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# SOUTHEAST NEW ENGLAND PROGRAM: SYNTHESIS REPORT

## Draft Report

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# List of Acronyms

BB NEP	Buzzard Bay National Estuary Program
CCC	Cape Cod Commission
CCMP	Comprehensive Conservation Management Plan
ERG	Eastern Research Group, Inc.
ESV	Ecosystem Service Values
GIS	Geographic Information Systems
LID	Low impact development
MA DEP	Massachusetts Department of Environmental Protection
MA DER	Massachusetts Division of Ecological Restoration
MA EOEA	Massachusetts Executive Office of Energy and Environmental Affairs
MAPC	Metropolitan Area Planning Council
MassDOT	Massachusetts Department of Transportation
NBEP	Narragansett Bay Estuary Program
NGO	Nongovernmental organization
RI CRMC	Rhode Island Coastal Resources Management Council
RI Planning	State of Rhode Island Division of Planning
RIDEM	Rhode Island Department of Environmental Management
SNEP	Southeast New England Program
SRPEDD	Southeastern Regional Planning & Economic Development District
TNC	The Nature Conservancy

# Executive Summary



Excess nutrients and pathogens from stormwater and wastewater have contributed to severe water quality problems in the southeast coastal regions of Rhode Island and Massachusetts; these problems include algal blooms, low dissolved oxygen conditions, fish kills, impaired benthic communities, and loss of important habitats such as sea grass and salt marsh—all exacerbated by sprawl development that eats away at open space, habitat, and the sense of place that gives New England its soul. Above all, climate change, especially the increased likelihood of extreme weather events, sea level rise, and increased precipitation, promises further stress to this region in coming years—both environmentally and socioeconomically.

The lack of an entity to respond creatively to these issues is one more challenge in this mix. But challenges often spark opportunity. Improved management, implementation of innovative approaches, and collaborative problem solving are all well-served at a regional level informed by local priorities. Recognizing the unique possibilities that could be pursued here, Congress in 2012 tasked EPA Region 1 with convening and leading a comprehensive regional coordination and outreach effort to protect, enhance, and restore the coastal watersheds of southeastern New England: the Southeast New England Coastal Watershed Restoration Program (SNEP).

This report synthesizes commonalities and gaps found across planning documents in the region as well as issues identified by expert interviews. In developing these findings, we have focused on issues that may be of particular interest to SNEP, including the rallying power of climate change and the growing interest in more integrated, systems-wide approaches to improving environmental and economic health. Thirty-seven planning documents were characterized in terms of the nine identified common priorities and the three most common priorities were land use and infrastructure, habitat, and water quality and quantity. Overall, the planning documents rarely focus on a single aspect of the environment or economy. While a plan's main end-goal may be very specific (e.g., increase population of freshwater fish species, reduce nonpoint sources of nitrogen), they are often inextricably linked to other environmental health or economic issues. Ecosystem service values (ESVs) were the least explored focus areas across all plans and the most frequently identified data need by interviewees.

Based on findings from this report, SNEP will focus on a few issues moving forward including improving collaboration and innovative management in the region, advocating and supporting a holistic approach to planning through a climate change lens, and prioritizing data gaps, including ESVs, and plan updates to support this holistic approach.





## 1. Introduction

### **SNEP: Leadership for Innovation in Coastal Watershed Resilience and Restoration**

Excess nutrients and pathogens from stormwater and wastewater have contributed to severe water quality problems in the southeast coastal regions of Rhode Island and Massachusetts; these problems include algal blooms, low dissolved oxygen conditions, fish kills, impaired benthic communities, and loss of important habitats such as sea grass and salt marsh—all exacerbated by sprawl development that eats away at open space, habitat, and the sense of place that gives New England its soul. Above all, climate change, especially the increased likelihood of extreme weather events, sea level rise, and increased precipitation, promises further stress to this region in coming years—both environmentally and socioeconomically.

SNEP seeks to draw on and leverage a network of stakeholders to support innovations in practices, technology, and policies that create a sustainable path for change and link environmental quality to economic opportunity and jobs by delivering local solutions in a regional and watershed context. SNEP goals include:

- Developing and investing in innovative, cost-effective restoration and protection practices – especially for nutrient management and adaptation to climate change – that apply new policy, economic, and technology approaches, including financing mechanisms;
- Delivering programs more effectively to the public by engaging in collaboration that builds and enhances long-term capacity, enhances municipal ability to finance and participate in environmental management programs, and improves information sharing and use;
- Implementing on-the-ground restoration projects that integrate habitat and ecological restoration with water quality improvement, especially reduction of nutrient impacts, and offer effective paths to ecological resilience; and
- Identifying and sustaining ecosystem services and functions, including demonstrating the public health, social, and economic benefits provided by environmental quality.



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The lack of an entity to respond creatively to these issues is one more challenge in this mix. But challenges often spark opportunity. Improved management, implementation of innovative approaches, and collaborative problem solving are all well-served at a regional level informed by local priorities. Recognizing the unique possibilities that could be pursued here, Congress in 2012 tasked EPA Region 1 with convening and leading a comprehensive regional coordination and outreach effort to protect, enhance, and restore the coastal watersheds of southeastern New England.

With its distinctive sense of place, bottom-up local solutions, and history of innovation, southeast coastal New England presents opportunities for leadership and reinvention to fundamentally change the way we manage our environment.

The first decades of the Clean Water Act resulted in extraordinary improvements in water quality in the nation's waterbodies. But more recently, those successes have slowed, largely because of the belated recognition that impairments stem not only from specific pollutants from diffuse sources, but also from historic and continuing patterns of development and land uses that are politically, technically, and programmatically very difficult to address. Nonpoint sources

and stormwater, habitat loss, lack of system connectivity, high rates of impervious surfaces—these sources are not amenable to traditional top-down approaches focused on one or two issues in relative isolation. Rather, there is a growing understanding that managing by watershed or ecosystem (humans included) is likely to yield much greater improvement to the environment along with important additional benefits to local economies and communities. Such a concept of comprehensive, watershed-based management is challenging to implement. It requires coordinated efforts, shared priorities among diverse stakeholders and interests, and the ability to engage in a broad range of restoration and protection activities that deliver effective local solutions in a regional and watershed context.

These are the goals of the newly launched Southeast New England Program (SNEP), which also seeks to develop and apply innovations and partnerships that can propel implementation of this vision and provide a model for others. SNEP's geographic focus – from Westerly, Rhode Island, to Pleasant Bay, Massachusetts – and unique institutional frameworks offer critical factors for testing the viability of integrated approaches:

**Transferability.** In New England and nationally, communities are pressured by

growing resource needs even as resource availability is shrinking. Solutions for working smarter, more cost-effectively, and with more public engagement are necessary. By virtue of its centuries-old industrial and development legacies, this area has already absorbed the waves of change—agriculture to industry, industry to white collar, white collar to outsourcing and urban abandonment—that others are now experiencing. Its manageable size, diversity of landscapes, municipalities, and industries, and intimate relationships between the rivers and the sea makes it an ideal laboratory for testing new policy and technology approaches.

New England as a whole is unique in its lack of a county system that could provide administrative and management efficiencies; its home rule tradition means that major environmental decisions are taken and implemented at the town level, with little coordination with other towns. SNEP watersheds are dotted with numerous small municipalities responsible for managing the environmental health of their communities. But these responsibilities often come with very few resources or dedicated staff, and too often fall at the bottom of long list of other priorities such as schools, police, and fire protection. The towns' small size and budgets make it difficult to undertake larger scale infrastructure projects, such as stormwater



management systems, and convincing voters of the benefits of coordination with other communities can be fraught with challenges. Southeast New England will be a difficult proving ground, but if SNEP can establish a framework or other support —by encouraging sharing of services and resources and splitting costs—that enables greater cooperation and collaboration among municipalities, the state, and the region, it will be a winning model to share with other parts of the country and perhaps even internationally.

## **Adaptation**

Adjustment or preparation of natural or human systems to a new or changing environment which moderates harm or exploits beneficial opportunities.

## **Resilience**

A capability to anticipate, prepare for, respond to, and recover from significant multi-hazard threats with minimum damage to social well-being, the economy, and the environment.

## **A technology and innovation center.**

Southeast New England is rich with academic institutions, businesses, hospitals, and urban centers that are sources for cutting edge research, innovation, and creativity. SNEP offers a way to harness these valuable assets as partners to reinvent how we undertake environmental management. Additionally, both Rhode Island and Massachusetts have political leaders who advocate for innovation at the intersection of the environment and economy.<sup>1</sup>

**Adaptation and resilience testbed.** Over the last 50 years, the Northeast has experienced a 71 percent increase in very heavy precipitation events, the greatest increase out of all U.S. regions (Melillo et al., 2014). Infrastructure and residents are becoming increasingly vulnerable to coastal flooding, with sea-level rise rates in the Northeast exceeding the global average. The southeast New England coastal watershed area is geographically compact, having a variety of land covers and land uses (high-density development, agriculture, wetlands, etc.) that will all experience impacts from climate change. All these characteristics contribute to the SNEP study area’s value as a microcosm of climate change challenges and potential responses to increase resilience.

