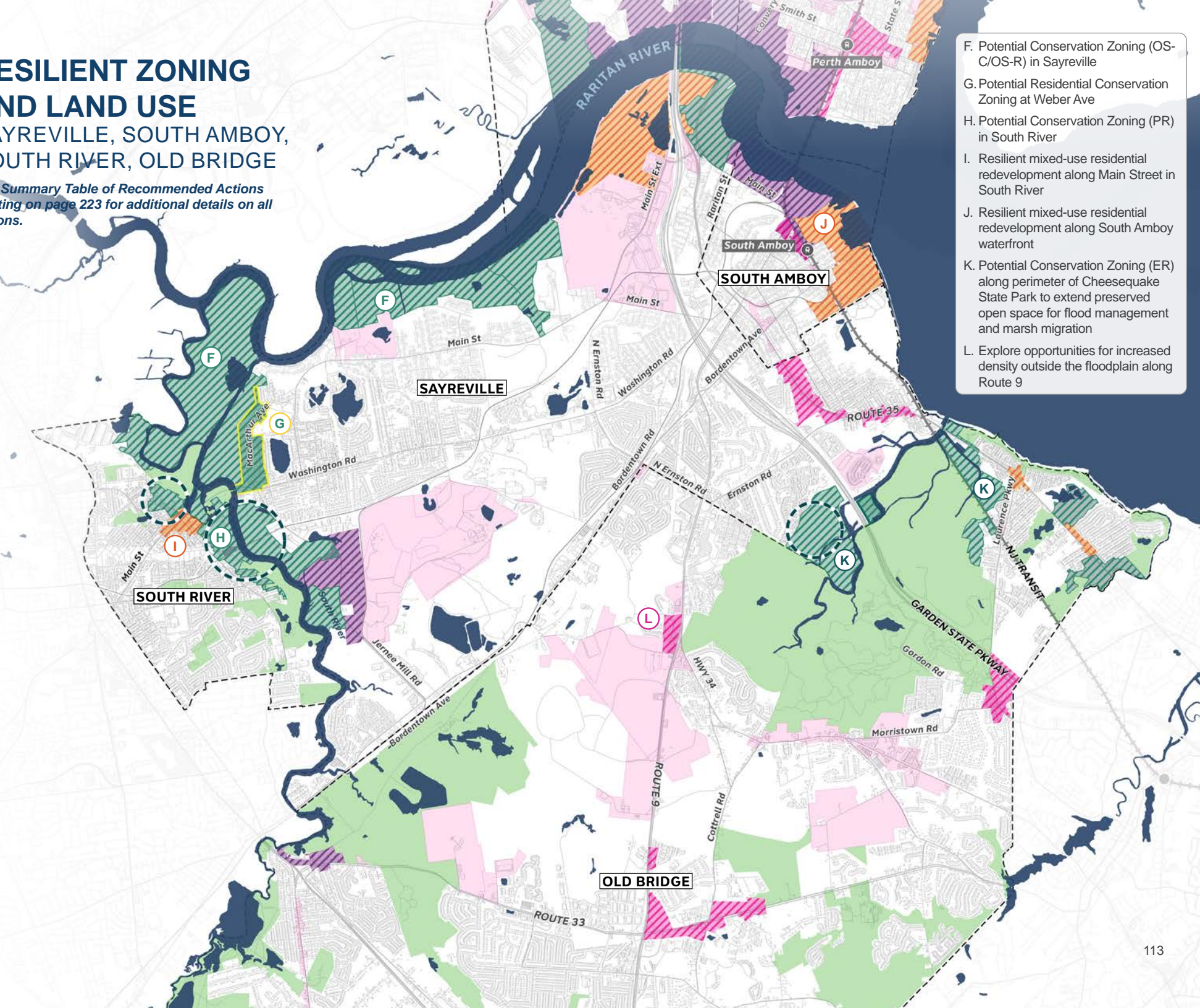
Open Space and Conservation Zones

Redevelopment Areas

Water bodies

Municipal Boundary

0 0.5 1



- F. Potential Conservation Zoning (OS-C/OS-R) in Sayreville
- G. Potential Residential Conservation Zoning at Weber Ave
- H. Potential Conservation Zoning (PR) in South River
- I. Resilient mixed-use residential redevelopment along Main Street in South River
- J. Resilient mixed-use residential redevelopment along South Amboy waterfront
- K. Potential Conservation Zoning (ER) along perimeter of Cheesecake State Park to extend preserved open space for flood management and marsh migration
- L. Explore opportunities for increased density outside the floodplain along Route 9

HOW TO INTEGRATE ADDITIONAL CLIMATE HAZARDS INTO POLICY AND ZONING

As with flooding, climate change is rapidly affecting the nature of various Additional Climate Hazards , such as extreme heat, air pollution, groundwater rise, drought, and wildfires. As the region advances its understanding of these evolving risks and their complex interactions, it must ensure that policies, regulations, and ordinances are continually updated to prepare for the future, mitigate the sources and consequences of these hazards, and reflect the highest national and international standards.

- **Adopt ordinances and building codes to state, national, and international models and guidance and consider higher standards.** Standards to look to include 2021 federal U.S. Department of Labor Occupational Safety and Health Administration (OSHA) standards, including inspection guidance for heat-related hazards, in line with the National Emphasis Program (NEP) on heat inspections (effective April 2022); 2021 International Energy Conservation Code (IECC) on energy efficiency and performance as well as spot-ventilation, isolation, and insulation of electrical and mechanical heat systems; federal U.S. Environmental Protection Agency (EPA) air quality standards; World Health Organization (WHO) Global Air Quality Guidelines; 2018 International Residential and Plumbing Codes water conservation and efficiency standards; and 2018 International Green Construction Code water conservation and efficiency standards. Could also include conservation subdivision ordinances to ensure water-efficient landscaping, e.g., requiring retainment of wooded areas or requiring a certain percentage of low water-use plants be used in design.

- **Pursue a statewide requirement, paired with a model ordinance, for municipalities to adopt regulations specific to environmental justice issues and cumulative impacts.** For example, look to the Newark Environmental Justice/Cumulative Impacts ordinance. Develop a streamlined standard operating procedure for integrating review of all potentially impactful development activity.
- **Enhance enforcement of existing local and state regulations**, including the 2021 NJ Stormwater Rule that requires municipalities to update their Stormwater Control Ordinances (SCOs) to require green infrastructure be included with new development (model ordinances provided); State Emission Statement rule which establishes regulations for the annual reporting of air contaminant emissions from stationary sources to help with the monitoring of the state’s progress toward the mandatory emissions reduction protocols; NJ Air Quality State Implementation Plan regulations; New Jersey’s existing statewide water quality standards, assessments, monitoring, and watershed-based plans and programs to reduce total maximum daily loads; landlord regulations for provision of window and door screen protections to tenants (for mosquito protection); regulations on design of water conveyance and holding structures to minimize potential for mosquito habitats; and others.
- **Explore zoning overlays, restrictions, and/or buffers to address groundwater contamination and wildfire risk.** Implement groundwater protection zoning overlay districts that protect any water within the 1-, 5-, or 10-year Time of Travel zones for contaminants, or buffer distances around groundwater intakes (e.g., a 1-year Time of Travel zone describes the radius around a well within which it would take 1 year for contaminants to reach the well). Develop specific zoning restrictions to address fire risk (e.g., adequate buffers for industrial-residential uses and wildland-urban interfaces, restricting development in the latter).



AERIAL VIEW OF THE WASHINGTON CANAL AND RARITAN RIVER IN SAYREVILLE
Image Credit: Wirestock Creators Via Adobe



PERRINE ROAD TRAIL AT CHEESEQUAKE STATE PARK
Image Credit: Demetrios Via Adobe

PHYSICAL & NATURE-BASED INFRASTRUCTURE



Across the region, the preferred scenario incorporates physical and nature-based infrastructure strategies such as:

- Site- or building-level adaptation of critical facilities
- Restoring wetlands and riparian zones
- Creating floodable spaces on publicly owned lands
- Increasing stormwater system capacity
- Restoring or daylighting riparian zones
- Replenishing and restoring beaches
- Implementing multi-purpose coastal flood barriers
- Enhancing resiliency of mobility systems
- Implementing tide and surge gates
- Retrofitting existing pump stations and modifying culverts

This set of strategies addresses the desire of residents and other stakeholders to both prevent damage and disruption from flooding and incorporate nature-based strategies. In addition to flood risk reduction, additional benefits of these strategies include new public spaces and community amenities as well as improved open space networks and ecosystem processes. Many nature-based solutions also have the potential to address additional climate hazards as well, including extreme heat (especially urban heat), poor air quality, stressed water supply and quality, invasive species, wildfires, and the threats posed to marine species by ocean acidification.

ADAPT OR PROTECT CRITICAL FACILITIES

Physical & Nature-
Based Infrastructure



Connection to Resilience

A wide variety of critical facilities in the RRBC region are at risk from rainfall and/or coastal flooding. The *Flood Impact Assessment* includes additional information about priority critical facilities within each municipality that may be exposed to flooding. Critical facilities were prioritized based on the breadth of impact--how wide-reaching losses of the asset might be felt--as well as the magnitude of exposure--approximated as the depth of flooding experienced across all flood events evaluated. For the purposes of this *Action Plan*, strategies to adapt or protect critical facilities are limited to prioritized, publicly-owned critical facilities with structures. These include utilities, community assets, and emergency response facilities across the region. Strategies for transportation infrastructure are recommended in the following section, Resiliency of Mobility Systems. Strategies for parks and open spaces are largely addressed in the Coastal Resilience and Stormwater Management sections.

Flooding of critical facilities in the region can have widespread and cascading impacts, such as the following:

- Utilities including power plants, substations, pump stations, cell towers, and wastewater treatment plants across the region are vulnerable to flooding. Cell towers may be flooded, resulting in service outages that can put citizens at risk during a storm event. Flooding of wastewater treatment plants can cause disruptions to sewage treatment and lead to the disposal of untreated water into river systems.

- Community assets including schools, libraries, and recreational centers across the region are vulnerable to flooding. Flooding of these assets disrupts community services, including education and care of school-aged children. School closures can impact the ability of parents to work further disrupting the economy in the aftermath of a flood.
- Emergency response facilities such as shelters, fire, and police stations in the region are vulnerable to flooding. Flooding of fire and police stations can delay emergency response times. Flooding of emergency shelters can result in shelters being inaccessible or unsafe and unable to provide their intended services during a disaster.

Strategies

Depending on the type of critical facility and type and extent of flood exposure, appropriate site or building scale adaptation measures vary. Opportunities to reduce the risk of critical facilities should be evaluated on a site-by-site or building-by-building basis.

Implement site- or building-level adaptation measures

Site- or building-level adaptation may include:

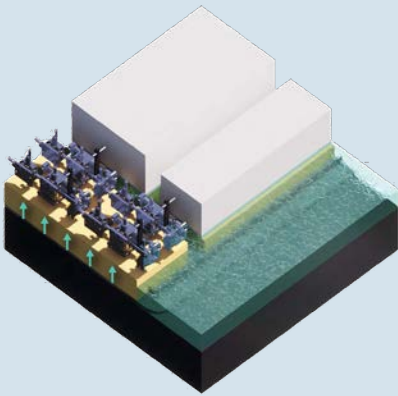
- Elevating critical mechanical systems, including emergency and backup generators
- Dry floodproofing which involves constructing flood barriers and/or shields around critical equipment, systems, or areas

- Retrofitting pump stations
- Relocating critical facilities should effective mitigation interfere with operations

Additional asset-specific study will be required to determine the most appropriate and cost-effective way of reducing risk at each priority asset.

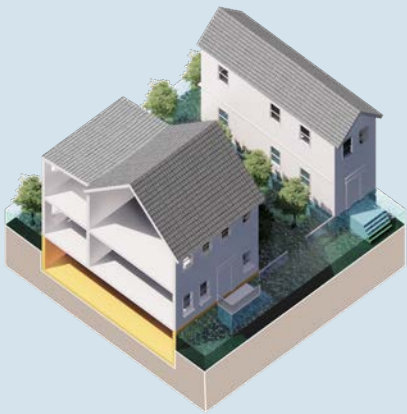
While some critical facilities may be protected from coastal flooding by regional coastal protection strategies, as discussed later in this section, many facilities are outside the areas that would be protected by any proposed coastal protection.

Elevate Critical Mechanical Systems



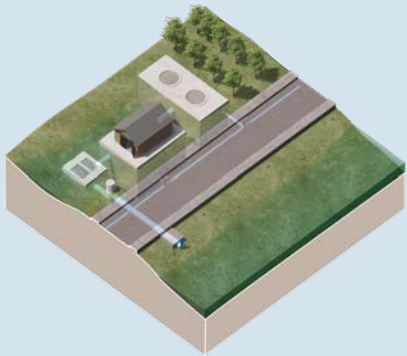
Relocating critical systems to higher floors or elevations reduces the impacts of flooding on critical services and reduces recovery times. This tool increases the resilience of essential services.

Dry Floodproof



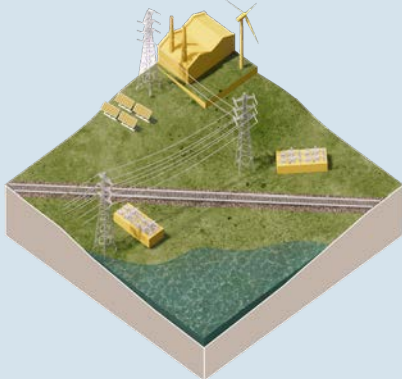
Dry floodproofing below flood levels involves fully blocking out floodwaters with both permanent and deployable structures. This tool retains usability of floors below grade for permanent and temporary uses. It allows for assets and utilities to remain below Design Flood Elevation (DFE) with a lessened chance of flooding.

Retrofit Pump Stations



Pumping is a crucial method to convey water out of areas vulnerable to inundation, where natural and gravity fed drainage is insufficient or not possible.

Relocate Critical Facilities



Where mitigation options interfere with operations, relocating critical facilities can reduce impacts of flooding on critical services. Additionally, creating decentralized and redundant energy generators and developing micro-grid systems can also ensure recovery of critical systems in case of failure within the wider network.

Key Considerations

- **Level of protection:** The appropriate level of protection for critical facilities should be higher than other, non-critical facilities. However, flood mitigation cannot impact the ability of the facility to provide services. If effective mitigation would interfere with the facility’s ability to provide services, relocation of the facility to a lower risk area should be considered.
- **Implementation:** Flood mitigation of critical facilities may pose implementation challenges including identification of and coordination with entities with jurisdiction, permitting, construction, and maintenance, etc.
- **Maintenance:** In order to be resilient, critical facilities must be regularly maintained. The same applies to emergency and backup generators and dry floodproofing. All facilities should consider how they will fund the cost of regular, ongoing maintenance in their operating budgets as well as who will be responsible for maintenance. Additionally, facilities should regularly practice deployment of any ‘just-in-time’ flood protection measures such as deployable flood barriers and doorway flood shields.
- **Environmental impacts:** Flooding of critical facilities can lead to a number of environmental impacts including contamination of flood water with raw sewage and other hazardous or toxic substances. This highlights the importance of effectively reducing risk for these facilities.

- **Permitting:** Permitting will vary based on the type, location, and ownership of each facility. Relocation of existing facilities will likely encounter additional permitting needs than adaptation to existing facilities. Any work on the waterfront or near wetlands will require additional state and federal permits.

Co-Benefits

Protecting critical facilities from flood risk will allow services to be maintained following a flood event. This can prevent cascading impacts as the impacts to one facility (such as power generation) can have significant downstream impacts on other facilities that depend on them. Additionally, protecting critical facilities has several benefits to public health including, but not limited to, avoiding contamination of flood water with raw sewage, maintaining access to clean drinking water, ensuring availability of emergency services and more. Other facility needs, like improving services or addressing maintenance needs, could be pursued at the same time as the resilience improvements.

Funding Opportunities

- **Federal Emergency Management Agency (FEMA) FEMA Public Assistance (PA):** Grants that provides reimbursement for disaster related expenses. Often used for repairs, restorations, reconstruction or replacement of public facilities or infrastructure damaged or destroyed by a disaster
- **Federal Emergency Management Agency (FEMA) Hazard Mitigation Grant Program (HMGP):** Funding to state, local, tribal, and territorial governments to develop hazard mitigation plans and rebuild in a way that reduces, or mitigates, future disaster losses in their communities. Dependent on presidentially declared disaster
- **Federal Emergency Management Agency (FEMA) Building Resilient Infrastructure & Communities (BRIC):** Competitive grants of up to \$50 M for hazard mitigation projects, reducing or eliminating the risks from future disasters and natural hazards.

Priority Actions

Actions below are priority actions that can be taken in the near- or mid-term to adapt or protect critical facilities. For a full list of recommended actions, see the *Implementation Roadmap* section.

STATE	<ul style="list-style-type: none">• Develop guidance for State and Local agencies on design standards and climate projections
LOCAL- ALL MUNICIPALITIES	<ul style="list-style-type: none">• Consider relocation of flood-prone shelters to lower risk areas
LOCAL - WOODBRIDGE	<ul style="list-style-type: none">• Site-specific mitigation of flood-prone assets at Henry Inman Elementary







CARTERET, PERTH AMBOY,
WOODBIDGE

See Summary Table of Recommended Actions starting on page 223 for additional details on all actions.



LEGEND

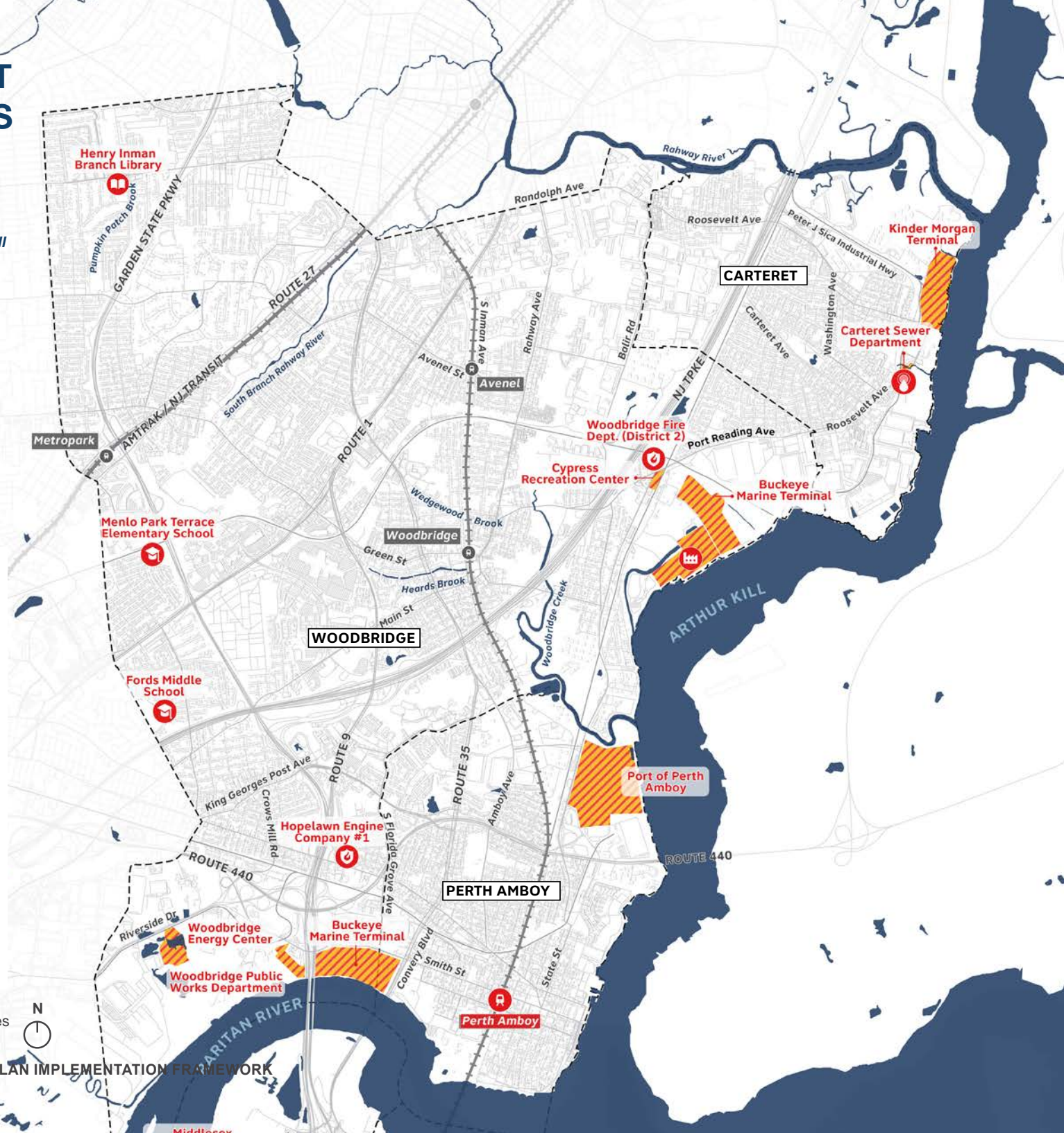
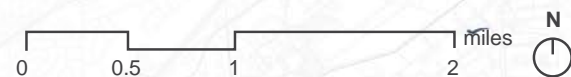
ADAPT OR PROTECT CRITICAL FACILITIES

Implement site or building level adaptation measures

-  Implement site or building level adaptation measures at critical facilities
-  Adapt/protect existing pump station
-  Adapt/protect existing substation
-  Adapt/protect wastewater treatment plant
-  Adapt/protect fire station / emergency medical services
-  Adapt/protect schools

BASEMAP

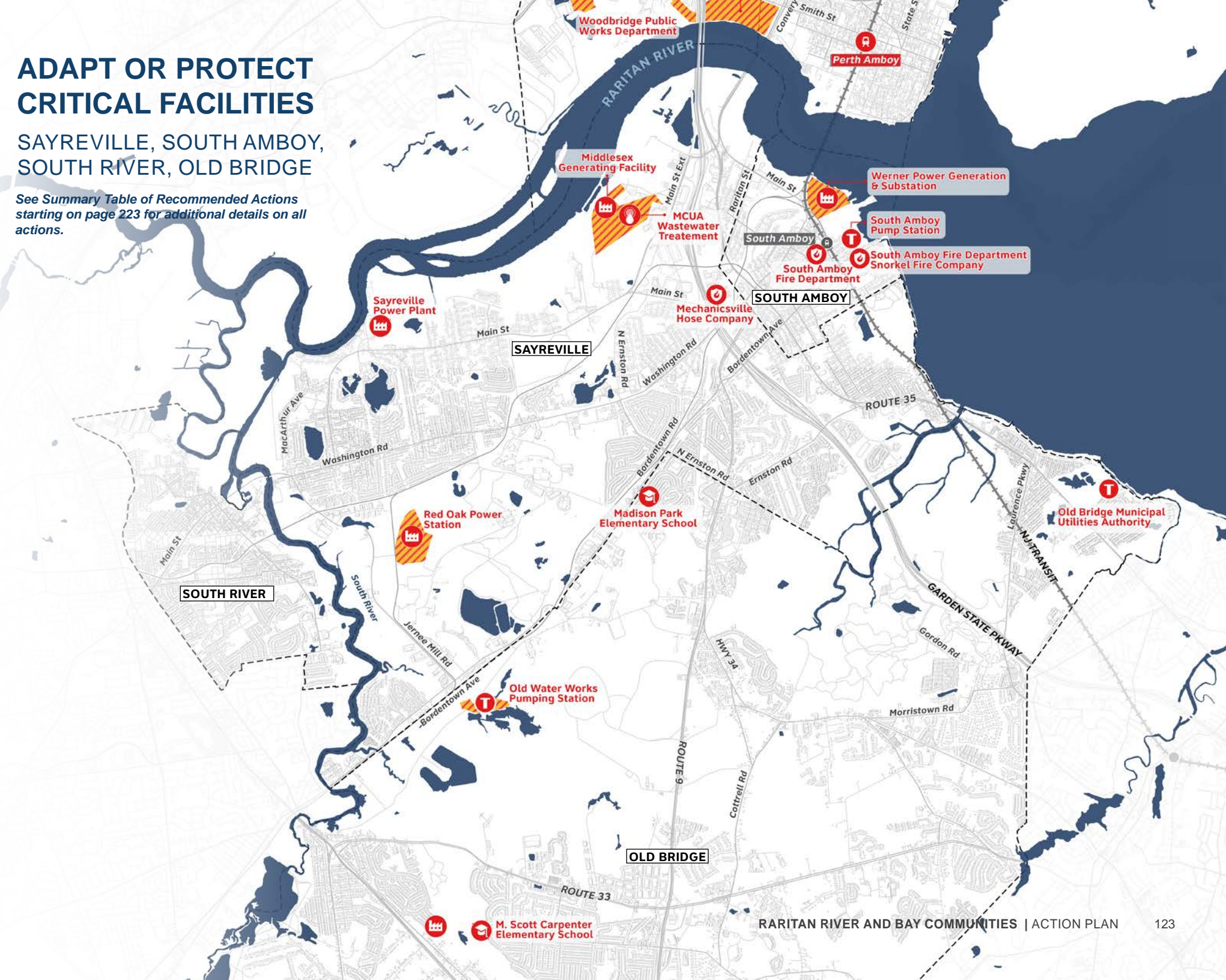
-  Water bodies
 Municipal Boundary



ADAPT OR PROTECT CRITICAL FACILITIES

SAYREVILLE, SOUTH AMBOY,
SOUTH RIVER, OLD BRIDGE

See Summary Table of Recommended Actions starting on page 223 for additional details on all actions.



ADAPTING CRITICAL FACILITIES TO ADDITIONAL CLIMATE HAZARDS

Adapting critical facilities to additional climate hazards could mean many things depending on the specific type of hazard. Among the most urgent threats are drought and water quality, with their implications for water supply infrastructure, and the threat of heat-related public health impacts at outdoor public spaces.

- **Prioritize capital improvement projects to replace and/or renew deteriorating and inefficient pipelines and water supply assets.** In accordance with the 2018 American Water Infrastructure Act, this would involve developing risk and resilience assessments for drinking water systems that consider climate change impacts. Could also involve partnering with the Lead Service Line Replacement program. Consider exploring a state mandate for routine water supply asset management planning, with consideration of future water demand and availability conditions. May involve creation of standardized metrics and reporting of conditions to support prioritization of Drinking Water State Revolving Fund.
- **Require specific mitigations on publicly owned properties.** For example, require outdoor heat mitigation, which may include measures such as canopy cover or photovoltaic (PV) shade canopies, water-based cooling stations, or cool pavements.



KEASBEY BROWNFIELD DEVELOPMENT
AREA AND WOODBRIDGE ENERGY CENTER
AND FACING RARITAN RIVER
Image Credit: PS&S



Connection to Resilience

The RRBC region is rich with a large variety of transportation systems, and elements of all these systems are vulnerable to flooding.

- Portions of each of the major highways that intersect the region—the **Garden State Parkway and New Jersey Turnpike (I-95)**—are exposed to rainfall and storm surge. Closures and flooding of these key corridors have the potential to cause major disruption to goods, services, and people. Additional key roadways include Route 35, Route 1, Route 9, and CR535. Many of the roadways also serve as bus lines that many commuters and socially vulnerable populations depend upon.
- The **North Jersey Coast Line** commuter rail line connects the Jersey Shore region to the metropolitan area in Northeastern New Jersey and New York City. With more than 24,000 daily riders, there is potential for flooding to greatly impact the region and its commuting population. Additionally, the rail line uses five moveable bridges that are vulnerable to high winds and storm surges during coastal storms, and sea level rise. Vulnerable stations in the RRBC region include Woodbridge, Perth Amboy, and South Amboy (however, the Woodbridge and South Amboy stations are elevated, resulting in a lower risk of flooding).
- The **Northeast Corridor Line** is a rail line that runs through Woodbridge and is vulnerable to rainfall flooding. This line connects the Trenton Transit Center to New York Penn Station and is a major line for commuters. In addition to these individual assets, many roadways across the region are vulnerable to flooding. In addition

to supporting vehicular travel, these roadways include critical bus routes, bike lanes, and sidewalks that support public transit and non-motorized transportation.

Increasing the resilience of these mobility systems is key to supporting the ongoing and continuous operation of these assets and maintaining a vibrant and connected region. The region’s economy depends upon the movement of goods, and hundreds of thousands of commuters travel through this region every day in cars, buses, and trains.

Strategies

Many transportation agencies have begun to address the resiliency of their assets, but additional analysis of key threats and examination of the feasibility of different approaches to protect vulnerable roadways, rail lines, and stations.

» Protect vulnerable rail lines, train stations, and roadways

Rail lines and roadways can be protected from flooding through either elevating them above projected flood levels or constructing barriers alongside them. Elevating rail lines can be challenging due to space constraints and limitations on grades than can be safely traveled. Barriers must also be designed to manage stormwater and not trap floodwaters behind the barrier. Barriers can include permanent floodwalls or deployable systems that are put in place before a storm.

Roadways identified as evacuation routes, such as the Garden State Parkway, NJ Turnpike (I-95),

Route 35 and Route 1, should be prioritized for protection to ensure those roadways are accessible before an evacuation. In addition, roadways that serve as critical bus routes should be protected from flooding.

While there are several train stations in the region exposed to flooding, the Perth Amboy Train Station is the most vulnerable to flooding as the station is at-grade and the tracks run in a depressed trench. Stations can be protected through elevation of critical mechanical systems or flood protection around the facility. Potential options should be further studied and evaluated.

» Integrate resilience infrastructure into proposed greenways

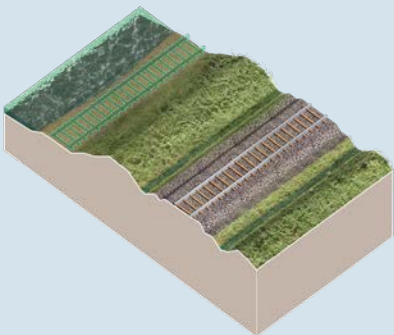
Greenways along the waterfront can be integrated into coastal protection projects, as discussed in Coastal Resilience. Stormwater management features can also be integrated, such as in the proposed Middlesex County Greenway Extension (see Page 190).

» Incorporate future flooding conditions into the design of transportation infrastructure

As new transportation infrastructure is designed and built, design standards are needed to ensure that those systems are built to be resilient to future flooding, taking into account sea level rise and future precipitation. While individual agencies have developed design standards, such as NJ TRANSIT, consistency across additional relevant agencies would help ensure resiliency of systems during future flood events.

Protect Vulnerable Rail Lines, Train Stations, And Roadways

Elevate or harden rail lines in flood prone areas



Rail lines and roadways can be protected from flooding through either elevating them above projected flood levels or constructing barriers alongside them. Barriers must also be designed to manage stormwater and not trap floodwaters behind the barrier.

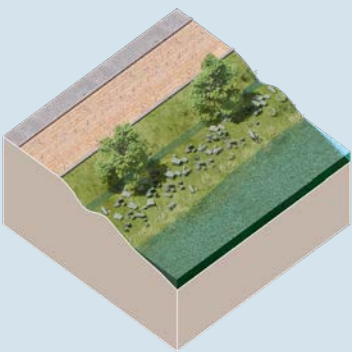
Elevate or harden roadways in flood prone areas



As new transportation infrastructure is designed and built, design standards are needed to ensure that those systems are designed to be resilient to future flooding, taking into account sea level rise and future precipitation.

Integrate Resilience Infrastructure into Proposed Greenways

Integrate berms or setback levees into proposed waterfront greenways



Berms and or setback levees are raised earthen structures erected to protect from flooding. They can be integrated with recreational boardwalks, walkways and bike paths. Their natural sloped sides can be used for plantings or recreational features and be integrated into coastal protection projects.

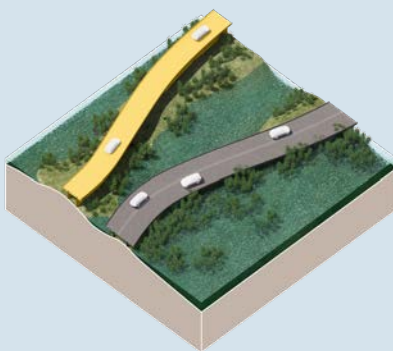
Integrate stormwater management into proposed greenways



Bioswales are vegetated drainage courses that can capture, detain, and infiltrate runoff allowing any excess rain water along right-of-ways to enter the piped stormwater system.