## **Search for Common Priorities and Shared Needs**

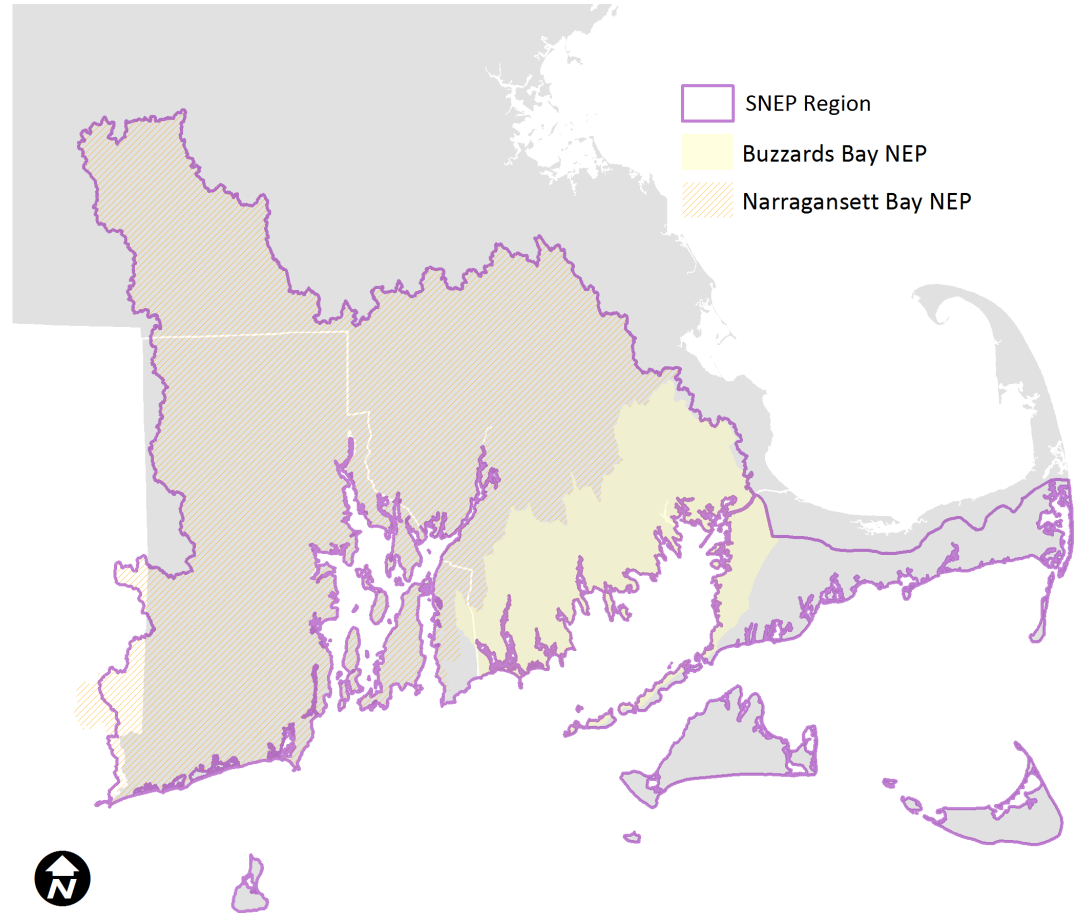
Water quality standards are the foundation of water pollution control programs mandated by the Clean Water Act; they are framed in terms of biological, chemical, and physical conditions or characteristics. These characteristics all influence water quality, yet rarely are considered together when planning and developing strategies to improve water quality. For example, a water quality plan that focuses on reducing nitrogen loads in a water body as a goal (a chemical characteristic) may include objectives related to reducing septic inputs. This may indeed reduce the nitrogen loadings from septic systems, but not address other sources or other impairments such as excess sediments that affect aquatic species. A broader approach would consider additive solutions such as preserving functioning wetlands or restoring wetland function; creating buffers or restoring plant communities that take up nutrients and provide critical habitat is another path. Another common past practice is sewerage large areas of undeveloped land to respond to failing septic systems. While that approach addresses the pollution coming from individual septic systems – often at great cost and public resistance – the secondary impacts of growth and development create a different set of pollution problems and are likely to



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exacerbate or create problems with groundwater recharge and hydrological function. When these connections are ignored, little improvement is likely in overall ecosystem health; in fact, conditions often continue to deteriorate. Moreover, the perceived tension between environmental protection and economic development continues to dominate decisionmakers' and the public's consideration of solutions.

Organizations and agencies tasked with addressing environmental quality and economic development within the SNEP study area (Figure 1.) do not individually possess sufficient resources to create comprehensive, integrated solutions and approaches at the watershed or regional scale. As a result, many plans have overlapping goals and objectives. While some planning documents may acknowledge and implement strategies that benefit multiple facets of the study region (e.g., environment, economy, and society), most tend to address causes of environmental or socioeconomic degradation by focusing on one or a few impacts at a time (e.g., nutrient pollution).



**Figure 1. SNEP study area, along with the jurisdictions of the two National Estuary Programs in the region**



This synthesis report<sup>ii</sup> examines a range of selected plans and strategies that have been developed in the study area and extracts some common themes, priorities, and objectives to help identify areas of collective focus and opportunities for collaboration; it also identifies commonly cited gaps or needs. While some documents have a very specific focus, others consider a more holistic, integrated approach to goal setting and planning.

The document review that was the basis for this report attempted to capture the range of planning documents that exist in the SNEP region, whether addressing one focus area or multiple areas. At one end of the spectrum are comprehensive efforts such as the National Estuary Program's *Comprehensive Conservation and Management Plans (CCMPs)* (NBEP, 2012; BB NEP, 2013) which address a wide-range of environmental and economic concerns, and at the other end are plans focused on a particular aspect of environmental or economic health, such as the Massachusetts Economic Development Council's *Choosing to Compete in the 21st Century* (Economic Development Planning Council, 2011), which focuses on improving economic strength through innovation and

infrastructure development. A matrix with categories that represent common focus areas found across all the documents such as water quality, recreation, habitat, etc., was created to synthesize the plans (Table 1).

For the past few years, many activities have attempted to improve water quality and restore ecological function in southeast New England watersheds. At this juncture, SNEP must identify common objectives and priorities to harness the strength of collective actions and identify how the program can best encourage integration, innovation, and collaboration. It is important for SNEP to first gain an understanding of existing priorities and goals that have been established in the region, strategies identified and implemented to achieve those goals, and gaps and needs that are preventing goals from being achieved. The findings from this synthesis report will help inform SNEP's discussions with partners on how to move the region forward and what role SNEP can play.

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<sup>i</sup> "Baker-Polito Administration Announces \$800,000 for Innovative Water Projects, Results of Water Technology Industry Roadmap" (<http://www.mass.gov/eea/pr-2015/800000-for-innovative-water-projects-announced.html>); "Governor Raimondo, Commerce RI and STAC Announce Infusion of Funding into Marine Based

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Research Projects"

(<http://www.ri.gov/press/view/24091>).

<sup>ii</sup> The synthesis report findings are based on a review of more than 70 publically available documents that the SNEP Working Group identified within the study area or overlapping with the study area. Appendix B contains an annotated bibliography of documents reviewed. Additional resources were identified through website searches. A series of informal interviews with state representatives, nongovernmental organizations, and planning organizations yielded additional insights and contributed to the recommendations. Appendix C contains a list of interviewees.



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## 2. Methods

To develop this synthesis report, more than 70 documents were reviewed, including planning documents produced by state, regional, and federal agencies, as well as documents providing regional scientific or historical context. Information was also provided during interviews with southeast New England coastal practitioners, who greatly informed and complemented this report's observations of commonalities, unique approaches, and gaps across plans. Many of those interviewed helped author the reviewed reports.

EPA and the SNEP Workgroup identified the majority of reviewed documents. Other resources were identified during targeted website searches or recommended by the experts interviewed. To incorporate applicable or significant information into the report and annotated bibliography, we applied the following criteria to determine if an identified source required further review (Table 1):

- The geographic focus of the resource is within or overlaps with the SNEP planning area (coastal watersheds of southeast New England).
- The resource is a planning document that contains goals, objectives, or strategies to

manage or improve resilience of the environment, economy, or society.

- If the resource is not an explicit planning document, it provides background scientific, economic, or historical information that could inform planning efforts. (These documents are included in the annotated bibliography and were used to inform the report, but are not included in the synthesis matrix).
- Municipal planning documents, such as local land use plans or hazard mitigation plans, were not considered.

Documents were examined to identify common priorities, actions, or approaches. An initial review of the documents revealed nine prevalent focus areas: water quality, water quantity, habitat, recreation, land use (housing development, green space preservation, etc.) and infrastructure (includes public transportation, wastewater, and roads), economic development, public health, ecosystem service values (ESVs), and climate change (each described in greater detail in Appendix A). These focus

areas were selected based on common themes or issue areas seen across the resources and in an effort to identify topics that overlapped between different plans (or topics that tend to be managed in isolation). Some documents mention themes in passing. Other documents dwell on the focus area(s) in detail. A focus area was identified as present if it was mentioned explicitly as a goal, objective, or strategy. Documents are characterized by one or more focus areas, as shown in Table 1 in the "Findings" section. See Appendix B for the annotated bibliography.

**Table 1. Focus area totals for planning documents reviewed**

Plan	Organization	Water quality	Water quantity	Habitat	Recreation	Land use & infrastructure	Economic development	Public health/safety	Ecosystem service values	Climate change
2004 Blackstone River Watershed Five-Year Action Plan	MA Executive Office of Environmental Affairs	●	●	●	●	●				
A Rhode Island Economic Strategy: grow the Top, Build a New Middle and Move the Bottom Up	RI Economic Policy Council		●			●	●			
A Sustainable Rhode Island Three-Year Work Plan 2012 - 2015	RI Division of Planning		●			●	●			
A Vision for Rhode Island Agriculture	Rhode Island Agricultural Partnership	●	●			●	●		●	
Actions for Economic Development in Rhode Island-- Highlights & Full Report	CommerceRI		●				●			●
American Shad Habitat Plan for Massachusetts Coastal Rivers	MA Division of Marine Fisheries	●	●	●						
An Action Agenda for 2020	Blackstone Valley Partnership	●	●		●	●	●			●
Ashton-Pratt Corridor Redevelopment Plan	Town of Lincoln & Town of Cumberland				●	●	●			
Barrington-Palmer-Warren Rivers Watershed Plan	FB Environmental Associates	●	●	●	●	●	●			
Blackstone River Visioning	Massachusetts Audubon Society & John H. Chafee Blackstone River Valley National Heritage Corridor	●		●	●	●	●			
Bristol-Kickemuit River Watershed Plan	FB Environmental Associates	●	●	●	●	●	●			
Buzzards Bay Coalition Strategy	The Coalition for Buzzards Bay	●		●	●	●			●	
Buzzards Bay Comprehensive Conservation and Management Plan 2013 Update	Buzzards Bay National Estuary Program	●	●	●	●	●	●	●		●
Cape Cod Water Quality Management Plan Update (208 Plan)	MA Department of Environmental Protection and EPA	●	●			●		●		
CCMP Comprehensive Conservation and Management Plan Update 2012 (all parts)	Narragansett Bay National Estuary Program	●	●	●	●	●		●	●	●
Chapter 4 Actions to Conserve Rhode Island's SGCN and Key Habitats	The Nature Conservancy, RI Department of Environmental Management, University of Rhode Island	●		●		●		●	●	●



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**Table 1. Focus area totals for planning documents reviewed (Continued)**

Plan	Organization	Water quality	Water quantity	Habitat	Recreation	Land use & infrastructure	Economic development	Public health/safety	Ecosystem service values	Climate change
Charting the Course: A Blueprint for the Future of Aquatic Habitat Restoration in Massachusetts	MA Aquatic Habitat Restoration Task Force		●	●		●	●	●	●	●
Choosing to Compete In the 21st Century: An Economic Development Policy and Strategic Plan for the Commonwealth of Massachusetts	Economic Development Planning Council					●	●			
Commonwealth of Massachusetts State Wildlife Action Plan (2015 DRAFT)	MA Department of Fish and Game	●		●						●
Five-Year Watershed Action Plan for the Taunton River Watershed	MA Executive Office of Environmental Affairs	●	●	●	●	●	●	●		
Geographic Roadway Runoff Inventory Program: Taunton River Watershed Pilot Project, 2010-2011	SRPEDD		●	●		●		●		
GreenDOT Implementation Plan	MA Department of Transportation	●	●	●		●		●		●
Integrating Climate Change into Northeast and Midwest State Wildlife Action Plans	DOI Northeast Climate Science Center, USGS, UMass Amherst			●						●
MA DER Strategic Plan (Executive Summary)	MA Division of Ecological Restoration	●	●	●					●	●
North Atlantic Coast Comprehensive Study: Resilient Adaptation to Increasing Risk Final Report (Main Report & Appendix D)	US Army Corps of Engineers		●	●		●	●		●	●
Rhode Island Nonpoint Source Management Program Plan	RI Department of Environmental Management	●	●	●		●	●	●	●	●
Rhode Island Water Resources Board 2012 Strategic Plan	Kenneth Burke, Kathleen Crawley, & Romeo Mendes	●	●	●		●	●			●
RI State Guide Plan: Rhode Island Rising (Economic Development for State Guide Plan)	RI Division of Planning	●	●	●		●	●	●		●
RI State Guide Plan: Rhode Island Rivers Policy and Classification Plan (Element 162)	Rhode Island Rivers Council	●		●	●	●		●	●	
RI State Guide Plan: Rhode Island Water 2030 (Element 721)	RI Division of Planning	●	●			●	●	●		●
RI State Guide Plan: Rhode Island's Comprehensive Outdoor Recreation Plan (Element 152)	RI Division of Planning	●		●	●				●	





**Table 1. Focus area totals for planning documents reviewed (Continued)**

Plan	Organization	Water quality	Water quantity	Habitat	Recreation	Land use & infrastructure	Economic development	Public health/safety	Ecosystem service values	Climate change
RI State Guide Plan: Transportation 2035 (Element 611)	RI Division of Planning	●		●	●	●	●	●	●	●
Stakeholder Summary Report: Report on Questionnaire and Interview Outreach for the MA Multimodal Project	MA Department of Transportation					●	●	●		
Strategic Plan for the Restoration of Anadromous Fishes to Rhode Island Coastal Streams	RI Department of Environmental Management		●	●	●	●			●	
Taunton River Watershed Climate Change Adaptation Plan	Manomet Center for Conservation Sciences	●	●	●	●	●	●	●	●	●
The Blackstone River - Clean by 2015	Blackstone River Coalition	●	●	●	●	●				
weMove Massachusetts Planning for Performance	MA Department of Transportation					●	●	●		●

## 1. Common Priorities

In developing these findings, we have focused on issues that may be of particular interest to SNEP, including the rallying power of climate change and the growing interest in more integrated, systems-wide approaches to improving environmental and economic health. This section begins with a discussion of common focus areas examined together in plans and common issues facing coastal practitioners from state agencies and nongovernmental organizations (NGOs) in the region (“interviewees”; see Appendix C); it concludes with gaps and needs that have been identified in the planning documents and during interviews.

Thirty-seven planning documents were characterized in terms of the nine identified common priorities according to the process described in the “Methods” section. Figure 2 shows the relative frequency of each priority addressed in the documents. The three most common priorities were land use and infrastructure, habitat, and water

quality and quantity (tied).<sup>iii</sup> Water quality—and how to manage nutrient pollution sources—was one of the common goals or objectives expressed in a majority of the documents, as was water quantity (mainly in relation to restoring stream flows and protecting drinking water supplies). Both focus areas were mentioned in 25 out of 37 documents. Habitat restoration for a variety of purposes (species protection, nutrient removal, flood mitigation) was also a common goal (26 out of 37 documents). Land use and infrastructure planning was the most frequent focus area represented in plans (31 out of 37) and in most instances planning for land use and infrastructure is offered as a strategy to address the other focus areas. For example, low impact development (LID) and open space preservation are cited as common practices to improve water quality and habitat within the SNEP study area. The least common priorities identified in the documents

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<sup>iii</sup> The documents reviewed were not randomly selected and therefore it cannot be assumed that the findings associated with them are applicable across all planning documents that exist in the region.