Incorporate Future Flooding Conditions into The Design of Transportation Infrastructure

Ensure resilient evacuation routes



By creating redundant routes, residents and emergency services can have mobility options when other, more susceptible routes are impassible. This tool applies to instances where critical emergency routes are often compromised by floodwaters.

Key Considerations

Criticality, risk tolerance and level of protection: It may not be feasible to elevate or protect all roadways or rail lines from all storm events. All roadways and rail lines should be protected from future high tide and other frequent flood events, and the most critical roadways and rail lines should be protected from rare, extreme events. Agencies should evaluate the level of protection needed for a route based on the implications of being flooded. Roadways that serve as evacuation routes, have high traffic, or connect to key critical facilities should be considered more critical than small roadways.

Maintenance: To be resilient, mobility systems must be regularly maintained. Strategies recommended to improve the resilience of mobility systems vary in terms of maintenance requirements.

Permitting: Permitting needs will vary based on the asset and location. Rail lines and roadways near the waterfront or wetlands may be more challenging and time consuming to permit. In some instances, there may be a need to acquire property along a rail or roadway corridor to have the space to implement flood mitigation.

Co-Benefits

Reconstruction of transportation assets to protect from flooding can also be an opportunity to improve the asset in other ways. This could include improving visitor waiting areas at a train station, improving traffic flow on a highway, or adding a bike lane to a bridge.

Case Study: NJ TRANSIT Raritan River Bridge Project

NJ TRANSIT is in the process of constructing a new bridge on the Raritan River between Perth Amboy and South Amboy which would replace the existing swing bridges that carry the NJ TRANSIT North Jersey Coastal Line. The bridges were damaged by Hurricane Sandy and the replacement project is funded through a Federal Transit Administration Emergency Relief Program. The new bridge will integrate resilient structural designs and materials to withstand future storm surges and be significantly less vulnerable to severe weather events.



Aerial view of NJ TRANSIT Raritan River Bridge connecting South Amboy and Perth Amboy over Raritan Bay

Image Credit: Wirestock via Adobe

Funding Opportunities

- U.S. Department of Transportation (USDOT) Promoting Resilient Operations for Transformative, Efficient, and Cost-saving Transportation (PROTECT):** Funded through the bipartisan infrastructure law, USDOT PROTECT provides formula funding to states and national competitive grants that local governments can apply to for resilience improvements to surface transportation assets, including making transportation resilient to future weather and natural disasters, assess vulnerability and plan emergency response strategies, and protecting coastal infrastructure at risk from sea level rise.
- USDOT Transportation Alternatives Program (TAP):** Funded through proportional set-aside of funds under the bipartisan infrastructure bill, administered by NJDOT, in partnership with the NJTPA, DVRPC and SJTPO, this program provides federal funds for community based “non-traditional” surface transportation projects, such as conversion and use of abandoned railroad corridors for trails for pedestrians, bicyclists, and other non-motorized transportation users and environmental mitigation to address stormwater management due to highway runoff.

Priority Actions

Actions below are priority actions that can be taken in the near- or mid-term to promote the resiliency of mobility systems. For a full list of recommended actions, see the *Implementation Roadmap* section.

NJDEP	<ul style="list-style-type: none">Develop guidance for State Transportation agencies on design standards and climate projections
NJ Turnpike Authority	<ul style="list-style-type: none">Examine sections of the Garden State Parkway at risk of future flooding and identify mitigation measures, such as the stretches within Cheesequake State Park and near Woodbridge Creek
NJ TRANSIT	<ul style="list-style-type: none">Study and develop alternatives to reduce flood risk to the NJ TRANSIT Coast Line, including the section in Old Bridge at Cheesequake Creek
NJDOT	<ul style="list-style-type: none">Review flood risk to vulnerable sections of State Route 35 in Laurence Harbor and integrate considerations for how to reduce flood risk into future capital plans to the extent feasibleUpdate the statewide evacuation plan, with input from Local and Regional stakeholders
Resilient RRBC	<ul style="list-style-type: none">Examine opportunities to protect vulnerable sections of State St. (CR 611) and Port Reading Ave near the Arthur Kill

RESILIENCY OF
MOBILITY SYSTEMS
CARTERET, PERTH AMBOY,
WOODBIDGE

See Summary Table of Recommended Actions
starting on page 223 for additional details on all
actions.

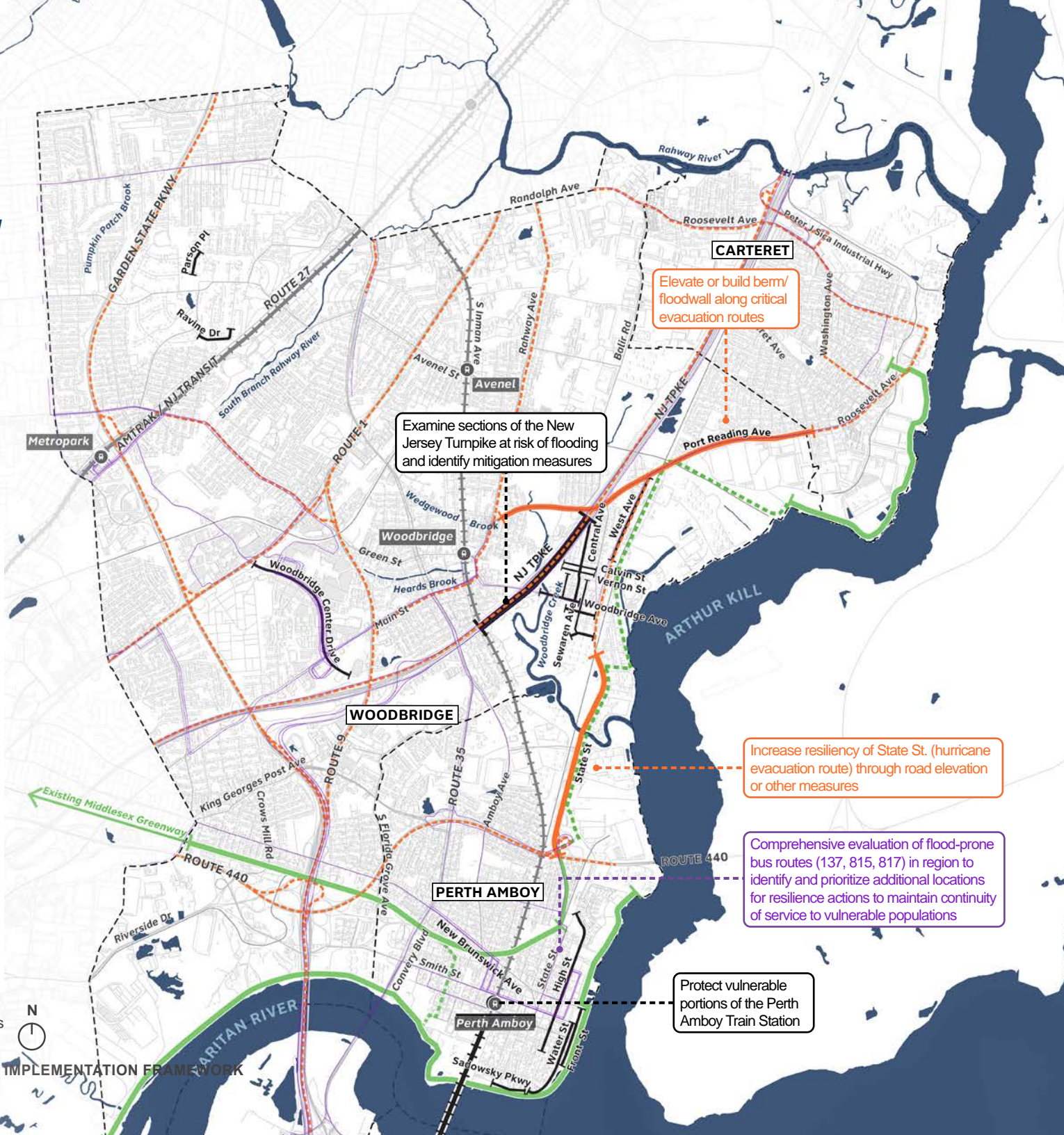
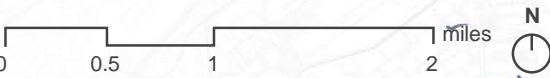
LEGEND

RESILIENT MOBILITY SYSTEMS

- Elevate or harden roadways
- Elevate or harden rail lines
- Integrate resilience infrastructure into proposed greenways
- Ensure resilient evacuation routes
- Ensure resilient bus routes

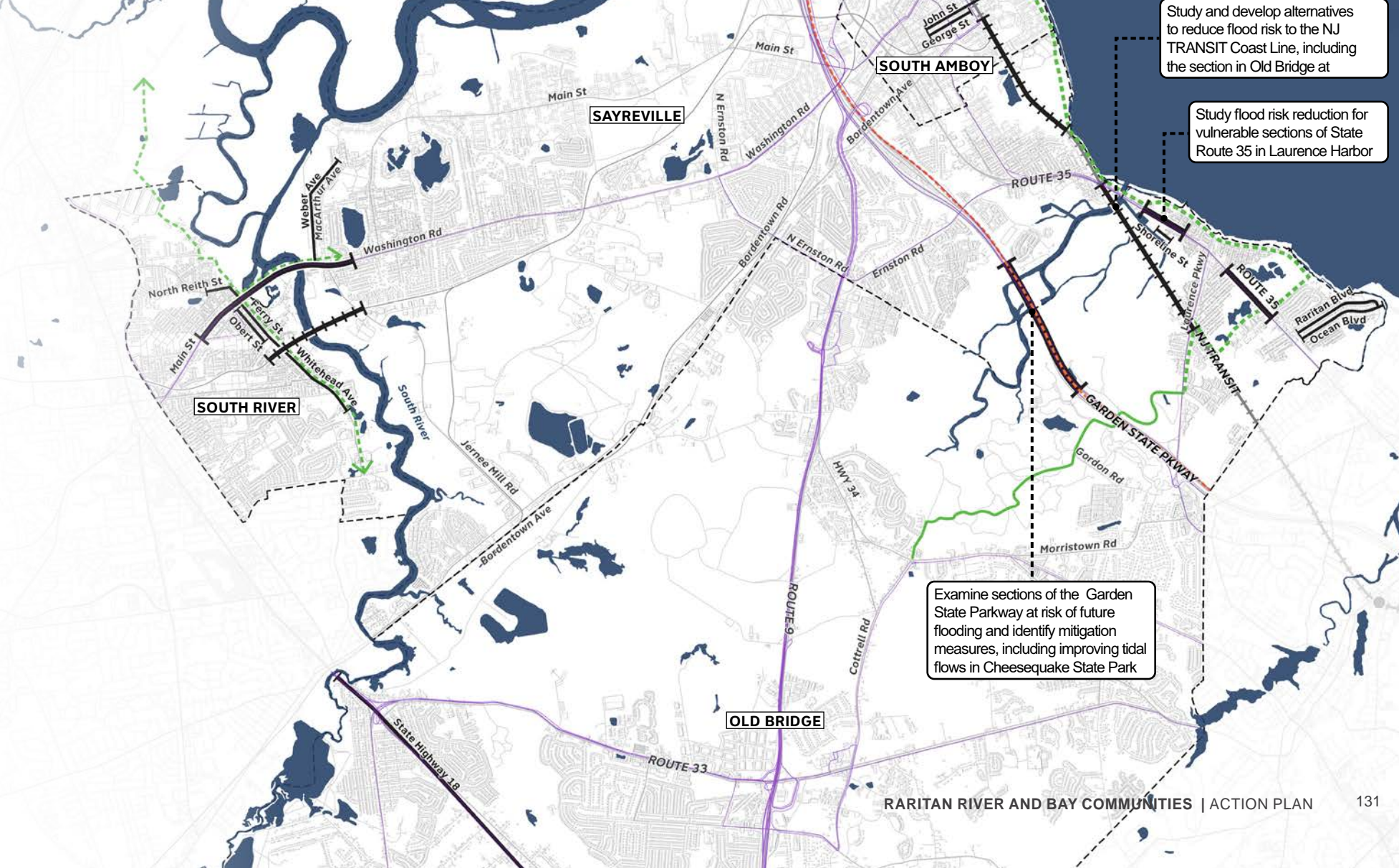
BASEMAP

- Hurricane Evacuation Routes
- Existing Greenways and Trails
- Proposed Greenways and Trails (L-Plan Middlesex County Greenway Opportunities, 2022)
- Water bodies
- Municipal Boundary



RESILIENCY OF
MOBILITY SYSTEMS
SAYREVILLE, SOUTH AMBOY,
SOUTH RIVER, OLD BRIDGE

See Summary Table of Recommended Actions
starting on page 223 for additional details on all
actions.



MOBILITY AND ADDITIONAL CLIMATE HAZARDS

In addition to policy-related approaches to protecting roadways and other transportation assets from the impacts of extreme heat (i.e., implementing load restrictions for older roads, bridges, and railways), broader transportation planning efforts can be leveraged to mitigate the severity of extreme heat and poor air quality. The types of solutions included in this strategy pair well with sustainability initiatives, as they could also lead to greater energy efficiency and lower greenhouse gas emissions.

- **Plan for accessible, equitable public, multi-modal transportation infrastructure.** Establish regional goals and undertake coordination to encourage local and regional planning for more accessible and equitable public and multi-modal transportation infrastructure to reduce emissions from cars. May include greater emphasis on sidewalk improvements, bicycle infrastructure, and pedestrian connectivity; expanding and enhancing public transit; encouraging mixed-use zoning; investing in electric and zero-emissions buses; investing in public electric vehicle charging stations; and establishing clear goals to convert 20% or more of the car fleet to electric by the end of the decade. This can be paired with other improvements such as PV canopies and/or green infrastructure at bus stops, as well as public-private partnerships to limit vehicular heat and pollution by starting or expanding bike share programs and exploring opportunities for streets to shut down to vehicular traffic and create a pedestrian-only experience.

OPPORTUNITIES TO IMPROVE EVACUATION PLANNING

Evacuation planning requires coordination across levels of government and consistent and clear communication with the public and community organizations.

The Federal Highway Administration provides national guidance on best practices and structures. The New Jersey Office of Emergency Management (NJOEM) coordinates the statewide evacuation plan and makes the determination of when a state evacuation order is needed and communicates that to the County level. The NJ Department of Transportation (NJDOT) identifies evacuation routes and zones and communicates messaging on state highways. Middlesex County coordinates with NJOEM and NJDOT on evacuation planning needs within the County, and coordinates with surrounding counties as needed. Each municipality communicates evacuation orders with their residents.

Opportunities to improve the coordination of evacuation planning across the region include:

- Municipalities can identify local evacuation routes to complement the existing County and Statewide evacuation routes.
- The State, Municipalities, and the County can continue their efforts to reach residents, particularly those at high-risk, in disadvantaged communities, or with disabilities. The recently launched NJ511 system allows geotargeted communications to drivers' cell phones. Additional communication strategies include websites, television, social media, door to door and other methods.

The State will be updating the Statewide Evacuation Routing plan and Counties will have the opportunity to provide their input on updates. Counties and Municipalities should be involved in this process to ensure that their residents needs are heard, and disadvantaged communities are considered during the evacuation route planning process.

Through the Resilient NJ planning process, several specific areas with high concentrations of residents in areas vulnerable to flooding were identified that would benefit from more targeted evacuation planning and communication. These include the public housing complex in Carteret and the Winding Woods apartment complex in Sayreville. Both areas are also predominantly low-income and house many residents of color.



ROUTE 35 (VICTORY BRIDGE) OVER THE RARITAN RIVER
Image Credit: *Christy Lang Photos Via Adobe*

Connection to Resilience

The Raritan River drains an area of more than 1,000 square miles, which covers a broad range of land uses and environmental resources. Development has greatly increased the amount of impervious surfaces within the region and has altered traditional drainage patterns. Storm sewer systems within the region are not sized to manage the extreme storms experienced more frequently over the past few years. The effectiveness of these systems will continue to degrade, as climate change is expected to lead to increased sea levels and rainfall intensities, reducing the capacity of catch basins, pipes, and outfalls to drain areas throughout the region. By 2070, a heavy rainfall event could cause \$4.9 billion in losses. Woodbridge and Perth Amboy face the highest risk with \$1.5 billion and \$700 million in losses respectively. Tidal flooding and high groundwater tables will also reduce the effectiveness of existing stormwater management infrastructure.