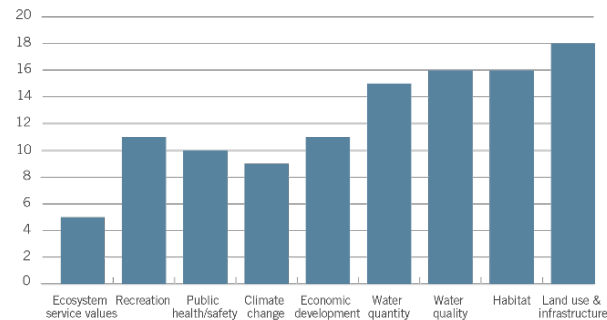
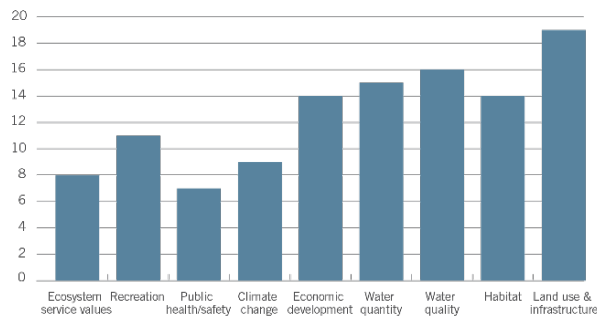
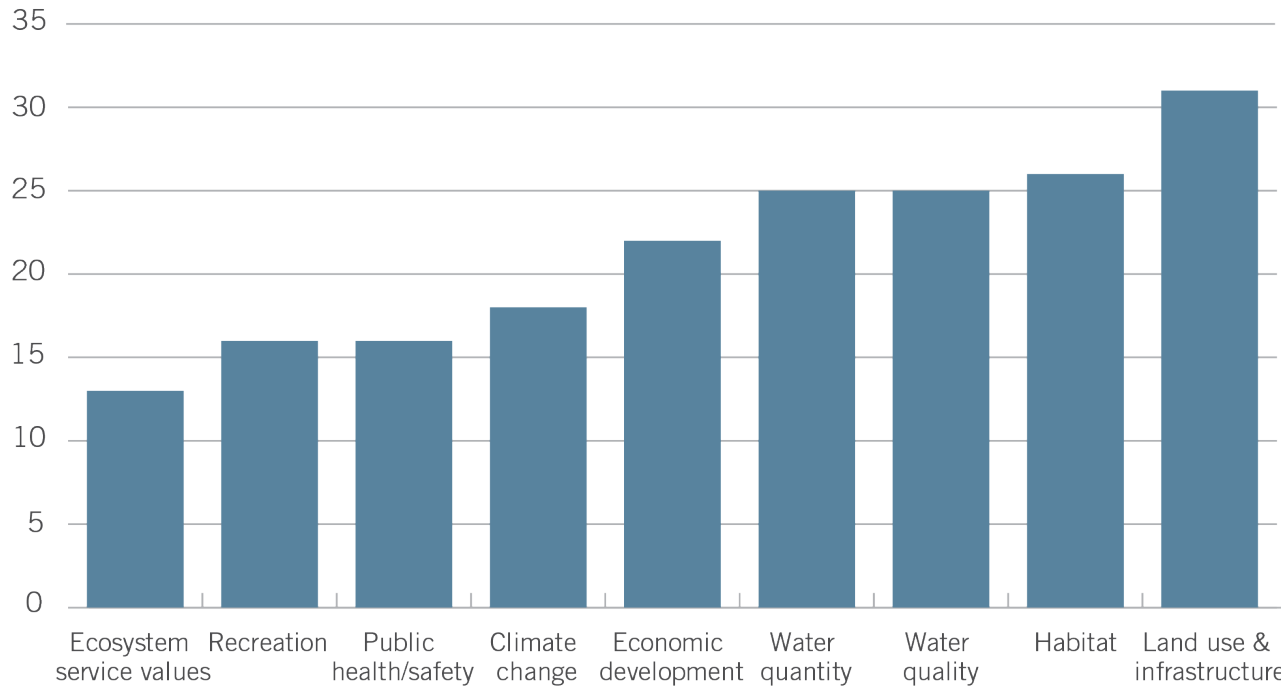
reviewed are ESVs, recreation, and public health/safety (Table 1; Figure 2a).

Differences between Massachusetts and Rhode Island approaches to addressing environmental, economic, and societal resilience and health are reflected in the documents reviewed. For example, Rhode Island has a different land and resource use planning system driven by state-established planning guide elements, several of which were synthesized for this report. Massachusetts has a more community-based planning system where only one regional planning commission (Cape Cod) has regulatory authority over the local plans. The other regional planning commissions provide only guidance. The focus areas of the plans reviewed for each state – including plans that explore watersheds that cross state boundaries – revealed similar tallies to the synthesis of all plans with land use and infrastructure being the most frequent focus area in both states (Figures 2b and 2c).

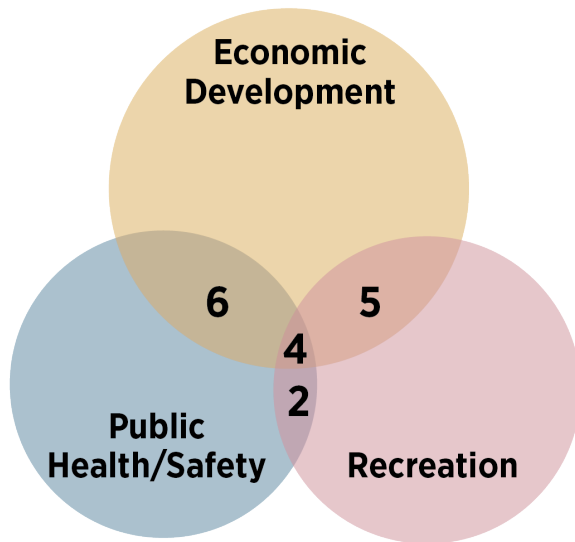


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**Figure 2. Figure 2a (top). Total focus area tallies for all documents. Figure 2b (bottom left). Tallies for Rhode Island-focused documents and Figure 2c (bottom right). Tallies for Massachusetts-focused documents**



**Figure 3. Example of overlap of three focus areas for reviewed documents.**



## 2. Overlaps and Gaps

Overall, the planning documents rarely focus on a single aspect of the environment or economy. While the plan’s main end-goal may be very specific (e.g., increase population of freshwater fish species, reduce nonpoint

sources of nitrogen), they are often inextricably linked to other environmental health or economic issues. The few documents that explored these topics in isolation are discussed below. All interviewees identified multiple focus areas of their work; no one is exploring water quality or climate change in isolation.

A few documents reviewed focus on reducing nitrogen in coastal waters. The *Cape Cod 208 Plan Update* (Cape Cod Commission, 2015) is a mandated regional water quality management effort to reduce nutrient loading on the Cape. Although very narrow in its focus on nitrogen reduction, the Update describes a variety of strategies to address nitrogen, as well as the cost of each approach, including conventional and non-traditional approaches.

The economic development plan for Massachusetts, *Choosing to Compete in the 21st Century* (Economic Development Planning Council, 2011), focuses on developing the state economy without explicitly considering environmental issues. The plan has goals—such as “create a more predictable

economic environment that supports the creation, growth, and expansion of businesses”—without acknowledging some of the environmental constraints, such as water supply and climate change that may pose challenges to achieving them or the role that improved environmental quality may play in attracting and sustaining businesses in Massachusetts.

Traditional habitat restoration plans and fisheries management plans tend to focus on very specific restoration activities (or specific species). For example, the aquatic habitat restoration projects described in *A Blueprint for the Future of Aquatic Habitat Restoration in Massachusetts* (Aquatic Habitat Restoration Task Force, 2008) focus on removing physical barriers, such as dams or culverts. Removing undersized or poorly designed restrictions improves fish habitat and can be coordinated with water quality improvements to more fully restore ecosystem health. However, while such leveraging opportunities may be occurring, they are not prominently mentioned in the Blueprint.

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Although not included in the review as planning documents, guidebooks and manuals in the region commonly focus on restoring specific habitat types rather than ecosystem-approaches; e.g., *Eelgrass*

### ***(Zostera marina) Restoration and***

***Monitoring Technical Guidelines*** (Evans and Leschen, 2010). A resource to inform planning activities, the ***Rhode Island Commercial Fishing and Seafood Industries – Development of an Industry Profile***

(Hasbrouck et al., 2011), is another example of a single-focus document that describes the economic value of fish and the agencies involved in managing fisheries, but does not address the connections between fisheries and habitat. However, manuals such as the ***Massachusetts Stream Crossings Handbook*** (MA DER, 2012) or ***Urban Environmental Design Manual*** (Dodson Associates, Ltd., 2005) are examples of guidance that more broadly examine land use, infrastructure, and habitat restoration/protection projects.

While several documents (including some noted above) reflect a very specific focus, 95 percent of the reviewed plans identified goals or strategies associated with three or more focus areas. These efforts are explored in greater detail below.

The vast majority of the plans (35 out of 37) include goals that focus on three or more of the matrix categories (Appendix A). The following observations indicate that there are several

synergies among land use and infrastructure, water quality and quantity, and fish/wildlife habitat plans. This section describes pairs of issues that seem poised for joint consideration, especially with respect to the economic-environmental connection.