Strategies

Effective management of stormwater to reduce flood risk within the Raritan River and Bay communities requires a watershed approach. Strategies have been identified that improve management from the headwaters to the mouth of rivers with the goal of re-establishing natural drainage functions. Specifically, the strategies recommended here include those that expand capacity to store stormwater and improve the conveyance or movement of stormwater through the system. Strategies are overlapped to provide redundancy and flexibility, allowing systems to adapt to changing environmental conditions. This watershed approach is most evident in several of the inland tributaries within the region, such as the Raritan River, South River, Woodbridge Creek, Rahway River, and

their tributaries. These waterways cut through the heart of communities in the region. Integrating multiple storage and conveyance techniques will reduce risk by mimicking pre-development conditions and protect against local stormwater flooding impacts.

» Expand storage on publicly owned land

Paved surfaces prevent rainfall from soaking into the soil, resulting in more stormwater runoff leaving sites more quickly. If large portions of the watershed are paved, an intense storm event can transform a downpour into flash flooding by quickly consolidating runoff from multiple sites. Providing areas for stormwater storage helps delay runoff and can reduce peak flows downstream. A distributed approach can counteract the impact of impervious surfaces.

Protecting and restoring natural features, such as wetlands and riparian zones, can improve stormwater storage and infiltration. There are also opportunities across the region to retrofit parks and other open spaces for stormwater management by adding stormwater storage through both green and grey infrastructure techniques. The map later in this section identifies some areas that have been identified on a preliminary analysis that should be further refined and prioritized. Utilizing existing corridors, such as the inactive rail line through Perth Amboy, provides opportunities to distribute green infrastructure while capturing additional benefits to public space and connectivity.

Partnering these distributed techniques with regional stormwater storage takes advantage of large publicly owned properties, where practices can be cost-effective to implement. When placed in conjunction with distributed techniques, these practices can manage larger stormwater stressors within the watershed and safely manage localized flood risk.

Matching stormwater management needs with publicly owned opportunity areas is a way to prioritize implementation of these techniques.

While limited in areas, voluntary buyouts of properties can create additional room to divert flows into storage areas to reduce peak flows downstream. While more study is needed to model the effectiveness of these approaches, areas of the South River can be prioritized for river management through upstream diversions and off-channel storage.

» Increase capacity of riparian corridors

In certain areas of the region, the storm sewer system effectively conveys flows to riparian corridors but development along these corridors has choked the ability to move these flows to Raritan Bay. Evaluating and eliminating these constraints can ensure that stormwater flows unimpeded through the watershed, limiting flood impacts.

Heards Brook and Wedgewood Brook are examples of stream corridors that have been significantly restrained due to the urban development that has occurred in Woodbridge. Infrastructure along this corridor, specifically the number of culverts associated with road crossings, pinches the corridor causing flooding in this area.

Expanding and restoring riparian zones, along stream corridors helps to convey larger storm events and provides additional space to safely manage flood events. Stream restoration has numerous additional benefits to water quality and habitat for fish and other species, and the new floodable green space along these corridors can provide accessible public open space that can be a popular amenity during non-storm events that provides numerous benefits for the health and wellbeing of residents.

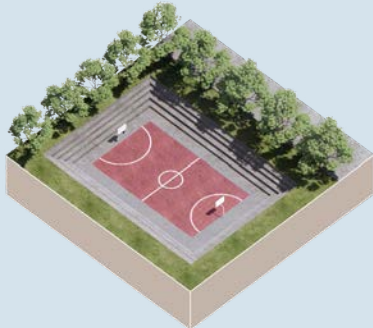
Expand Storage on Publicly-owned land

Restore wetlands and riparian areas for stormwater storage and infiltration



Wetland restoration involves returning the natural functions of former or degraded wetlands that have been filled, drained, or impounded to promote stable water exchanges into and out of the wetland.

Retrofit parks and open space for stormwater management



Retrofitting parks and open space can capture and store stormwater collected from impervious areas. Stored water is then released directly through an outlet pipe back into natural waters at rates designed to reduce peak water flows during storms.

Create upstream diversions and stormwater storage on flood-prone rivers



Capturing runoff and diverting water upstream can help reduce downstream or localized flooding and enable groundwater recharge. Retention ponds, for example, are artificial basins used to manage stormwater runoff and promote infiltration.

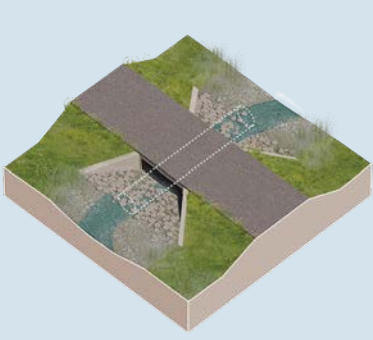
Increase Capacity of Riparian Corridors

Stream corridor restoration and riparian zone expansion



Stream daylighting is the exposure of some or all of the flow of waterways covered by pipes or culverts. Stream daylighting and restoration of natural drainage systems can help eliminate flooding issues by re-creating a functioning floodplain and riparian area.

Culvert enlargements



Enlargement of culverts that are not able to manage large flow surges during heavy rain events or spring thaw can help reduce the likelihood of localized flooding upstream of the culverts, assuming additional floodwater doesn't exacerbate flooding issues downstream.

Increase stormsewer capacity



Breakwaters are partially or fully emergent structures that extend above mean high water. They are built with armor units to help attenuate storm waves to improve safety and prevent damage to buildings and infrastructure.

This can be coupled with culvert enlargements to reduce or eliminate “pinch points” and help effectively convey runoff from larger storm events. This is particularly critical at road and rail crossings.

» Eliminate barriers caused by existing infrastructure

As the Raritan River basin developed, overlapping infrastructure and conflicting priorities have altered natural drainage pathways. These barriers restrict stormwater flows and exacerbate localized flooding problems. Reversing these barriers without impacting the conflicting infrastructure can be difficult, requiring creative strategies to effectively manage stormwater. Highways or railways are a common source of these constraints, cutting across riparian corridors and cutting off drainage pathways. In the Hopelawn neighborhood of Woodbridge, natural drainage pathways flow south towards the Raritan River. These flows need to travel past an abandoned rail embankment, the complicated interchange of NJ-440 and the Garden State Parkway, and residential, commercial, and industrial properties. Publicly owned corridors can be an opportunity for regional consolidated conveyance of stormwater. This infrastructure can be leveraged to help consolidate stormwater, by collecting drainage along the abandoned railway, and sent past the other barriers in a more efficient and effective location.

Additional challenges with existing drainage infrastructure may arise as climate change increase the severity of storm events. This infrastructure was designed based on historic records of rainfall and sea level – already dated for today’s design conditions but even more for systems that have been built more than 50 years ago. Expanding the existing sewer system, separating stormwater, adding pump stations, and/or high-level storm sewers in the combined sewer areas of Perth Amboy, can address these localized

barriers in sewer infrastructure. Another alternative is to capture and store combined sewer overflow (CSO) discharges in a deep storage tunnel during a storm event and pump the overflow back into the sewer system when conveyance and/or treatment capacity is available. Adding tide gates and pump stations, as proposed for the mouth of Noe’s Creek, overcomes the barriers caused by sea level rise inundating existing sewer outfalls. Connecting these projects with the combined sewer overflow long term control plan for Perth Amboy can help to achieve increased resiliency along with the planned water quality benefits.

» Incorporate climate considerations into Long Term Control Plans

NJDEP requires utilities that operate combined sewer systems (CSS) to develop Long-Term Control Plans (LTCPs) that outline steps they will take to reduce combined sewer overflows to improve water quality. Within the RRBC region, Perth Amboy is the only municipality with a combined sewer system. While the primary goal of the LTCPs is to address water quality issues, they can also provide resilience benefits. Strategies to reduce CSO events by increasing storage capacity can also alleviate flooding. The current standards set by NJDEP that LTCPs must follow use historic rainfall data, not including future projections, despite them being long-term plans. Incorporating climate projections into the process for developing LTCPs would ensure that they better address near and long-term resilience and water quality issues.

Key Considerations

Level of protection: Agencies should evaluate the level of protection or service needed to be provided by stormwater infrastructure. For example, agencies can require green infrastructure to manage a 2-year storm

event and all new gray infrastructure to manage a 10-year storm event. Before enlargement of any culverts in the study area, additional study will be required to demonstrate that culvert enlargement will not exacerbate flood risks elsewhere. In areas vulnerable to coastal storm surge, the potential for enlarged culverts to allow more storm surge to propagate inland must also be considered.

Land use changes: Stormwater improvements should account for land use changes, such as increased impervious areas and changes to drainage patterns.

Costs: Stormwater management costs will initially increase to account for increased rainfall intensity and additional stormwater infrastructure capacity. Proper planning and implementation moving forward will produce cost savings.

Potential community disruption: Construction impacts may disrupt the community but will be followed by reduced local flooding.

Maintenance: In order to be resilient, stormwater management assets must be regularly maintained. All stormwater management assets require routine maintenance to maximize their operational performance, but each has unique maintenance requirements. Green infrastructure will require varied and specific maintenance per practice type, and inspections should be prioritized in critical areas and following rain events.

Permitting: Most stormwater improvements will require permits from local, state, and federal agencies, which can be time-consuming and expensive. All the permitting needs for a project permitting should be examined early in the process to identify necessary regulatory agencies to engage, and to minimize implementation challenges later in the process. Some project may also require land acquisitions or easements to be coordinated with private property owners.

Co-Benefits

Stormwater improvements can have numerous co-benefits to surrounding areas, such as:

- Increased green space
- Improved water quality
- Reduction of urban heat island effects

Funding Opportunities

NJDEP Natural Climate Solutions Grant: Offered through NJDEP and funded through Regional Greenhouse Gas Initiative. Provides grant funding for on-the-ground implementation of projects that create, restore, and enhance New Jersey’s natural carbon sinks, such as salt marshes, seagrass beds, forests, urban parks and woodlands, and street trees

National Fish & Wildlife Foundation (NFWF) America the Beautiful Grant: The goal of this program is to connect and restore the lands, waters, and wildlife of the US through cooperative agreements with other federal agencies. Funding is focused on mitigating flooding and storm threats and improve resilience to wildfire and drought

New Jersey Infrastructure Bank (I-Bank): Independent state financing authority responsible for providing and administering low interest rate loans to qualified municipalities, counties, regional authorities, and water purveyors in NJ. Eligible projects include green infrastructure and stormwater management

NJDEP Stormwater Competitive Grant Program: \$7 million grant program providing funds to improve water quality and quantity through implementation of green infrastructure, retrofits and redesigns of existing stormwater management basins, restoration activities resulting in the removal or reduction of impervious surfaces, and planning and analysis

activities associated with the implementation of the aforementioned activities.

NJDEP Stormwater Utility Feasibility Study Technical Assistance /Stormwater Resilience Planning: Funding for municipalities, counties, and public authorities to conduct feasibility studies for forming stormwater utilities.

Priority Actions

Actions below are priority actions that can be taken in the near- or mid-term to improve stormwater management. For a full list of recommended actions, see the Implementation Roadmap section.

STATE	<ul style="list-style-type: none">• Explore opportunities for expanded stormwater storage on State facilities
RESILIENT RRBC	<ul style="list-style-type: none">• Continue to explore a regional stormwater utility in partnership with municipalities• Explore opportunities for expanded stormwater storage on County facilities• Assess opportunities for incorporating flood storage and conveyance into an extension of the Middlesex County Greenway
LOCAL - ALL MUNICIPALITIES	<ul style="list-style-type: none">• Explore opportunities for expanded stormwater storage on municipal-owned facilities• Incorporate higher standards into stormwater management (see page 111)
LOCAL - PERTH AMBOY	<ul style="list-style-type: none">• Implement the Long-Term Control Plan to reduce CSOs

REGIONAL STORMWATER UTILITY

The Middlesex County region experiences localized flooding and additional stormwater-related problems such as sedimentation build up. A dedicated stormwater funding source, such as a stormwater utility, could be used to solve this issue by implementing capital improvement projects and best management practices, paying for administration and operations services, meeting permit-required minimum control measures, and performing ongoing operations and maintenance activities.

Reliable stormwater funding helps increase resilience by allowing municipal agencies to address issues related to aging infrastructure, increasing flooding problems, and increasing regulatory requirements for stormwater management and pollution reduction. Creating a dedicated funding source for stormwater management provides a stable revenue source for stormwater and resilience programs

Funding Methods

There are numerous funding methods available to municipalities and utilities for the development and implementation of stormwater and resilience programs. The following table presents the funding methods that typically form part of stormwater financing strategies.

Importance of dedicated funding. Stormwater can be used as a dedicated source to fund stormwater programs to leverage other funding methods presented in the table above. Stormwater utility fees reduce the pressure to raise taxes and reduce reliance on an entity’s general fund. In 2019, New Jersey signed into law the Clean Stormwater and Flood Reduction Act, allowing the governing body of any county, municipality, or municipal authority to establish stormwater utilities.

Traditional Funding Sources	Innovative Funding Sources
Stormwater utilities	Cost sharing programs
Grant and loan programs	Public-private partnerships
Municipal bonds	Private and non-profit sources
Taxes (General Fund)	Capital markets
Fee in-lieu-of programs	Mitigation banking programs
Developer funding (plan review and inspections)	Credit trading programs

What is a Stormwater Utility?

A stormwater utility creates the ability to assess fees, based on a fair and equitable approximation of the contribution of stormwater runoff from a real property, which can then be used to fund stormwater programs within the governing body. A stormwater utility operates similarly to any other utility, such as a water or electric utility. This is an especially valuable tool as part of a watershed approach for flood resilience, as it facilitates implementation of stormwater management practices for new and redeveloped areas, creates incentives for retrofits on private property, and provides dedicated funding for beneficial public stormwater projects and maintenance activities.

There are different types of stormwater utilities and varying strategies to calculating stormwater fees. It is up to the governing body to select a method most suitable for their community. The majority of stormwater fees are based on the impervious footprint of a property. While property taxes are solely based on the value of a property, the Clean Stormwater and Flood Reduction Act requires stormwater fees to be based on a fair and equitable approximation of the proportionate contribution of stormwater runoff. Properties with more impervious area and thus those that contribute the most to stormwater runoff will pay higher fees than properties with minimal impervious area.

Credits can be used to provide incentives to implement best management practices and reduce a property’s stormwater fee. These credits can improve equity during implementation and reward properties that manage stormwater on their own property or minimize impervious areas. The maximum credit for a property is typically capped. Stormwater utility revenue projections will account for the impact of credits to assure revenue sufficiency.

Stormwater utility fees reduce the pressure to raise taxes, provide a dedicated funding source for stormwater management, create a more equitable allocation of costs because higher property values do not necessarily contribute higher amounts of stormwater runoff. Furthermore, tax-exempt properties are responsible for paying stormwater fees based on their contributing runoff, making stormwater utilities more equitable. Stormwater fee credit policies can incentivize improved private stormwater facility maintenance as well as facility upgrades.

Local vs. Regional Stormwater Utilities

The state of New Jersey has over 560 jurisdictions, many which have similar stormwater challenges and a lack of dedicated funding to address all their stormwater needs. A regional approach to implementing a stormwater utility may be a logical approach to addressing resilience and stormwater problems that span beyond municipal boundaries.

A regional approach could consist of an existing regional authority or county agency providing stormwater services or consist of several communities pooling together to form a new stormwater utility. This regional approach can create economies of scale where administrative, compliance and project costs can be shared. This regional approach also works for other utilities such as water, wastewater, or electricity. The table below, presents advantages and challenges of local and regional stormwater utilities.

	Advantages	Challenges
Local Stormwater Utility	+ Local control of policies + Dedicated funding at the local level	x Stormwater problems do not follow municipal boundaries
Regional Stormwater Utility	+ Address stormwater problems that span beyond municipal boundaries + Cost savings through economies of scale and shared resources + Increase access to grants and innovate funding sources + Opportunities to share technical expertise + Able to adapt rate structure to support regional goals + Streamline implementation to regulatory compliance and O&M costs + Dedicated funding for regional implementation	x Potential loss of local control of certain operational or project decisions, hiring, etc. x Project prioritization requires regional procedures agreed by participants in the regional stormwater utility

Given the local stormwater and resilience needs, the region should establish a dedicated funding source, potentially including a regional stormwater utility in coordination with municipalities within the county boundary.

The recommended process to establish a stormwater utility includes the following steps [laid out by NJDEP](#):

- 1. Discuss the concept:** assess the pros and cons of a regional stormwater utility.
- 2. Conduct a preliminary feasibility study:** obtain an inventory of all current stormwater facilities and define the services to be provided.

- 3. Engage management:** gather support from local government.
- 4. Conducting a comprehensive feasibility study:** identify the project team and process, take inventory, identify needs and expenses (i.e., program revenue needs for capital, operation and maintenance, administrative, and compliance), analyze impervious and pervious surfaces, develop level of service options, define billing procedures and administrative policies, and establish fee and credit structures.
- 5. Engage stakeholders:** have transparent and ongoing public education and outreach programs that will extend throughout the duration of the feasibility study and into implementation, if approved. Consider the formation of a Stormwater Advisory Committee (SAC) that includes representatives from stakeholder groups and represent a cross section of the community that uses or benefits from the County’s stormwater services. This SAC allows the County and municipalities team to build a knowledge base among leaders in the community, provides a resource for understanding the stormwater requirements and problems facing community members, and provides a sounding board for developing tools and approaches that will appeal to the broader public as the stormwater utility moves toward implementation.
- 6. Engage the public:** gather general public support to draft an ordinance to establish the stormwater utility. Consider the use of workshops, watershed tours, public meetings, social media, mailings, etc.
- 7. Implement the stormwater utility:** establish an implementation team to set up the utility and move towards launch and implementation, including being ready to deliver the identified stormwater services.

Middlesex County and the participating municipalities must first ensure there is leadership and commitment to evaluate the feasibility of a regional stormwater utility among the interested member communities and then develop a regional concept or model for funding. This concept or model will describe the overall framework on how stormwater services would be provided and will refine the benefits of the regional approach to the county and interested municipalities. Community engagement will be essential for receiving buy-in and public acceptance. It is recommended that after performing initial outreach to establish a list of interested member communities that Middlesex County conduct a feasibility study with those communities to further define the services to be provided by the regional stormwater utility, develop procedures for project prioritization, analyze applicable rate structure, and estimate potential stormwater fees before developing an implementation plan.

For additional information on establishing a stormwater utility see *Appendix L* and NJDEP provided guidance on establishing fees and credits, developing an asset management program for stormwater management systems, and develop guidance for stormwater management related public education and outreach available [here](#).

STORMWATER MANAGEMENT

CARTERET, PERTH AMBOY, WOODBRIDGE

See Summary Table of Recommended Actions starting on page 223 for additional details on all actions.

LEGEND

STORMWATER STRATEGIES

Expand Storage On Publicly Owned Land

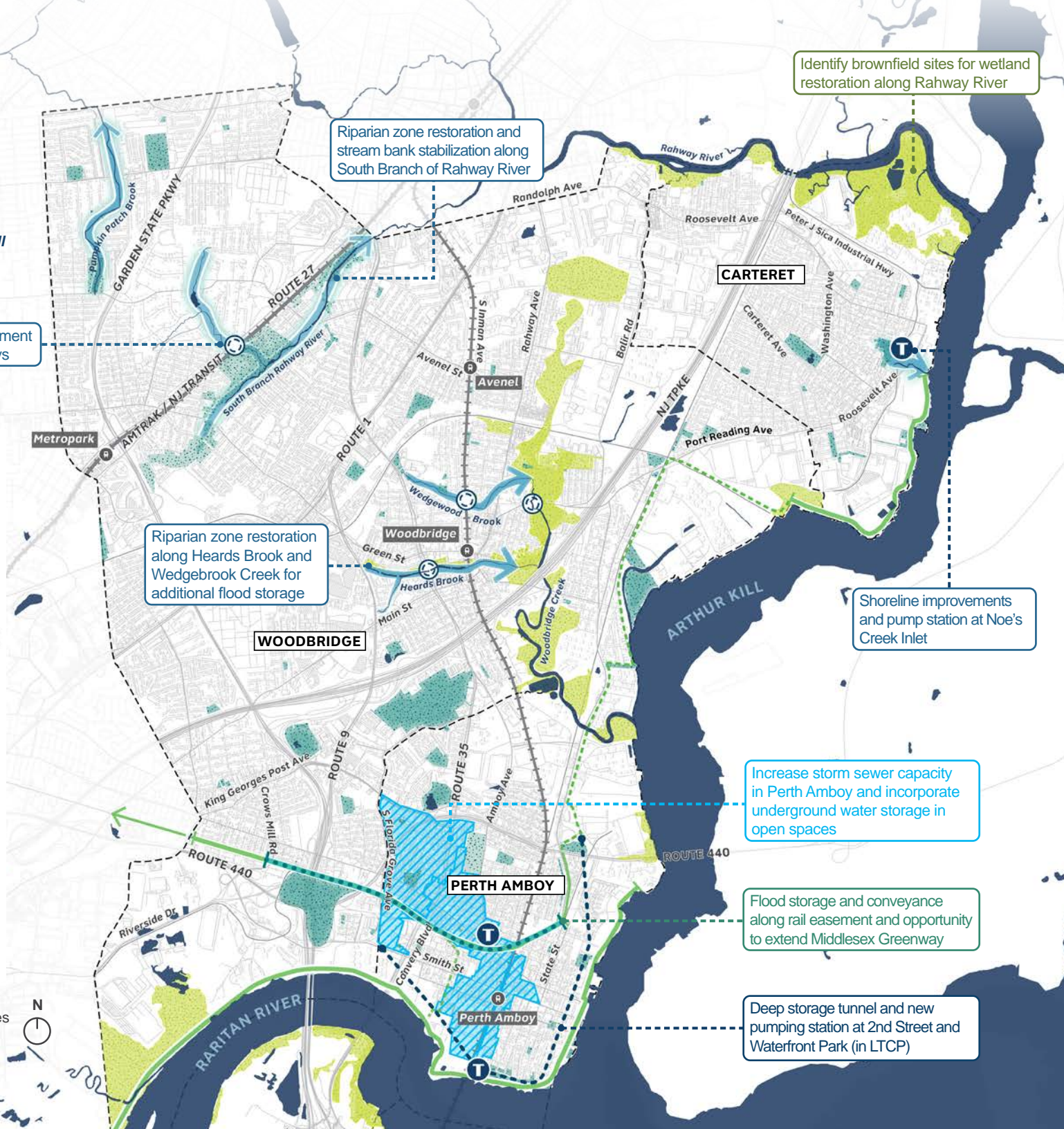
- Protect and restore natural features for stormwater storage and infiltration
- Retrofit parks and open space for stormwater management (study & prioritize)
- Create upstream diversions and off-channel storage on flood-prone rivers (South River only)

Increase Capacity Of Riparian Corridors

- Expand and restore riparian zones
- Culvert enlargements

Eliminate Barriers Caused by Existing Infrastructure

- Opportunity for regional consolidated conveyance along publicly owned corridors
- Stormsewer separation (study & prioritize)
- Increase stormsewer capacity - deep storage tunnel (Long Term Control Plan)
- New Pump Station



STORMWATER MANAGEMENT

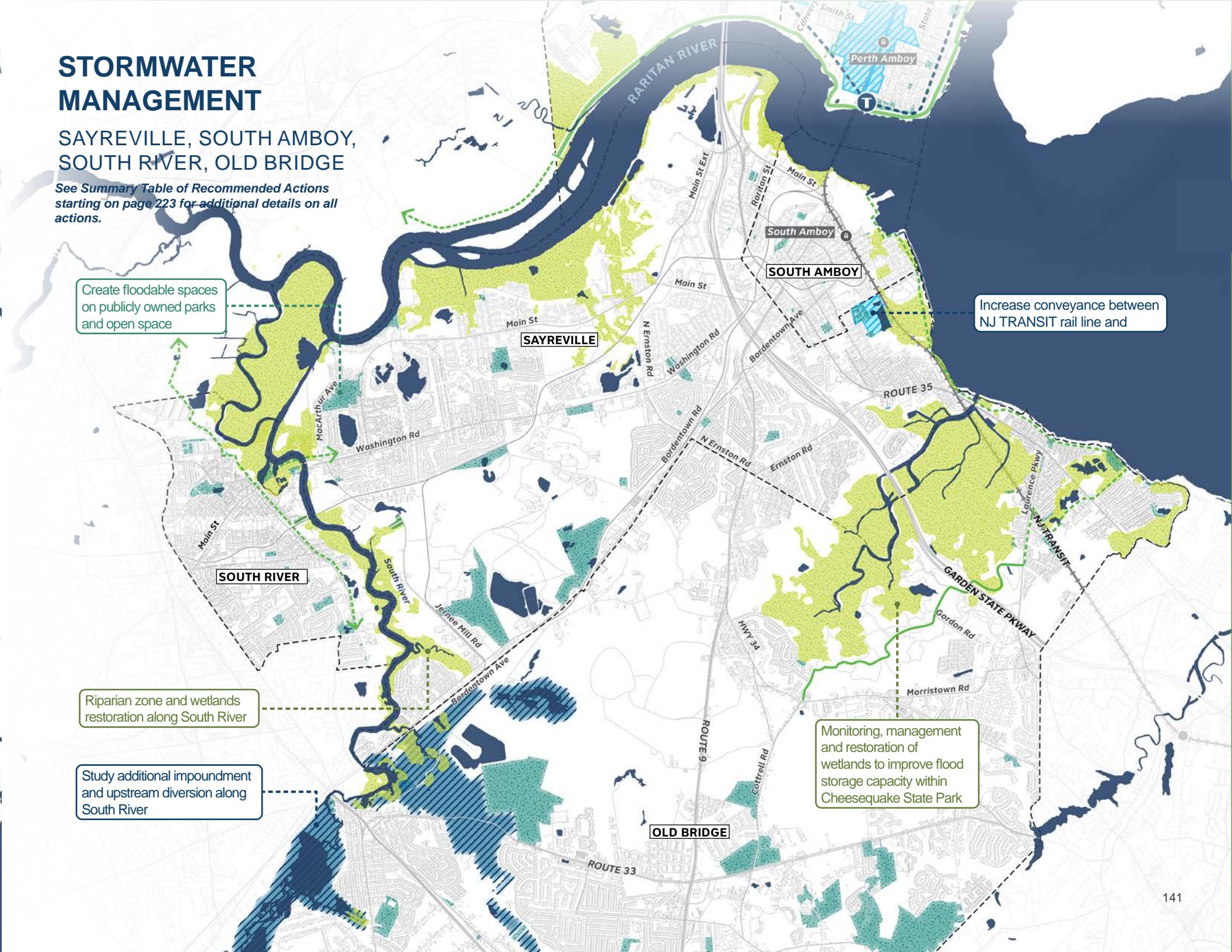
SAYREVILLE, SOUTH AMBOY, SOUTH RIVER, OLD BRIDGE

See Summary Table of Recommended Actions starting on page 223 for additional details on all actions.

Create floodable spaces on publicly owned parks and open space

Riparian zone and wetlands restoration along South River

Study additional impoundment and upstream diversion along South River





Connection to Resilience

As evidenced by Hurricane Sandy in 2012, much of the Raritan River and Bay Communities region is vulnerable to coastal flooding. With 2.4 feet of sea level rise, a storm like Sandy could flood approximately 5,000 buildings across the region, impact approximately 22,000 residents, and cause \$2.8 billion in damage. Areas along the Raritan Bay coast in Old Bridge, South Amboy and Perth Amboy are vulnerable to coastal storm surge, in addition to the waterfront up the Arthur Kill, along Woodbridge Creek and Rahway River, as well as along the Raritan River and South Rivers.

In addition to storm surge, low lying areas along the coast will also be flooded more regularly by high tides due to sea level rise. With 2.4 feet of sea level rise, 32 structures that house 44 residents will be impacted by daily tidal flooding. If no actions are taken, some areas along the coast, particularly along the South River, will no longer be safe places for people to live.

Strategies

To reduce these risks, the region’s coasts and waterfronts will need to be adapted to provide a “first line of defense” against storm surge and sea level rise. This includes strategies that prevent erosion of land, like bulkheads, those that serve as a barrier to flooding, such as floodwalls, berms, and levees, as well as strategies that serve to buffer wave action, like breakwaters. There are also strategies to preserve or adapt naturel systems, such as beaches, dunes, or coastal wetlands, to enhance the ability of these landscapes to buffer storms and adapt them to sea level rise.

» Coastal Flood Barriers

Adapt existing bulkheads

Much of the region’s coast has been heavily altered by development and bulkheads have been constructed along the shoreline, particularly along the Arthur Kill. As sea levels rise, these structures will need to be adapted to maintain functionality. Standards and guidance statewide are needed to provide a consistent methodology for how property owners should determine a suitable elevation as structures require improvements.

Construct multi-purpose coastal flood barriers

In areas with significant coastal flood risk and where there is available land under largely public ownership, coastal barriers are an effective way to address flood risk. In addition to providing protection from coastal flooding, flood barriers can be designed to provide pedestrian and bike pathways along the waterfront. In Carteret, there is an opportunity to incorporate a coastal barrier into the planned greenway along the Arthur Kill. This could tie into an elevated redevelopment site north of Noe’s Creek, connected by a tide gate across the creek. For more on the Noe’s Creek proposal, see Chapter 5.3.1. Further south in Perth Amboy, a similar approach could be used to provide a waterfront greenway along the Harbortown development as well as along the Sadowski Parkway and connecting into Woodbridge Riverfront Park to provide contiguous public access and coastal storm surge protection.

Along the Rahway River in Carteret and Woodbridge, the U.S. Army Corps of Engineers (USACE) has developed a proposed design for a levee and floodwall to provide coastal flood protection to the West Carteret neighborhood

and industrial properties in the Avenel section of Woodbridge (Rahway River Basin (Tidal) Flood Risk Management Project). This project has been authorized for construction and awaits funding allocation. By incorporating public access to this project, the proposal can also improve waterfront public access along this waterway and connect into Joseph Medwick Park.

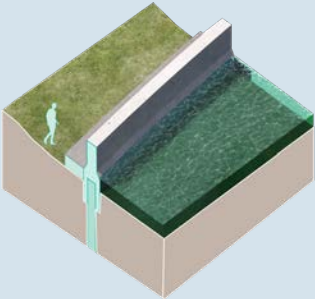
Along the South River, there are targeted opportunities to protect areas of high flood risk and substantial density, such as the Main Street section of South River, that should be further studied as priority areas for coastal protection. Sections of this potential alignment may be achieved through deployable flood protection measures, and through development of a berm or floodwall along the roadway or on land acquired through voluntary buyouts.

Tide or surge gates deployed along drainage and waterways keep out floodwaters during high tides or storm events. In Carteret, adding a tide gate at the mouth of Noe’s Creek can block this flood pathway and prevent flooding due to coastal storm surge and also ensure the existing sewer outfalls do not get inundated due to sea level rise. The USACE is also studying regional coastal protection strategies as part of the New York and New Jersey Harbor and Tributaries Study. This includes examination of a storm surge barrier across the Lower New York Bay from Sandy Hook to Breezy Point, which would protect the entire RRBC region, as well as more localized surge barriers such as across the Arthur Kill at Perth Amboy, which in combination with a barrier at the Narrows would protect the northern portion of the region.

In areas where coastal barriers are not feasible

Coastal Flood Barriers

Adapt existing bulkheads



Bulkheads are concrete structures along shorelines of large bodies of water that protect from flooding, wave action and erosion. They can be integrated into recreational greenways and provide waterfront access to users.

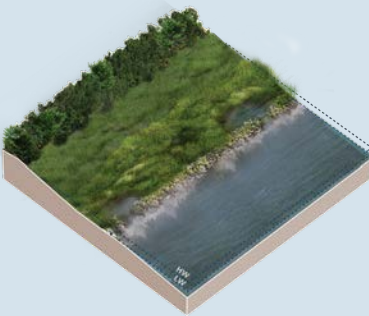
Construct multi-purpose coastal flood barriers



Berms and levees are raised earthen structures erected to protect from flooding. They can be integrated with recreational boardwalks, walkways, and bike paths, and their sloped sides can be populated with vegetation and plantings.