### **Water quality paired with land use and infrastructure, habitat**

#### **Water quality and land use & infrastructure.**

More than half of the plans that include goals or strategies associated with land use and infrastructure concurrently have water quality goals. The most frequently cited water quality threat is stormwater (Blackstone River Coalition, 2008; Buzzards Bay Coalition, 2015), which was also mentioned as a regional threat by every person interviewed. The Watershed Plans for the Bristol-Kickemuit River Watershed (FB Environmental Associates, 2012a), and the Barrington-Palmer-Warren Rivers Watershed (FB Environmental Associates, 2012b) discuss the threats of poor water quality due to stormwater to drinking water supplies and shellfish and describe actions that can be taken at the watershed, municipal, and individual/NGO level to address stormwater. Although not synthesized in the matrix, both Rhode Island and Massachusetts Departments of Transportation produce BMP manuals in order to address stormwater management requirements associated with runoff from roadways (RIDEM, 2010; MassHighway, 2004).

#### **Key Points**

The most common pairings of issues involved land use and infrastructure coupled with habitat (21), water quality (21), or water quantity (22).

More than half of the plans that include goals or strategies associated with land use and infrastructure concurrently have water quality goals.

Low impact development practices were one of the most common approaches mentioned across plans to address stormwater.

Land protection/open space preservation was considered a relatively cost-effective and successful approach to addressing water quality and habitat restoration.

Recreation is mentioned in 40 percent of plans reviewed; in nearly all of those instances, habitat is also a focus area.

More than a third of the plans addressed some aspect of climate change's impact on ecosystem health via changes to habitat.

Septic systems were another commonly mentioned source of nutrients that can impact water quality in the region (Cape Cod Commission, 2015; NBEP, 2012). While several interviewees mentioned the challenge of addressing septic systems as a source of nutrient pollution through upgrades, maintenance, or sewerage, some felt that stormwater was a larger concern and more

*Stormwater management is really complex... Both states [Massachusetts and Rhode Island] are pushing for regional stormwater utilities and regional stormwater solutions.*  
- Interviewee, Rhode Island

*Stormwater problem is so immense that it will only be tackled to meet EPA regulatory changes. Or [if there is] collaboration amongst towns to share resources...*  
- Interviewee, Massachusetts

*Laws/policies in Rhode Island have been drivers of environmental improvements; e.g., compelled 50 percent reduction in nutrients from wastewater plants, wetland buffer law.*  
- Interviewee, Rhode Island

*The 3 percent local option (transfer tax); that was successful in helping the Cape acquire open space/land. Similar strategies like this may be successful elsewhere.*  
- Interviewee, Massachusetts

complicated challenge because of its connection to land use practices.

Interviewees felt that the most effective long-term option would be to create a regional scale stormwater management utility. One person suggested that the regional sewage authorities

should somehow tackle stormwater as well. However, a few people acknowledged that addressing stormwater one community at a time may be more feasible due to lower initial costs for this piecemeal approach as compared to large-scale stormwater utility projects.

Since stormwater sources are the result of land and infrastructure development, stormwater solutions are closely connected to land cover and land use. Solutions vary and include large, expensive infrastructure projects; inexpensive, site-scale best management practices; green infrastructure solutions; and land use strategies that include open space preservation and compact development (discussed below).

**Water quality and habitat.** Nearly three-quarters of the plans that contained objectives or strategies related to terrestrial or aquatic habitat also contained water quality goals or strategies. Habitat and conservation plans for fish, such as the **American Shad Habitat Plan for Massachusetts Coastal Rivers** (MA Division of Marine Fisheries, 2014), consider water quality impairments. The Nature Conservancy (TNC) and Rhode Island Department of Environmental Management's (RI DEM's) **Actions to Conserve RI's SGCN and Key Habitats** (2014) identified "land/water protection" as the top priority action. As explained in the **Narragansett Bay CCMP's** goals, fisheries issues are viewed through the context of habitat function, restoration, and protection as opposed to detailed, species-

specific fisheries management actions (NBEP, 2012). The **Buzzards Bay Coalition Strategy 2015–2020** (Buzzards Bay Coalition, 2015) also jointly focuses on water quality (particularly reducing nitrogen pollution) and habitat preservation/restoration.

Water quality and land use are inextricably linked, and strategies for addressing stormwater often recommend land use planning techniques. Low impact development (LID) practices were one of the most common approaches mentioned across plans to address stormwater near or at its source (BB NEP, 2013; Black River Coalition, 2008; Cape Cod Commission, 2015; GeoSyntec Consultants, 2004; NBEP, 2012; FB Environmental Associates, 2012a, 2012b). LID best practices are discussed as an affordable and effective option to manage stormwater compared with traditional treatment systems (BB NEP, 2013). LID approaches can be incorporated into new development design plans or into retrofits of existing infrastructure. Many of the agencies and organizations that mention LID as an approach have developed guidance documents for developers and for coastal communities. **The Buzzards Bay CCMP** recommends creating local LID bylaws and promoting state-level LID as one approach to managing stormwater runoff (BB NEP, 2013).

A handful of interviewees indicated that land protection/open space preservation are relatively cost-effective and successful



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approaches to addressing water quality (including stormwater). In Massachusetts, the Community Preservation Act enacts (for local adoption) an up to 3 percent property transfer tax, some of which can be allocated to open space purchases. The establishment of local land trusts in Rhode Island and Massachusetts has been critical to the success of coastal land conservation and preservation.

Two interviewees mentioned shellfish aquaculture as a possible means of mitigating stormwater impacts within the upper Narragansett Bay. However, this approach is still being studied; while interviewees were not optimistic that this approach alone would be capable of reducing nutrient loads, it could be used in conjunction with other methods. Green infrastructure, including wetlands restoration, was also a frequently discussed solution for water quality and habitat concerns.

### **Habitat paired with infrastructure, recreation, and climate change**

**Habitat and infrastructure.** More than half of the plans reviewed recognize infrastructure's role in fragmenting and degrading, but also connecting or improving, habitat. Many of these plans acknowledge the historical damage done by past infrastructure and are using modifications as the primary tool in restoration efforts. Dams, roadways, railroad, and

residential developments can isolate migrating species and destroy habitats. Planners address these obstacles by building fish ladders or widening and deepening culverts to improve stream flows and wetland tidal fluctuations (Aquatic Habitat Restoration Task Force, 2008; MA Division of Marine Fisheries, 2014; RI DEM, 2002). Planners also recommend working across agencies, such as the Department of Transportation, to manage pollution from runoff (SRPEDD, 2012; TNC et al., 2014). The most holistic plans recognize that complete removal of flow restrictions could restore the landscape to support wider species diversity. However, they also recognize that socioeconomic and historic issues may impede such actions (RI DEM, 2002).

There are increasing efforts to alleviate some of the strain roadways, bridges, and other transportation infrastructure places on the natural environment. Since 1998, the Southeastern Regional Planning and Economic Development District's (SRPEDD's) *Geographic Roadway Runoff Inventory Program* has been documenting problems created by poorly designed road drainage systems, especially in environmentally sensitive areas. Poorly designed road-stream crossings can act like dams, blocking water flow and movement of aquatic organisms and threatening both aquatic life and public safety (SRPEDD, 2012). This program identifies and prioritizes intersections that have potential for upgrades and restoration work, which SRPEDD

then passes on to partners to remedy collaboratively. The next step to efforts such as this would be state DOTs proactively designing infrastructure projects that consider impacts to water quality and habitat rather than retrofitting and mitigating after projects are already completed.

**Habitat and recreation.** Recreation is mentioned in 40 percent of plans reviewed; in nearly all of those instances, habitat is also a focus area. A healthy ecosystem provides recreational fishing, waterfowl hunting, and wildlife observation, as well as aesthetic and educational opportunities (Aquatic Habitat Restoration Task Force, 2008; RI DEM, 2002; RI Planning, 2009). Improvements in recreational opportunities are more often mentioned as indirect benefits of a particular plan rather than a main objective. In addition, recreational activities (e.g., canoeing, kayaking, paddleboarding, fishing) that threaten restoration goals may be restricted in restoration plans, such as in the *Strategic Plan for the Restoration of Anadromous Fishes to Rhode Island Coastal Streams* (RI DEM, 2002) or the *Actions to Conserve RI's SGCN and Key Habitats* (TNC et al., 2014).

**Habitat and climate change.** More than a third of the plans reviewed addressed some aspect of climate change's impact on ecosystem health via changes to habitat.

These changes include increasing water temperatures, increasing precipitation and flow, more frequent storms, and the spread of invasive species and diseases (Staudinger et al., 2015; TNC et al., 2014). Because climate change adaptation to address broader needs may impact habitat via modifications in land use and infrastructure, a holistic approach should be considered to avoid exacerbating the expected direct impacts of climate change on species populations.

## 3. Opportunities

### Planning hotspots

Rhode Island's small size means that many planning documents have a statewide geographic scope. When the majority of geographic areas of the plans are mapped together, they cover the entire state, but there are some "hotspot" areas of planning activity where multiple plans overlap, particularly in the northeastern corner of the state in the municipalities of Cumberland and Lincoln and in the eastern part of the state in Bristol and East Providence (Figure 4). These areas are where the Rhode Island statewide planning documents overlap with watershed planning efforts for the Blackstone, Palmer, and Barrington and Warren rivers, which are planning efforts that cross the state boundary with Massachusetts.

When looking at some of the Massachusetts-based plans' jurisdictional boundaries—for example, the communities identified in the Buzzards Bay CCMP or in the Taunton River Five-Year Watershed Action Plan—there are a few hotspot areas that emerge where multiple plans overlap as well. The communities of Middleborough, Fall River, and Freetown, and Attleboro contain areas of greatest plan intersection within the Taunton River watershed. Swansea is another community where multiple plans overlap, including watershed plans for the Bristol-Kickemuit and for the Barrington-Palmer-Warren rivers.

These communities are areas already the focus of multiple plans (whether historically or currently), and may be appropriate places to begin to identify overlapping efforts and opportunities for greater partnerships and leveraging of existing work. As mentioned previously, these hotspot communities represent common areas of overlap of planning documents reviewed for this report and cannot be said to represent hotspots of all planning efforts in the region (see Appendix D for additional maps and GIS methodology).

### Economy and climate change

Rhode Island is in a unique position as a small state focused on the coastal and marine environment for its economic and social well-being. This differs from Massachusetts, which

#### Key Points

Climate change is the catalyst for bringing economic and environmental interests together in Rhode Island's state planning documents.

Economic development was explored in more than half of the plans.

Essentially every plan that explored economic development also considered land use and infrastructure (21 out of 22).

ESVs were the least common focus area in the synthesis matrix and the most frequently identified data need by interviewees.

Emergence of natural responses ("green infrastructure") to mitigate rising seas and storm surge; in particular, salt marsh restoration or preservation.

*The economic imperative for innovation is embedded in an equally dramatic environmental imperative* (Rhode Island Economic Policy Council, 2008).

has more diverse landscapes and a locally focused planning approach.



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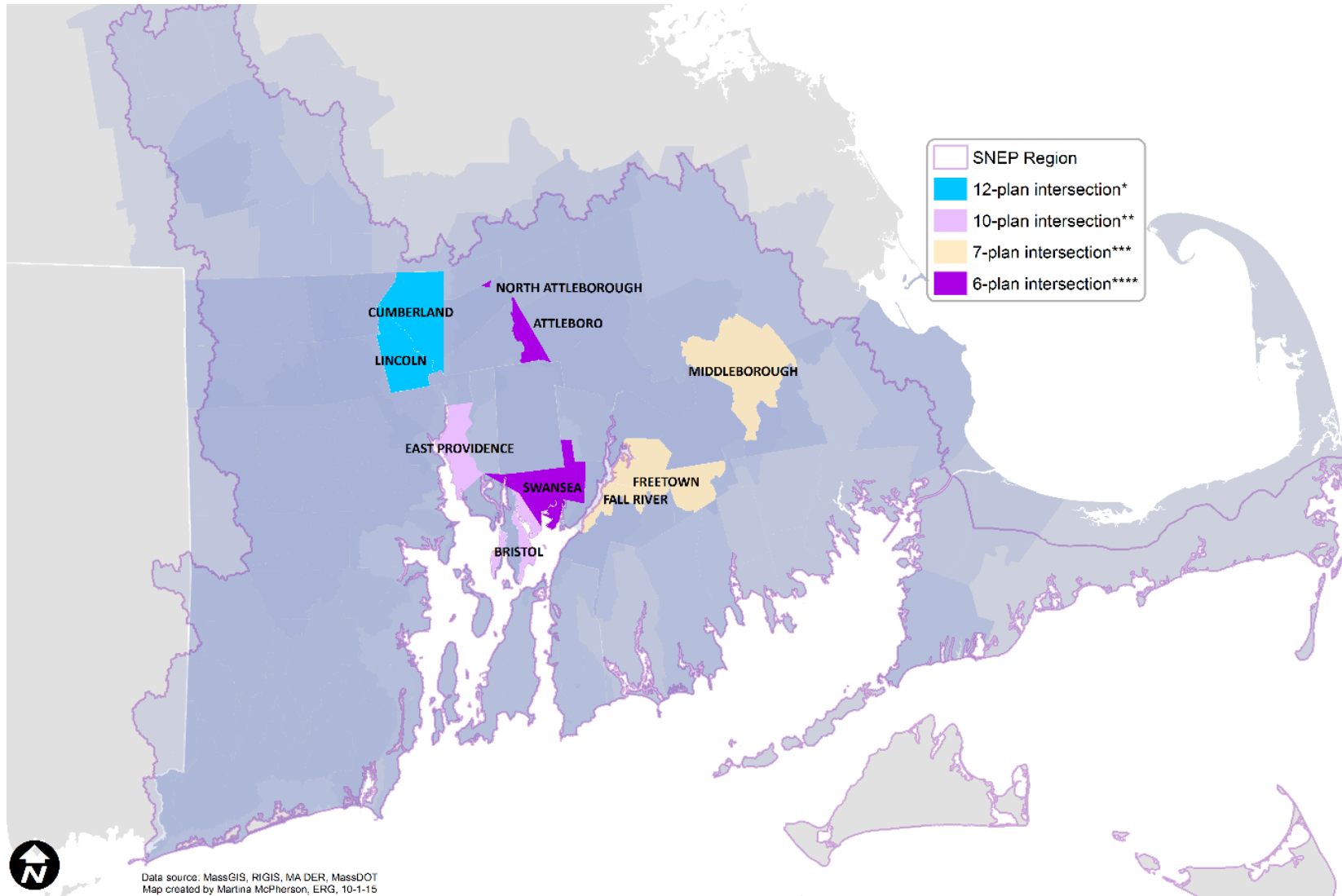


Figure 4. SNEP region with areas of overlapping plan jurisdictions highlighted. For details on how jurisdictions were identified, see Appendix D.

Despite these differences, climate change is challenging ecosystem and economic health in both states. It has become a common concern for environmental, social, and economic groups alike as lives are threatened and large investments along the coast are becoming more susceptible to damage from flooding and erosion. The public and private sectors are acknowledging the linkages between a healthy economy and environment when improving resilience to climate change and also realizing the inherent value of healthy ecosystems. These ESVs - although acknowledged in plans - are not always quantifiable and, for the most part, remain a gap in environmental planning efforts.

Climate change is the rallying point for economic, social, and environmental interests alike across New England. All interviewees mentioned improving resilience and consideration of climate change impacts as a focus of their agency planning efforts. Although their work focuses on environmental management, the majority of interviewees struggle to address economic and social resilience (see Appendix C – Interviewee list). Research and experience has pushed natural habitats to the forefront as options for addressing flooding, erosion, and other hazards that are being exacerbated by the changing climate and threatening infrastructure, homes, and public health. Environmental managers acknowledge that their efforts to improve

water quality or restore habitat need to consider rising sea levels and increasing temperatures.

More than half of the plans explored economic development. This high frequency of occurrence compared to ESVs (one-third of plans) is partly attributable to how frequently land use and infrastructure were mentioned across documents, given that land use and infrastructure-related projects are more traditionally associated with economic development. Essentially every plan that explored economic development also considered land use and infrastructure (21 out of 22). Transportation projects undertaken in Rhode Island and Massachusetts present one opportunity where economic growth and development, impacts from climate change, public health and safety, and environmental quality all collide. Roadways, bridges, and other transportation infrastructure are necessary for economic growth and public safety and are already required to address stormwater. As was seen in the 2010 flooding of I-95 in Rhode Island, climate change is already impacting the assets of the state DOTs. The opportunity for DOTs to use their relatively large annual budgets to begin to consider adaptation to climate change has been realized through efforts like MassDOT's **GreenDOT Implementation Plan** (MassDOT, 2012), which identifies adapting their facilities to the impacts of climate change as a task to

improve ecological functions of the state's water systems.

Rhode Island has pushed adaptation to climate change to the forefront of state agency planning efforts. The state's population and infrastructure are concentrated along 400 miles of coastline; therefore, discussions on development are already considering rising sea levels. The Rhode Island Planning program has actively ensured that environmental, economic, and societal concerns are addressed in the State Guide Plan.<sup>1</sup> The land use element of the State Guide Plan, **Land Use 2025**, integrates the enormous range of issues and policy choices represented in the other state planning

*Climate change will have cascading effects on ecological systems... [T]hese changes are expected in the form of shifts in timing, distribution, abundance, and species interactions (Staudinger et al., 2015).*

*Climate change and sea-level rise will directly impact some of Rhode Island's most important assets and infrastructure, and we need to plan accordingly.*

- Rhode Island Rising (RI Planning, 2014)

<sup>1</sup> The state has acknowledged that the 24 elements that make up the State Guide Plan have become unwieldy and is currently working to consolidate them.