Natural and Nature-based Features

Living Shorelines



Living shorelines stabilize and protect estuarine coasts, sheltered coastlines, and tributaries by incorporating natural features, vegetation, or submerged aquatic vegetation. Hybrid systems also integrate harder shoreline structures for stability such as stone, sand fill, rock sills, and other structural and organic materials.

Implement beach and dune restoration and renourishment



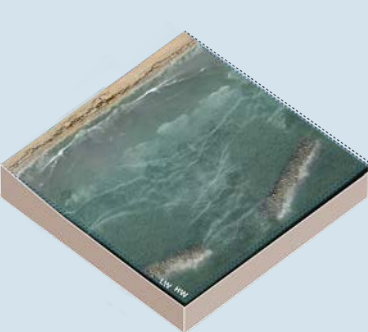
Dunes are landforms that occur with sufficient transportation of sand or sediment, and rely on a healthy and extensive root system of dune grasses and other vegetation to maintain their shape. Dunes act as a buffer, reducing damage to communities by attenuating ocean waves.

Protect and manage tidal wetlands for sea level rise



Low-lying tidal wetland ecosystems are among the most vulnerable environments to sea level rise. The resilience of tidal wetlands to sea level rise depends on the potential for horizontal migration to upland areas and the vertical accretion rate of the wetland, which can be supported through restoration and expansion.

Living Breakwaters



Breakwaters are partially or fully emergent structures that extend above mean high water. They are built with armor units to help attenuate storm waves to improve safety and prevent damage to buildings and infrastructure.

due to a mix of property ownership and land use considerations, there will need to be outreach to property owners to promote protection on individual sites, particularly critical facilities owned and operated by industrial business and utilities. For more on this strategy see the sections on Adapt or Protect Critical Facilities and Technical Support for Property Owners. Coastal barriers can serve as impediments to natural drainage patterns, so planning for inland drainage storage and conveyance is a critical part of implementing these strategies.

» Natural and Nature-based Features

Protect and manage tidal wetlands for sea level rise

Tidal wetlands provide important habitats for numerous species. Large, contiguous tidal wetland areas can also reduce the impacts of coastal storms by buffering wave action. Much of the wetlands across the region are compromised by invasive species, fill, and poor water quality. Sea level rise will present an additional threat if sediment supply is not adequate. Existing wetlands should be preserved and protected from development through zoning and other regulations (see Land Use and Zoning section above) and wetlands in poor health should be restored to improve ecological quality and promote adaption to sea level rise.

Construct living shorelines

Living shorelines are an alternative to bulkheads that create space for tidal wetlands to manage erosion, provide some wave attenuation benefit, and create and preserve intertidal habitats. There are numerous opportunities to incorporate living

shorelines throughout the region—as part of waterfront development projects like the Riverton in Sayreville, coastal restoration projects like the South River Ecosystem Restoration and Flood Resilience Enhancement Project, and park projects like Alvin P. Williams Memorial Park in Woodbridge.

Implement beach and dune restoration and renourishment

Beaches and dunes can buffer upland areas from coastal waves but can also be eroded by major storms. They also provide habitat and recreational spaces. There are existing beaches along the Raritan Bay in Perth Amboy, South Amboy, and Old Bridge. Renourishment of these beaches can provide resilience benefits, while additional structures like breakwaters and jetties can manage sediment transport to protect beaches from erosion and maintain key navigational channels.

Build living breakwaters

Breakwaters are offshore structures that reduce wave action, thereby protecting shorelines from erosion. Breakwaters can be completely or partially submerged and can be designed with a variety of materials. A living breakwater is a structure that mimics the function of coastal reefs to break waves and support marine life.

Key Considerations

Costs and maintenance: Coastal resilience strategies vary in terms of their costs. Coastal barrier systems are generally the most expensive as these projects involve significant construction. Nature-based solutions are often less expensive, but may require more extensive on-going maintenance, such as ongoing beach nourishment.

Coastal barrier systems also require maintenance, with greater maintenance needed for any gates or closure elements.

Level of protection: The level of protection for coastal resilience projects will vary based on the specific risks the project is addressing and the type of strategy. Bulkheads are typically designed to protect land from erosion and daily high tide flooding, but not from coastal storm surge events. Coastal barrier strategies, give their high costs are typically designed to protect against relatively infrequent events, such as the event that will have a one percent annual chance of occurring. Nature-based strategies may be designed to protect against a lower storm event that those specific techniques are most able to address.

Potential community disruption: Construction impacts may disrupt the community but will be followed by reduced flooding.

Permitting: Most coastal resilience projects will require permits from local, state, and federal agencies, which can be time-consuming and expensive. Coastal areas are regulated by the U.S. Army Corps of Engineers as well as the NJDEP. Specific projects may require review by additional agencies based on the project scope and location. All the permitting needs for a project should be examined early in the process to identify necessary regulatory agencies to engage, and to minimize implementation challenges later on in the process. Some projects may also require land acquisitions or easements to be coordinated with private property owners.

Co-benefits

Coastal resilience projects can advance multiple goals beyond flood risk reduction, including:

- Waterfront access
- Habitat creation

Funding Opportunities

FEMA Public Assistance (PA): These grants provide reimbursement for disaster related expenses and are often used for repairs, restorations, reconstruction or replacement of public facilities or infrastructure damaged or destroyed by a disaster.

United States Army Corps of Engineers (USACE): The USACE funds large, coastal resilience projects throughout the county and received significant funding from the Bipartisan Infrastructure Bill for future studies and projects. The process for identifying prioritizing and designing civil works projects through the USCAE can be lengthy.

National Oceanic and Atmospheric Administration (NOAA) National Fish and Wildlife Foundation (NFWF) National Coastal Resilience Fund: This grant program funds the planning, design, and restoration of natural and nature-based solutions to help protect coastal communities from impacts of storms, floods, and other natural hazards and enable them to recover more quickly and enhance habitat for fish and wildlife.

Priority Actions

Actions below are priority actions that can be taken in the near- or mid-term to improve coastal resilience. For a full list of recommended actions, see the Implementation Roadmap section.

USACE	<ul style="list-style-type: none">• Rehabilitation of Cheesequake Creek Jetty• Implement Rahway River Basin project• Study regional and local coastal protection strategies through the NYNJ HATS study
LOCAL - SAYREVILLE	<ul style="list-style-type: none">• Work with Riverton developer to incorporate nature-based solutions along the shoreline, such as a living shoreline/ into redevelopment plan
NGOs	<ul style="list-style-type: none">• Study resilience of existing wetland systems and identify opportunities for restoration and improvements
LOWER RARITAN RIVER WATERSHED PARTNERSHIP	<ul style="list-style-type: none">• Implement the South River Ecosystem Restoration & Flood Resiliency Enhancement Project and study opportunities for additional improvements along the South River

COASTAL RESILIENCE





CARTERET, PERTH AMBOY, WOODBIDGE

See Summary Table of Recommended Actions starting on page 223 for additional details on all actions.

LEGEND

COASTAL RESILIENCE

Coastal Flood Barriers

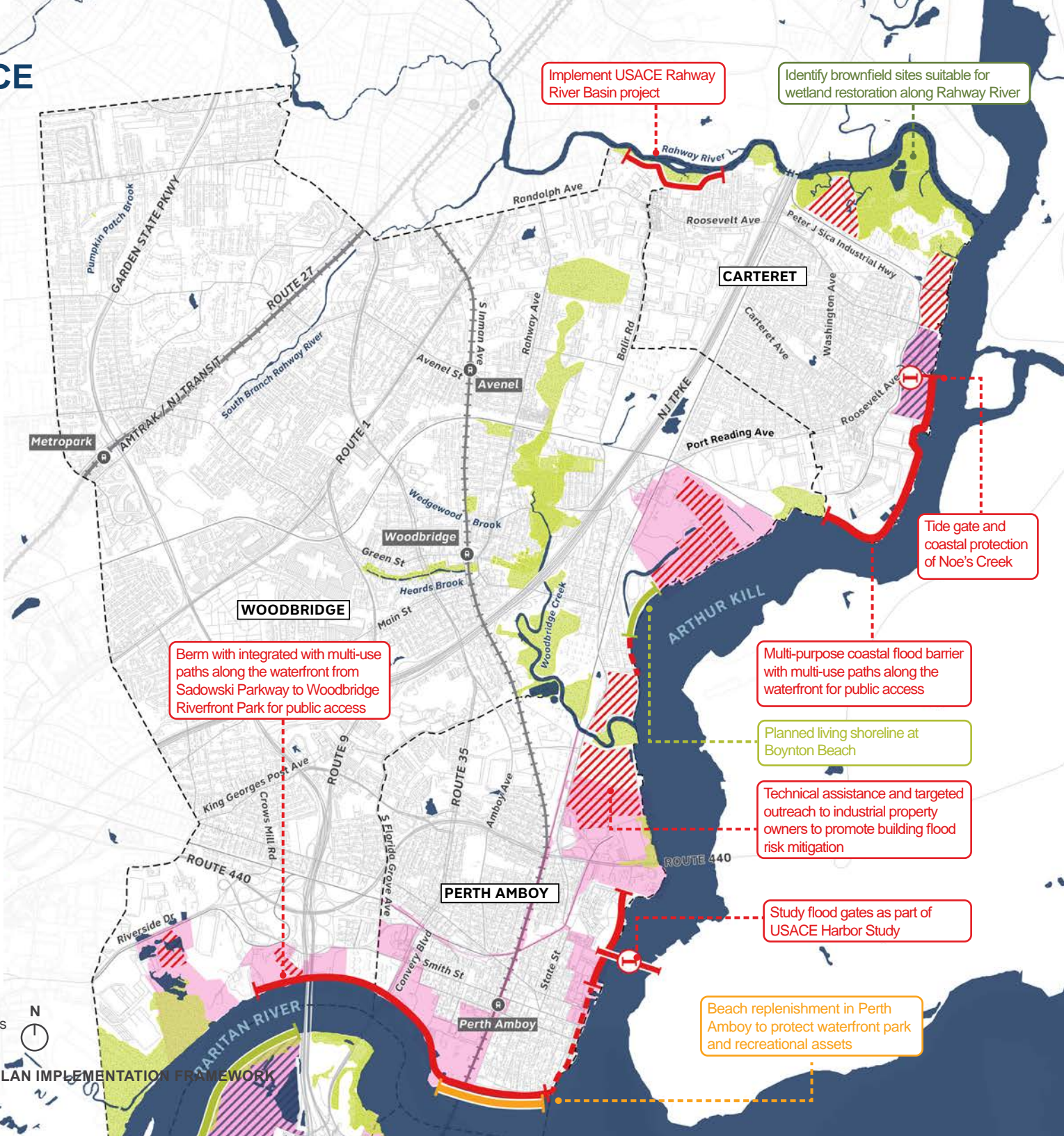
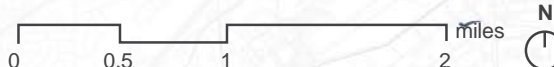
-  Adapt existing bulkheads
-  Construct multi-purpose coastal flood barrier systems
-  Tide/surge gate
-  Outreach for site or building level adaptation of critical facilities

Natural and Nature-based Features:

- Protect and manage tidal wetlands for sea level rise
- Construct living shorelines or vegetated berms to enhance shoreline ecology
- Implement beach and dune restoration and renourishment
- Build living breakwaters

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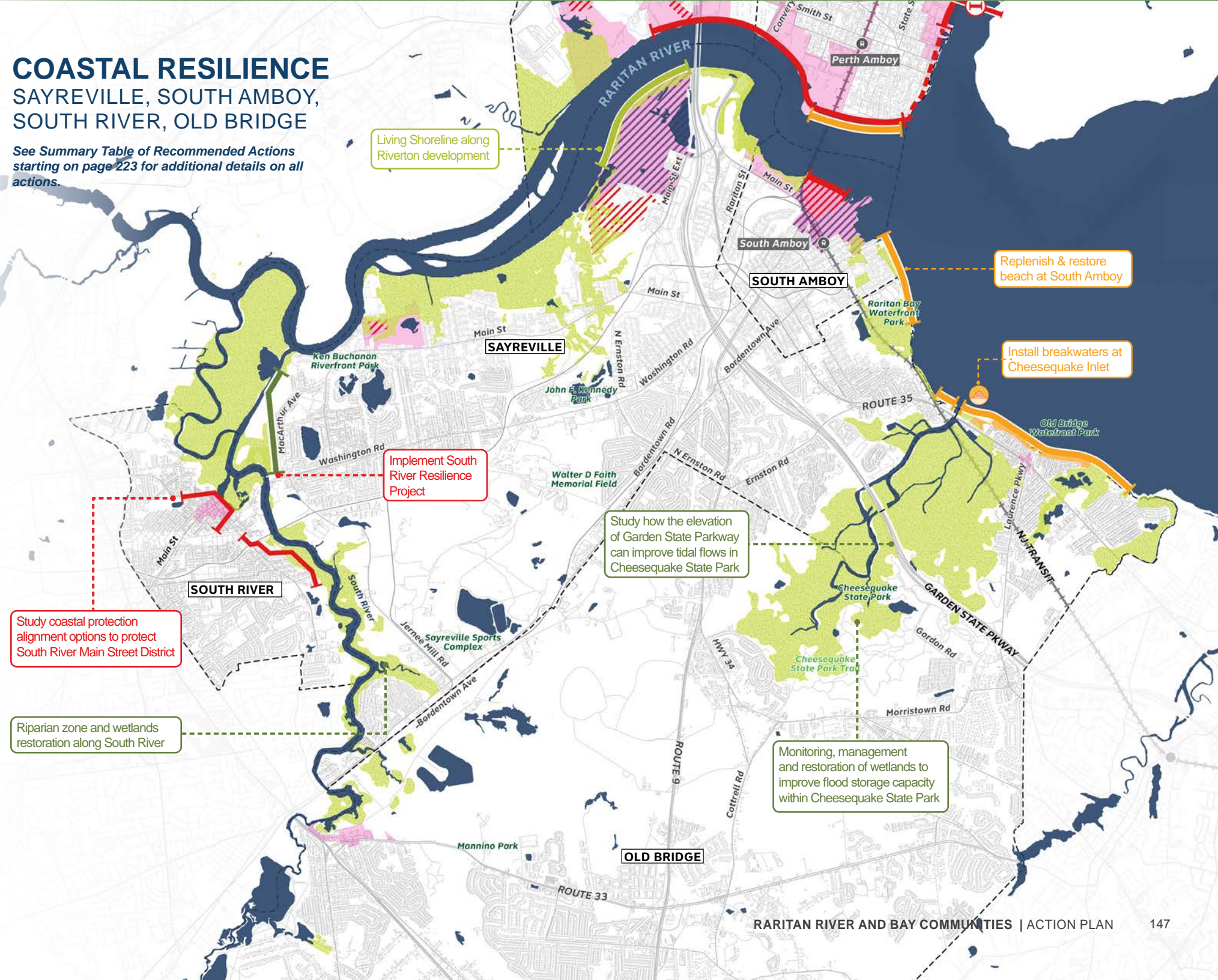
-  Water bodies
-  Waterfront redevelopment areas with planned elevation
-  Waterfront redevelopment areas - see zoning and land use section for resilient redevelopment standards
-  Municipal Boundary



COASTAL RESILIENCE

SAYREVILLE, SOUTH AMBOY,
SOUTH RIVER, OLD BRIDGE

See Summary Table of Recommended Actions starting on page 223 for additional details on all actions.



BENEFITS FOR ADDITIONAL CLIMATE HAZARDS

At a regional scale, the shifting dynamics of natural processes driven by climate change form a nexus between hydrologic processes, increasing temperatures, habitat shifts, and other processes. While presenting a sticky challenge, this also presents an opportunity at a regional scale to implement large-scale, holistic, and innovative projects that can tackle multiple hazards at once.

Invest in regional ecosystem-based adaptation projects to address multiple climate hazards.

Projects founded on principles of large-scale watershed-based management, habitat restoration, and sustainable agroforestry practices can not only reduce greenhouse gas emissions but also reduce local heat; improve regional air quality; protect water supply sources; increase natural filtration; improve groundwater recharge; keep surface water systems, such as wetlands and lakes, in good health to minimize risk of contaminants; promote native plants that require fewer fertilizers while keeping out invasive species; manage freshwater inflows into estuaries with implications for coastal ecosystems already experiencing stress from ocean acidification; minimize tick presence; and minimize wildfire risk.