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elements. **Transportation 2035** (the state’s long range transportation plan), **RI Water 2030** (the state’s water use plan), and **Land Use 2025** provide a comprehensive framework for growing the Rhode Island economy while simultaneously providing housing and vibrant culture and preserving the unique Rhode Island natural landscape in the face of a changing climate. The state’s **Nonpoint Source Management Program Plan** (RI DEM, 2014) has multiple policies and actions related to sea-level rise and climate change, including addressing sea-level rise alterations to saltmarsh and evaluating the climate change impacts to water withdrawals for agriculture.

Economic planning documents in Rhode Island recognize the importance of the marine and water-based economy to the state and the threat that rising sea levels pose to that economy. “Action Plan 5” from **Actions for Economic Development in Rhode Island** (CommerceRI, 2014) is “cultivating a resilient economy,” which includes actions related to innovation around and development of resiliency-related products, as well as preparing businesses for climate variability. **Rhode Island Rising** (RI Planning, 2014), the State Guide element on economic development, has one of six goals dedicated to creating a more resilient state, as well as plans that encourage agencies and municipalities to

consider the impacts of sea-level rise on property, infrastructure, and economic centers.

Many interviewees pointed to Rhode Island’s nation-leading effort to address climate change. The state views management activities through a climate change lens, whereas Massachusetts focuses its environmental health and economic development planning activities around issues such as water quality and habitat restoration, mentioning climate change as an outside force with potential impacts.

The Massachusetts planning situation differs from Rhode Island’s due to community-based land-use planning and zoning traditions. Statewide plans in Massachusetts, such as the **Economic Development Policy and Strategic Plan** (Economic Development Planning Council, 2011), focus on goals and strategies related to infrastructure and education, with no mention of climate change or other environmental issues. Some of Massachusetts’s regional planning councils in the SNEP region (Cape Cod Commission, Metropolitan Area Planning Council [MAPC], SRPEDD) are bringing climate change into their comprehensive, economic, and environmental planning recommendations; e.g., MAPC’s **Metro Boston Regional Climate Change Adaptation Strategy Report** (MAPC, 2015; not included in this report’s review). MassDOT has also increasingly embraced its role as “an important steward of natural resources,” which “will be critical in helping minimize the impacts of

climate change on the transportation system” (MassDOT, 2012). In a recent Executive Order, Governor Baker established the Seaport Economic Council which is tasked with coordinating coastal community planning and investment activities in order to stimulate growth in the maritime economic sector and protect coastal assets. The connection between the maritime economy and a changing climate is explicitly noted in the reasons for establishing the council: “rising sea levels and extreme weather events such as coastal storms and hurricanes present significant threats to coastal communities, requiring development of

*We need to design places that not only respond to the market but also respond to environmental challenges, and that serve as talent magnets and platforms for upward mobility. We need to create whole places—that is places that are: dense, mixed-use, mixed income and walkable; full of life, distinctive and diverse in their built form, natural environment and social networks; empowering of their people; water and energy efficient; transit and digitally connected; and disaster resilient.*  
- A Rhode Island Economic Strategy (Rhode Island Economic Policy Council, 2008)

resilient coastal assets in a sustainable fashion” (Executive Order No. 564, August 10, 2015).

### Broader collaboration and holistic planning

The approaches to achieving habitat, water quality, and other goals for the southeast New England study area are moving in the direction of more integrated, comprehensive plans, such as the Rhode Island State Guide Plan (RI Planning, 2010, 2012a, 2012b, 2014) and the Buzzards Bay and Narragansett Bay CCMPs (BB NEP, 2013; NB NEP, 2012), as well as watershed-based plans, such as the *Taunton River Watershed Climate Change Adaptation Plan* (Plocinski et al., 2013). The Massachusetts Division of Ecological Restoration’s (DER) *Strategic Plan Summary 2011-2016* (MA DER, 2011) outlines the division’s guiding principles and strategic goals aimed at “holistic restoration” projects that are completed by partnerships across sectors. Even MassDOT has implemented actions related to the goal of improving “ecological function of water systems” as part of its GreenDOT plan (MassDOT, 2012).

Why is it so important to take an ecosystem approach to restoration and other activities that improve environmental and economic health? Because ecosystems are self-sustainable and do not rely on excessive operations and maintenance (MA DER, 2011). Additionally, multiple benefits tend to accrue

from a more holistic approach. For example, a specific recommendation from the *Taunton River Watershed Climate Change Adaptation Plan* to address both biodiversity and flood control goals emphasizes that “protecting and restoring large, contiguous habitat blocks and the corridors that connect them is an important strategy to maximize watershed resilience” (Plocinski et al., 2013).

A broader planning scope that considers environmental, economic, and societal health, as well as climate change, logically demands a larger, more diverse group of people to represent a wider range of expertise and interests. There are several planning documents that indicate a wide array of partners are involved in setting priorities and implementing them. These documents tend to have more comprehensive focus areas:

- The *Massachusetts Aquatic Habitat Plan* (Aquatic Habitat Restoration Task Force, 2008) acknowledges the importance of a variety of sectors working together, emphasizing that “partnerships get projects done.” It then goes on to identify a wide spectrum of impacts, including environmental (e.g., reduced species diversity), economic (e.g., lost revenue from fisheries, tourism; storm-damage protection), and societal (e.g., clean drinking water).

- The *Blackstone River Watershed Five-Year Action Plan* (MA EOEA, 2004) was developed by 38 towns and key stakeholder organizations, including the Blackstone River Coalition, a group composed of nearly 20 state and federal agencies, nonprofit organizations, municipalities, and businesses. The priority actions included water quality, water quantity, habitat improvement, land use planning, recreational use, capacity-building, public outreach, and sustainable development.

- *The Blackstone River: Clean by 2015* addresses a wide scope of issues, including

*Long recognized as being the most effective means to protect and restore water resources, a watershed-based approach recognizes that watersheds transcend political boundaries.*  
—Nonpoint Program Management Plan (RI DEM, 2014)

*[T]he John H. Chafee Blackstone River Valley National Heritage Corridor has served as a catalyst for regional initiatives since its creation in 1986* (Lighthouse Consulting Group, Inc., 2015).

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stormwater, nutrients from wastewater, land uses, streamflow, recreational opportunities, and education (Blackstone River Coalition, 2008).

- Efforts occurring as part of the **John H. Chafee Blackstone River Valley National Heritage Corridor** were mentioned in several Blackstone watershed/river documents (Crossman Engineering, Inc., 2004; Dodson Associates, Ltd., 2004; GeoSyntec Consultants, 2004). “National Heritage” seems to be a designation that has helped unify regional efforts in the area (Lighthouse Consulting Group, Inc., 2015). The Federal Commission managing the Corridor invests in a range of activities, including community and land use planning, heritage tourism, downtown revitalization, river restoration, recreation development along the river, interpretation, and environmental education.

All interviewees working in Rhode Island expressed the ease with which collaboration among state agencies, NGOs, utilities, other interests, and academia occurs. Rhode Island state agencies have a history of partnering with academia (University of Rhode Island [URI], Roger Williams, Brown, etc.) that goes beyond the ad hoc partnerships between academic institutions and state and regional entities in Massachusetts. The URI Coastal Institute played an instrumental role in developing the

Rhode Island Ocean Special Area Management Plan (SAMP) and is currently conducting an economic analysis of the entire Narragansett Bay watershed.

When discussing Rhode Island’s successful collaborations, interviewees were also quick to point out that the state’s size makes collaboration between state agencies and other partners very simple and allows for easier negotiations related to environmental mandates (e.g., 50 percent nutrient reduction in wastewater, new wetland setback law). About half of interviewees mentioned the successful negotiations and cooperation that paved the way for a recent statewide wetlands setback standard. The bill managed to garner support from environmental groups and the construction industry. The new 200-foot setbacks for lakes, ponds, rivers, and other wetlands are a win for builders who now have a universal, clear, and predictable standard, as well as a win for environmental groups who have achieved protection for previously exempt water bodies (RI General Assembly, 2015).

Interviewees in Massachusetts pointed to the proven success of intermunicipal collaboration among communities (coastal communities around Buzzards Bay at one point established a Mutual Aid Agreement for oil spill response); however, there are no similar existing efforts. The **208 Plan Update** (Cape Cod Commission, 2015) strongly encourages collaboration

*Promote more systems-based and process-based restoration at holistic level.*

- Interviewee (on how SNEP can help the region)

among towns to address the nutrient problem in the shared watersheds across Cape Cod. Conservative estimates from the Regional Wastewater Management Plan suggest that shared infrastructure and economies of scale could result in a savings of up to 9 percent on capital/construction costs and up to 25 percent on annual operations and maintenance costs (Cape Cod Commission, 2015).