Regional integrated water resources management practices should be implemented as part of these processes to develop holistic approaches to managing future water supply, such as through conjunctive seasonal use of surface water and groundwater. Other types of projects to consider include large-scale forest stand improvement projects including enhancing native habitats, removal of additional brush and debris, and monitored localized burnings, as well as large-scale projects to conserve and protect marine life vulnerable to ocean acidification.

LIVING SHORELINE PLANNING & DESIGN RESOURCES IN NJ

A living shoreline is “a shoreline management practice that addresses the loss of vegetated shorelines, beaches, and habitat in the littoral zone by providing for the protection, restoration or enhancement of these habitats.” ([Coastal Zone Management Rules at N.J.A.C. 7:7-1.5](#))

When properly designed, living shorelines can mitigate the effects of erosion and sea level rise while also providing habitat for endangered and threatened species. In 2013, the State of New Jersey adopted [Coastal General Permit 24](#) (also referred to as the Living Shorelines General Permit) to encourage the use of living shorelines along the coastline. To support this effort, the NJDEP Office of Policy and Coastal Management has compiled a variety of resources on their [Living Shorelines](#) website. These resources include:

- **Planning and design resources on living shorelines.** *The Living Shorelines Engineering Guidelines* was developed byNJDEP and the Stevens Institute of Technology in 2015 to help engineering consultants, regulators, and private property owners ensure that living shorelines in the state are designed, permitted, and constructed in a way that leverages the best available information. An update of these guidelines is forthcoming.
- **Resources and information on permits and regulations** that apply to implementing living shoreline include New Jersey coastal zone management regulations and applicable state and federal permits.
- **Case studies** of successful living shoreline projects from around the state.

Case Study: South River Ecosystem Restoration And Flood Resilience Enhancement Project, Sayreville, NJ

The Lower Raritan Watershed Partnership, along with Princeton Hydro, Rutgers University, Middlesex County, and other partners received funding in 2018 from the National Fish and Wildlife Foundation to develop an “eco-park” which combines a vegetated berm along with wetland restoration strategies to provide coastal flood protection as well as ecosystem enhancements. For more information on the South River Ecosystem Restoration & Flood Resiliency Enhancement Project, [visit their website](#).

SOUTH RIVER ECOSYSTEM RESTORATION & FLOOD RESILIENCY ENHANCEMENT PROJECT SITE

Image Credit: LRWP

RESILIENT TRANSFORMATION OF CONTAMINATED SITES AND BROWNFIELDS

Physical & Nature-
Based Infrastructure



Connection to Resilience

The region contains many contaminated sites due to its industrial history. Many of these sites are located along the Arthur Kill and the Raritan River, where many industrial sites were once clustered. The presence of hazardous substances associated with these sites poses risks to human health and ecosystems due to possible exposure. Contaminated sites in areas vulnerable to flooding from both heavy rainfall and storm surge present possible additional risks from spreading of surface-level contamination in floodwaters, spreading of subsurface contamination with groundwater rise, or damage to engineered controls due to storms or other climate events. Climate change may exacerbate these risks in the future; the level of risk is also related to a variety of other factors, including the type and extent of contamination.

The sites also present an opportunity to remediate and transform these industrial areas into open space or develop them to meet demand for new uses and economic growth, while incorporating stormwater management and resilience components. Redevelopment of these sites can also support the residential redevelopment strategies recommended in the *Zoning and Land Use Policy* section. Transformation of these sites can reduce a potential threat from flooding, in addition to meeting other community goals. For example, the Dupont site on the Carteret waterfront is in the process of being cleaned-up and transformed into a waterfront greenway, while the upland portion will be redeveloped with new uses.

According to the NJDEP Known Contaminated Site List dataset, there are approximately 500

contaminated sites within the RRBC region. The team conducted an analysis of these sites to identify priority sites based on the following factors using currently available data:

- Exposure to flooding based on the six modeled flood scenarios developed for the Resilient NJ program
- Density of population living within a half-mile of the contaminated site
- Social and economic demographics of the adjacent population using the CDC Social Vulnerability Index
- Site remediation status (Pending or Active)
- Contaminant type
- Distance from existing green space
- Whether or not the site was in a redevelopment area
- Inclusion in the NJDEP brownfields inventory
- Presence in a U.S. Department of Treasury Opportunity Zone
- Presence in an Urban Enterprise Zone

Other information, such as the concentration and extent of contamination, might be useful to understand the capacity for a site to be transformed, but is not widely available. Further analyses, including consideration of desired end use of each site, can help identify specific sites for transformation. More details on this prioritization methodology and results can be found in *Appendix I*.

Strategies

Developing a pipeline of contaminated sites and brownfields that can be prioritized for remediation can expedite the clean-up of potentially hazardous sites within areas prone to flooding, as well as create additional benefits for the region.

» Promote remediation and redevelopment of brownfields and contaminated sites in areas exposed to flooding

Developing a prioritized set of sites could facilitate the alignment of potential funding sources. The preliminary priority list developed by the Resilient NJ team can serve as a starting place for additional collaboration with municipalities, the county, and the state to develop a pipeline of sites. The state could further support this process by collaborating on the development of a set of guidelines and requirements for how a site can flow through the process of clean-up and enhancement.

Many of the contaminated sites in the region are owned by municipalities, who could fund and advance projects to transform these sites. Other sites are owned by private entities, and outreach and engagement could foster advancement of resilience projects.

What’s the Difference Between a Contaminated Site and a Brownfield?

Contaminated sites are properties where there is known presence of hazardous substances. Contamination can be in the soil or groundwater near the surface or below bedrock and can originate from different sources such as placement of historic fill, dumping of waste products above or below ground, and spills of toxic chemicals.

As noted previously, NJDEP maintains a database of known contaminated sites that includes information about the owner, site clean-up status, and whether there is a classification exception area and/or deed notice associated with the site, which are types of institutional controls to prevent exposure to contamination.

Although NJDEP updates the database regularly, data are inherently imperfect. Brownfields are, to some extent, a subcategory of contaminated sites in that they are defined by the State (in the Brownfield and Contaminated Site Remediation Act) as “former or current commercial or industrial sites, currently vacant or underutilized, and on which there has been, or there is suspected to have been, a discharge of a contaminant.” The distinguishing features of brownfields are that they are specifically commercial and industrial sites, and that there only needs to be a perception of contamination for a site to be considered a brownfield.

CHEESEQUAKE STATE PARK, OLD BRIDGE

Image Credit: Adobe Stock Photos

» Improve data collection

NJDEP’s Brownfield Inventory, which was used in the preliminary prioritization process developed by Resilient NJ, only includes Community Collaborative Initiative (CCI) municipalities, which means it only covers Perth Amboy in this region. Expansion of this dataset statewide would support additional municipalities in developing plans to remediate brownfields.

Additional data improvements to the Known Contaminated Site List and other state-managed databases to provide more complete information on resilience-related factors is also needed. For instance, there is a need for expanding the available information or accuracy on contaminant type and extents, remedial design type, and site status.

» Incorporate climate considerations into remediation

A statewide climate-related risk assessment of contaminated and remediated sites would be beneficial to fully understand the magnitude of risk these sites could present if flooded and make the potential case for further investment. This should include a specific study of the impacts of climate-related hazards such as groundwater rise on risks posed by various types of site contamination.

In addition, there is a need to explore higher standards for contaminated sites to consider climate change impacts in remedial design.

Key Considerations

Data and science gaps: Preliminary prioritized sites identified in this plan should be reviewed in more detail, as the process was based on the data sets currently available which have their limitations, as noted above. In addition, there is limited scientific knowledge around the potential dangers to public health when contaminated sites are flooded, or the long-term implications of sea level rise.

Implementation: Remediation and redevelopment of contaminated sites and brownfields is a lengthy process that will require concerted action at many levels of government, and in close coordination with the private sector.

Co-Benefits

Remediation and re-used of contaminated sites and brownfields can result in the provision of open space in areas that currently lack open space and contribute to reducing the urban-heat island effect. Redevelopment of sites can also contribute to economic development.

Resilient Transformation of Contaminated Sites for Additional Climate Hazards

High concentrations of hazardous materials and wastewater discharge throughout the region can pose a serious risk to public health and safety as groundwater levels rise proportional to sea level rise. The following strategies can help mitigate these risks.

Develop site-specific plans for contaminated sites near wellhead protection areas, especially those located in environmental justice communities. This strategy would likely require extensive engagement and partnerships with private property owners and other key stakeholders. As groundwater levels rise, it will also be increasingly essential to develop site-specific plans to remediate contaminated plumes, which could include full soil removal replaced with new topsoil.

Identify high opportunity contaminated sites for urban green space placement in underutilized and non-municipal land. See page 134 on Stormwater Management.

Funding Opportunities

- **U.S. Environmental Protection Agency (EPA) Brownfields Job Training Program:** This is a program to recruit, train, and place unemployed and under-employed residents from communities impacted by brownfield. Funding can be used for hazardous waste training, green remediation technologies, stormwater management training, emergency response training, enhanced environmental health & safety related to site remediation, energy efficiency and alternative energy technologies
- **New Jersey Economic Development Authority (NJEDA) Brownfields Impact Fund:** This fund provides loans and grant on a first come, first serve basis to assist with cleanup of brownfield sites throughout New Jersey
- **NJDEP / NJEDA Hazardous Discharge Site Remediation Fund (HDSRF):** The fund provides loans or grants for remediation and / or cleanup of contaminated and underutilized sites. Funding can cover preliminary assessments, site investigation, remedial investigation and remedial action

Priority Actions

Actions below are priority actions that can be taken in the near- or mid-term to promote transformation of contaminated sites. For a full list of recommended actions, see the *Implementation Roadmap* section.

STATE	<ul style="list-style-type: none">• Expand the brownfields inventory across the state, beyond CCI municipalities (which are the only municipalities included as of June 2022)• Continue data improvements to Known Contaminated Site List and other state-managed databases to provide more complete information on resilience-related factors (e.g., expanding available information or accuracy on contaminant type and extents, remedial design type, site status)• Coordinate and align state funding programs to accelerate resilient transformation of contaminated sites. Consider:<ul style="list-style-type: none">• Collaborating in the development of guidelines and requirements a site might follow to flow through the process• Funding and supporting resilient transformation of high priority sites under RNJ banner
RESILIENT RRBC	<ul style="list-style-type: none">• Support refinement of the prioritization methodologies presented herein and support municipalities in confirming high risk and high opportunity sites for action
LOCAL- ALL MUNICIPALITIES	<ul style="list-style-type: none">• Support refinement of the prioritization methodologies presented herein and confirm high risk / opportunity sites• Advance catalyst resilient transformation projects at high risk / opportunity publicly owned contaminated sites / brownfields

CONTAMINATED SITES
AND BROWNFIELDS
CARTERET, PERTH AMBOY,
WOODBIDGE

See Summary Table of Recommended Actions
starting on page 223 for additional details on all
actions.

LEGEND

BROWNFIELD REMEDIATION

Promote remediation and redevelopment of brownfield and contaminated sites in areas exposed to flooding

Priority Brownfield Remediation Sites

Publicly-owned Brownfield Remediation Sites

Brownfield Sites - Exposure to Flood Risk

Highest

High

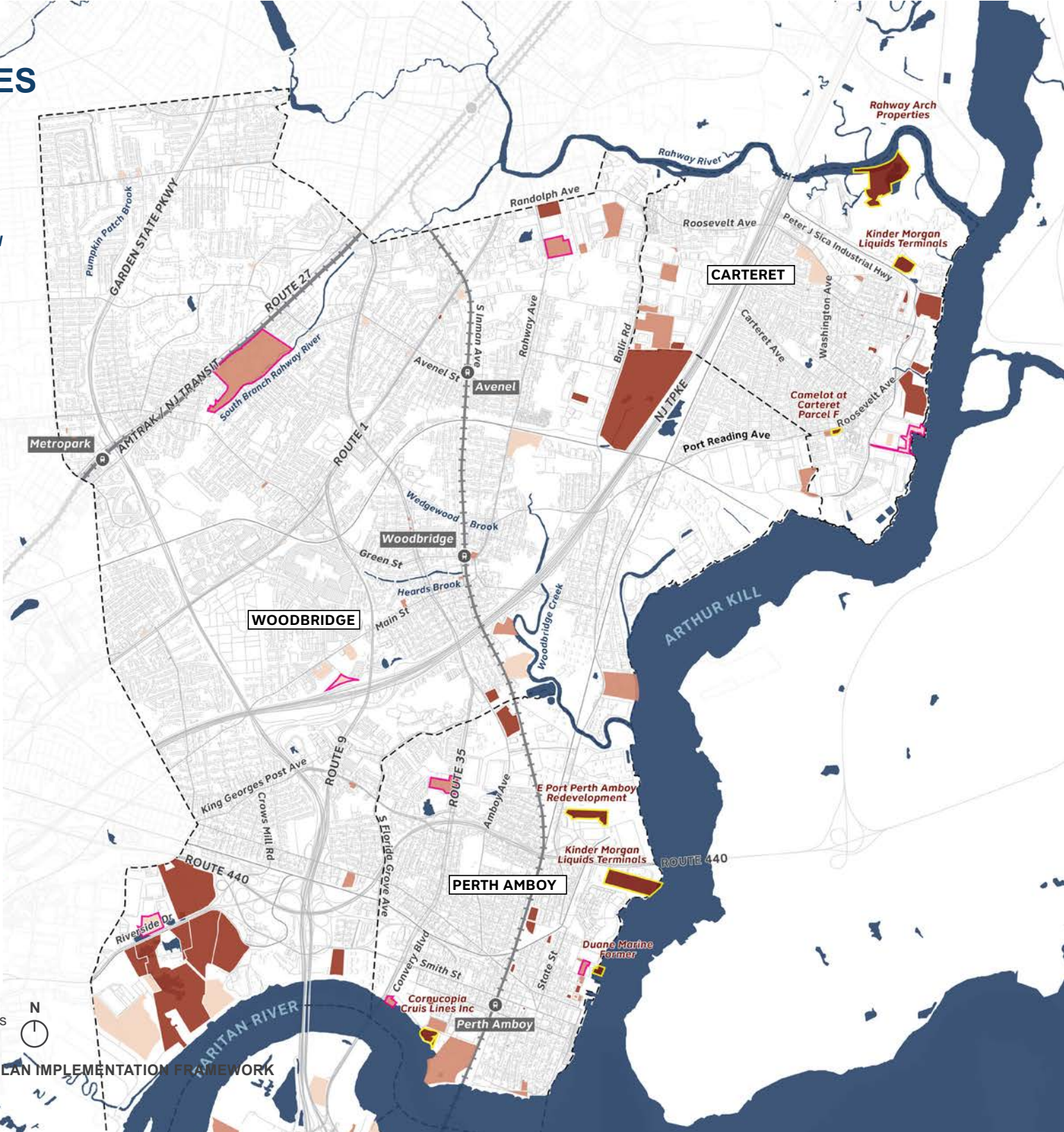
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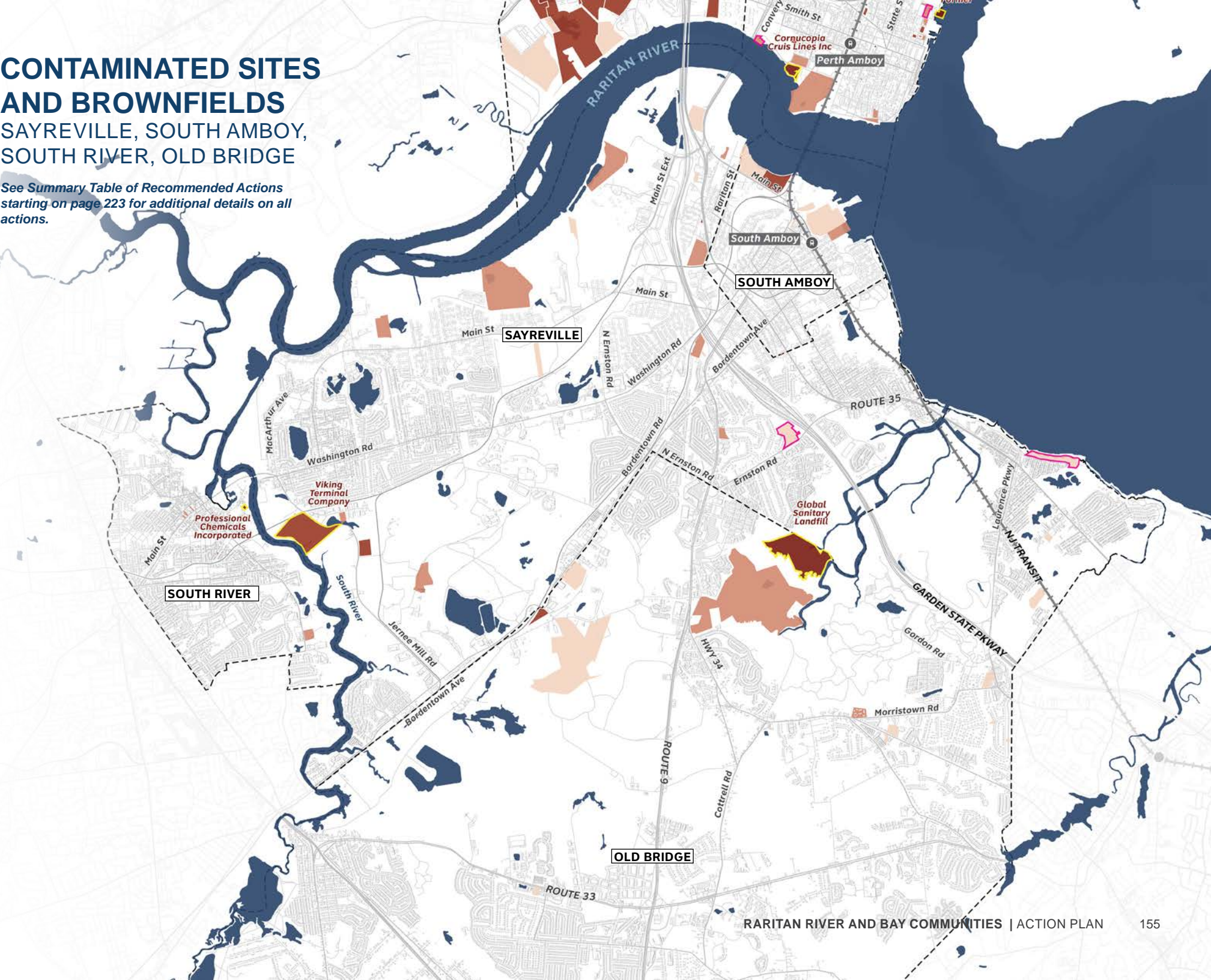
Water bodies

Municipal Boundary



CONTAMINATED SITES
AND BROWNFIELDS
SAYREVILLE, SOUTH AMBOY,
SOUTH RIVER, OLD BRIDGE

See Summary Table of Recommended Actions
starting on page 223 for additional details on all
actions.





YMCA OLD BRIDGE WORKSHOP

OUTREACH, EDUCATION, AND CAPACITY BUILDING



A wide range of strategies focused on outreach, education, and capacity building can serve as a strong foundation for any physical, nature-based, or policy and governance projects and decision-making processes.

The preferred scenario includes actions that serve to:

- Increase awareness of flood risk through public outreach
- Provide technical assistance and targeted outreach to property owners to promote building mitigation and flood insurance uptake
- Develop a funding program for flood mitigation and green infrastructure for private property owners
- Conduct targeted outreach to incentivize relocation of residences and businesses away from the most flood-prone areas.

Many of these strategies can also be adapted or leveraged for non-flooding hazards. This suite of actions responds to communities' expressed desire for greater public involvement and investment in relationships between the government and community members as well as the need to ensure all actions undertaken work to preserve a sense of home, community, and cultural diversity.

Connection to Resilience

The region faces flood risk from multiple sources of flooding. Flooding can damage property and put lives in danger, as evidenced during Hurricane Ida. It is essential that those who live, work, and play in the region have a strong awareness of flooding. This includes knowing how your property or home is exposed to flooding and what to do before, during and after a flood. Throughout the development of this plan, Resilient NJ RRBC has led an outreach campaign to ensure community members understand the causes and sources of flooding. We have developed and shared a video series explaining flooding hazards and spoken of flood risk at community events and public meetings. Communicating flood awareness helps to ensure a resilient community that is prepared for flooding. By providing community members with the tools and knowledge to understand flood risk, we hope to ensure preparedness for future flooding.

Strategies

There are several ways to increase flood awareness throughout the RRBC region. Components of an outreach campaign may include post-cards or other mailers, informational videos, and permanent signage. These activities should be ongoing and evolve over time to meet the changing needs and flood risk awareness of the community.

» Postcard Mailing Campaign

Sharing information on flood risk in community mailings to ensure all members of the community

are equally knowledgeable on flood risk. Using flood maps, particular focus will be given to raising awareness in those areas most at risk.

» Video Series

Campaign of local municipal officials, community leaders, and experts explaining the project and flood risk to ensure understanding of flooding. This will be shared across digital media platforms.

» Permanent Signage

Install signs in popular areas that are prone to flooding or have experienced flooding in the past. In both English and Spanish, these signs can show high water marks from previous flooding events and expected high water marks from future events. This is a powerful tool to convey future flood risk and visualize how impactful flood waters can be on a neighborhood.

» Social Media

Continue to share flood awareness information on social media.

» Meeting-in-a-Box

Adapt the successful “meeting-in-a-box” materials, which provide an overview of the project, flood risks, and potential solutions, to continue to meet with community groups and further spread awareness.

Key Considerations

Flooding can happen quickly and with little warning to prepare. It is important for individuals to understand their risk and have a plan in place to be able to respond quickly. Knowing how one’s home and travel can be impacted by flooding is important to ensuring safety and preventing damage.

Co-Benefits

- Community resilience from informed and prepared residents
- Potentially reduce need for emergency services and likelihood of property damage and injury since residents are prepared for flood events

Funding Opportunities

The Funders Network (TFN) and Urban Sustainability Directors Network, Partners for Places Mini Grants: Helps local governments, place-based funders, and frontline community groups build relationships, align around project ideas, and ideally develop a proposal that centers racial equity in water, sustainability, and/or climate action work to develop a full Partners for Places matching grant proposal

NJDEP Community-Based Art Grant Program: Grants for 5 community-based organizations (CBOs) to be paired with an artist team and then hosting/promoting art installations through the community they serve. Purpose of grants is to increase public awareness of how individuals will be impacted by climate change and what they can do about it.

FEMA Building Resilient Infrastructure & Communities (BRIC), Capability and Capacity Building: FEMA, through NJOEM, offers grants to help communities build whole community resilience. This could include hosting a forum to share best practices and lessons learned or conducting mitigation-related tabletop exercises to build relationships or pursuing opportunities for knowledge transfer between partners

Sustainable Jersey, Sustainable Communities Grant Program: The Environmental Stewardship Grants are intended to help municipalities plan for, protect and improve public spaces such as local parks, natural areas, and recreation resources. In addition, grants can be used in combination with other funding sources to cover a portion of the expenses associated with developing and/ or supporting their open space programs not otherwise covered by state or county programs. Resiliency Grants support projects that enhance a municipality’s capacity to prevent and respond to catastrophic events and emergencies.

Priority Actions

Priority outreach and awareness actions should:

- Translate flood awareness information into consumable forms and share broadly with the community, in both English and Spanish.
- Establish readily available flooding resources and empower municipalities and community partners to share this information
- Include targeted outreach to communities in high-risk areas on evacuation planning, such as the Winding Woods apartment complex in Sayreville and Jeanette Smith Village in Carteret

- Train municipalities to understand flood risk, educate their community, and take action

Actions in the table are priority actions that can be taken in the near- or mid-term to increase awareness of flooding. For a full list of recommended actions, see the *Implementation Roadmap* section.

STATE	<ul style="list-style-type: none">• Explore opportunities for additional funding to continue community outreach and awareness building developed through Resilient NJ
RESILIENT RRBC	<ul style="list-style-type: none">• Support ongoing outreach and awareness in partnership with the YMCAs and municipalities
LOCAL- ALL MUNICIPALITIES	<ul style="list-style-type: none">• Support ongoing outreach and awareness in partnership with the YMCAs and the County
YMCAs/ OTHER NGOs	<ul style="list-style-type: none">• Integrate flood awareness into community programming using materials developed by Resilient NJ

Connection to Resilience

Throughout RRBC, privately-owned industrial, commercial, and residential properties are vulnerable to current and future flood hazards. To build resilience in the region, it is essential that private property owners are both aware of their flood risks and have access to resources to help them reduce that risk. The flood risk awareness outreach campaign will provide property owners with the tools and knowledge to understand their flood risk. This strategy supports the awareness campaign by then providing property owners with the technical support needed to identify and fund potential mitigation options.

Though there are existing educational resources available to property owners at the federal, state, and local levels, property owners may not know how to access them. Additionally, there is a growing demand for funding to implement flood mitigation strategies on privately owned properties. In RRBC, stakeholders indicated the need for targeted outreach to promote building-scale mitigation in flood-prone areas, funding to implement buyouts of commercial, industrial, and multi-family housing structures, and funding to install green infrastructure on private properties.

Strategies

Encouraging flood mitigation on privately owned properties will require a two-pronged approach. First, property owners must be aware of their flood risk and the options available to help reduce it. Second, funding and other implementation resources should be made available to encourage floodproofing, elevation and other mitigation actions.

Increasing Awareness of Flood Risk and Mitigation Options

The first step to reducing flood risk is understanding flood risk. Private properties across the region may be vulnerable to flooding from one or multiple sources. Knowing both the type of flooding that may impact a property and the severity of expected impacts can help property owners make decisions about the best flood risk reduction options for their property.

Additionally, to make informed decisions about which flood risk reduction options may work for their property, property owners need access to information about the wide variety of mitigation approaches including floodproofing, elevations, buyouts, and green infrastructure. To help private property owners understand how to reduce their flood risk, this strategy includes the development of both educational resources and technical capacity.

Outreach and coordination with private owners and operators of critical facilities including oil and gas terminals (operated by Buckeye Global Marine Terminal and Kinder Morgan) and power plants (run by PSE&G, Next Era, and CPV Woodbridge) is also recommended. Flooding at these facilities can have a major impact on community health and safety both during and after a flood event. Coordination is key to ensuring owners and operators understand risks and the opportunities available to mitigate them.

Entities at the state, county and local level all play a role in developing and providing resources on flood risk and mitigation options for private properties. At the state level, additional information about flood mitigation options can be developed and disseminated to counties and municipalities.

Case Study: PSE&G
Sewaren Power Plant
Woodbridge, NJ

Some privately owned critical facilities, such as the PSE&G run power plant in Sewaren, have already taken steps to protect their facilities. The PSE&G power plant was flooded during Hurricane Sandy, prompting the facility to act. Mitigation actions taken on the site to harden and upgrade the Sewaren Switching Station include elevating electric distribution equipment above levels required by FEMA, installing new, elevated transmission facilities to maintain a reliable electric system. In making the facility more resilient to flooding, PSE&G also incorporated upgrades to make the power station more energy efficient.

The state may also consider expanding training opportunities available to county and municipal officials on topics related to resilience and flood risk reduction. Such trainings could be released in support of recently released and forthcoming NJPACT regulations.

At the county level, technical support can be provided through staff time to help municipalities understand where to target outreach and how to access and use informational resources available from the state. Municipalities can look for opportunities to engage private property owners in targeted, highly vulnerable areas to discuss flood mitigation options. Informational resources developed by the county and state can inform these conversations.

Increasing Funding for Implementing Building Scale Flood Mitigation

Increasing awareness of flood risk and the increasing frequency of flood events throughout the region will continue to increase demand for funding to implement building scale flood mitigation on private properties. To meet this need, the state should develop funding programs, including both loans and grants, that can be provided to a variety of property owners to implement floodproofing, elevation, buyouts and green infrastructure retrofits. Priority funding opportunities include:

- Increased buyouts for commercial and industrial properties through the NJDEP Blue Acres Program
- Buyouts for multi-family housing properties through the NJDEP Blue Acres Program
- Green infrastructure retrofits for residential and commercial properties
- Building-scale mitigation of industrial properties that have the potential to contaminate surrounding areas during flood events

Key Considerations

- Flood risk awareness and education about mitigation options must be an ongoing process, including sharing information about Risk Rating 2.0
- This work must be tied into a larger awareness of climate change so homeowners understand that risk will continue to grow in the future
- Community members should be educated on nuisance flooding as well, so they understand just because flooding hasn't happened before, does not mean it won't happen in future

- Developing and sharing materials will require dedicated funding and staffing resources
- Regular follow up should be conducted following the development and sharing of materials. State and county staffing resources should be made available to answer questions and direct property owners to additional resources. Stakeholder feedback on materials should be collected periodically and used to make materials more useful and user friendly.
- Increased funding for building scale flood mitigation will require increased staff capacity to administer and manage funding streams
- Funding should have a dedicated source and be made available on a regular basis in perpetuity
- All building scale flood mitigation funded through these strategies should be held to a standard higher than minimum resilience requirements
- All buyout programs should include relocation assistance to encourage property owners to relocate to areas of lower risk

Co-Benefits

- Economic benefits associated with reduction in repetitive loss achieved through building-scale mitigation and buyouts
- Expanded staff capacity at local, county and state level to address resilience challenges
- Increased opportunities for coordination between local, county, and state levels of government
- Remediation and/or environmental restoration of acquired industrial and commercial sites



Funding Opportunities

- **NJDEP Community-Based Art Grant Program:** Grants for 5 community-based organizations to be paired with an artist team and then host/promote art installations in the community they serve; Purpose of grants is to increase public awareness of how individuals will be impacted by climate change and what they can do about it.
- **FEMA FMA:** The Flood Mitigation Assistance Program is a competitive grant program that provides funding to states, local communities, federally recognized tribes and territories. Funds can be used for projects that reduce or eliminate the risk of repetitive flood damage to buildings insured by the NFIP.
- **Garden State C-PACE:** Program will finance eligible commercial clean and renewable energy projects in participating municipalities. The program pays for the up-front costs of the project. Eligible uses include energy efficiency improvement, renewable energy system, stormwater management system, electric vehicle charging infrastructure, flood resistant construction improvement, or hurricane resistant construction improvement.

Priority Actions

Actions below are priority actions that can be taken in the near- or mid-term to promote the resiliency of mobility systems. For a full list of recommended actions, see the *Implementation Roadmap* section.

STATE / NJDEP	<ul style="list-style-type: none">• Develop funding programs including loans and grants that can be provided to property owners (residential, multi-family, and commercial) to support building scale mitigation through floodproofing, elevations, buyouts, and green infrastructure retrofits
RESILIENT RRBC	<ul style="list-style-type: none">• Enhance staff capacity to support dissemination of state resources and support municipalities in building-scale mitigation• Enhance coordination and relationship between the County and municipalities
LOCAL- ALL MUNICIPALITIES	<ul style="list-style-type: none">• Share information on flood risk with property owners to empower them to take action and advocate for additional support

EXPANDING OUTREACH TO ADDITIONAL CLIMATE HAZARDS

Start a regional education campaign with resources for individual mitigation and to promote advocacy related to additional hazards. This campaign should take a two-pronged approach of pointing people to the right resources to minimize their own risk while collaborating with community-based organization to educate on how to organize for collective action and advocacy around these issues. Should involve developing and distributing accessible, multilingual information and educational materials designed to reach as many communities as possible, especially environmental justice communities.

Conduct targeted community outreach with agricultural and fishery workers. Work with trusted local and regional organizations to develop relationships with agricultural producers and communities that depend on marine species for their livelihoods. Outreach should be focused on understanding future needs and localized social and economic impacts of ocean acidification and changes to water supply levels and projected future demand to help shape decision making.

Work with community-based organizations to conduct public health studies of localized current-day “invisible” effects of air quality. Poor air quality in the region is not merely a future issue. The RRBC population is currently at extremely high risk, relative to the rest of the state, for air toxics-related cancer impacts. As such, it is highly likely that communities are already experiencing these effects, especially communities with higher rates of elderly people, people with existing health conditions (such as asthma), low-income households with limited access to health care, and communities in areas with little access to green space and high urban heat island effect.