### Ecosystem service values

Out of the 37 plans that were included in the synthesis matrix, only 13 mentioned ESVs while discussing benefits of planning goals and priorities. Some of the planning documents that describe comprehensive approaches to planning and management and reference the value of restored environmental quality include **Transportation 2035: State Guide Plan Element 611** (RI Planning, 2012a), the **Taunton River Watershed Climate Change Adaptation Plan** (Plocinski et al., 2013), and the **Narragansett Bay CCMP** (NB NEP, 2012). Out of the 13 plans exploring ESVs, nearly two-thirds explore six or more of the nine focus areas identified in the synthesis table, indicating a more comprehensive planning

approach is connected to consideration of ecosystem values.

ESVs are “the direct or indirect contributions that ecosystems make to the well-being of human populations” (EPA SAB, 2009). As previously discussed, plans exploring improved water quality or habitat will often discuss the benefits of those projects in broad terms—most commonly, recreation opportunities. The values of commercial and recreational fisheries have also historically been identified and quantified. However, as evidenced in our small cross-section of planning documents for Rhode Island and southeastern Massachusetts, ESVs are not commonly identified, especially in documents that are not taking more holistic, comprehensive approaches to environmental planning. In fact, interviewees unanimously mentioned ESVs as a data gap in their planning activities.

Over the last decade, regulators and coastal managers have placed “increasing focus on valuing ecosystem services holistically to capture as complete an accounting as possible of ecosystem service values and improve decision-making” (IEc, n.d.). This explains why the reviewed plans that refer to ESVs, even briefly, generally have more comprehensive scopes. MA DER commissioned several studies that evaluate and quantify the economic and community benefits from restoration projects, most recently stream barrier removal projects

(IEc, 2012). Although they are not plans included in the matrix, DER’s studies have been critical in bridging the gap between environmental improvements and economic effects. These DER studies are only the start of what will hopefully be continued interest and investment in valuing environmental quality. The DER findings showed that ecological restoration creates jobs, stimulates economic activity, and generates long-term economic value by improving ecosystems services. All Rhode Island interviewees mentioned the importance of having an agency like the Massachusetts DER, and noted that this was a management gap in Rhode Island.

A recent study of Long Island Sound found that the Basin’s natural capital provides ecosystem service flows of at least \$17 billion to \$37 billion every year (Kocian et al., 2015). Other U.S. bays have also conducted their own economic analyses, including Tampa Bay (Tampa Bay Estuary Program and the Tampa Bay Regional Planning Council, 2014) and Chesapeake Bay (Phillips and McGee, 2014). As mentioned above, all interviewees identified ESVs as a data gap for the SNEP study area; several also identified these types of bay-level analyses as a useful tool for their work.

The emergence of nature-based infrastructure (“green infrastructure”) and habitat restoration for southeastern New England’s coastal resilience purposes is also connected to this rise in interest in ESVs, despite the lack of

*We’re moving beyond restoring habitat for habitat’s sake—it’s about the ecosystem services.*

-Interviewee

*...for every \$1 million spent, the average economic output of DER projects generates a 75% return on investment and creates or maintains 12.5 full-time-equivalent jobs. These results equal or exceed those for other capital projects such as road and bridge construction, and replacement of water infrastructure.*

- Economic Benefits from Aquatic Ecological Restoration Projects in Massachusetts (IEc, 2012)

*[The Massachusetts Division of Ecological Restoration’s] work is driven by the core principle that public funds spent on restoration should maximize the return on investment in terms of social, economic, and ecological benefits.*

- Massachusetts Division of Ecological Restoration website

data. Transportation plans for Massachusetts and Rhode Island (MassDOT, 2012; RI Planning 2014), watershed plans for the Taunton and Blackstone Rivers (GeoSyntec Consultants, 2004, 2006), and the CCMPs for Buzzards Bay

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and Narragansett Bay (BB NEP, 2013; NB NEP, 2012) identified restored and constructed wetlands as solutions to address a variety of issues. Wetlands protection and restoration has been gaining traction as a “green infrastructure” strategy to address water quality, habitat, flooding threats, and sea-level rise. Several interviewees mentioned restoration of coastal and freshwater wetlands as an important part of their work, particularly the attempt to move towards larger scale wetlands restoration, rather than smaller-scale acre-by-acre projects.

As discussed in greater detail in the next section, lack of funding has often proved an obstacle to past efforts to identify and assess ESVs. Planning and restoration efforts have been limited in scope and duration due to available budgets. However, as nonprofit organizations and private sector, local, state, and federal groups increasingly collaborate and combine resources and knowledge, we will hopefully continue to see more holistic approaches to environmental management that save money in the long term.

*More studies on ESV in the region will help build the case for holistic habitat restoration.*

- Interviewee

### 4. Gaps and Needs

The following are highlights of the more common gaps, needs, and obstacles noted across all documents and interviews:

#### Resources

- Cost has been the major impediment to wastewater plans on Cape Cod. The existing wastewater costs to homeowners tend to be “hidden.” Most people do not recognize the annualized expense of owning and maintaining a septic system (Cape Cod Commission, 2015).
- Innovative financing is a huge gap in the region’s projects. The interviewees noted the need for private investment to avoid sole reliance on government funding/tax dollars.
- Completing economic studies tends to be resource-intensive (even free software such as iTree can be time-intensive); ESVs can therefore rarely be provided to all the local communities that would be interested in them (in Massachusetts).
- Several interviewees identified municipalities as “the challenge.” Municipalities vary in terms of staff and resources across both states.

#### Collaboration and outreach

- Several interviewees mentioned the lack of capacity to address stormwater at a regional level. The lack of intermunicipal collaboration to address stormwater is related. It would be useful to have the ability to scale successful projects up from local/site-specific to sub-watershed and watershed levels. This will also require improved communication among municipalities.
- Communication across state boundaries was identified in several watershed plans. For example, “RI and MA NRCS offices should work together in the Palmer River watershed. Create a memorandum of understanding to work across state lines and help improve water quality....Have local agricultural commissions work together on a watershed level” (FB Environmental Associates, 2012a, 2012b).
- Pre-disaster mitigation plans are a benefit to the cities and towns in the Taunton River watershed, especially in light of the changing climate; however, a parallel focus on climate change adaptation at the regional level would be beneficial (Plocinski et al., 2013).
- In both Rhode Island and Massachusetts, interviewees would like to do a better job getting all segments of the population

involved. Education/outreach is a common goal of many of the plans reviewed.

- Science needs to be more transparent and better integrated into decision-making; generally better collaboration with academia is needed. Academia needs to be more responsive to management timeframes.
- Academic institutions each have their specialties and expertise, which are consistently brought into state projects. This type of collaboration is less apparent in Massachusetts where interviewees pointed to collaboration with academia on a more ad hoc basis for new projects.
- Lack of internal capacity requires advocacy, communication, and outreach to potential partners, including private landowners, state and federal regulatory agencies, land trusts, other NGOs, and municipalities (TNC et al., 2014).
- A few interviewees acknowledged that Rhode Island struggles somewhat with engaging the public (all segments of the population).

### ***Comprehensive/holistic approaches***

- Major gaps/obstacles to achieving more integrated management plans, such as embayment plans, include the cost and political consensus to pass the necessary

zoning or non-zoning bylaws or regulations (BB NEP, 2013).

- ESVs are a data gap mentioned by all interviewees. Existing data or studies are rarely site-specific. Organizations in both states have undertaken some studies but admit that they are massive undertakings.
- There is no Massachusetts DER-equivalent in Rhode Island; several interviewees mentioned this as a gap.
- Ecosystem-based management of commercial and recreational fisheries is made challenging by a variety of factors, including the lack of baseline data for reference (unimpaired) ecosystems, the concern by fishers about the possible economic impacts of regulations and policies, the difficulty in collecting accurate and timely data, and the difficulty in separating environmental factors from fishing impacts (NB NEP, 2012).
- Local planning and zoning were ineffective in preventing sprawled residential development patterns that increase the cost of conventional wastewater solutions (Cape Cod Commission, 2015).

### ***Other data gaps***

- Specific data gaps mentioned by interviewees include nutrient modeling, marsh migration information (process,

rates, ideal conditions), and research on the benefits of natural infrastructure.

- Information storage was mentioned by one interviewee as a large need. The interviewee suggested creating a regional data warehouse. Do not only commit to uploading the information to a computer, but also engage in an annual information verification loop where assumptions are tested.
- An interviewee described how it is generally difficult to innovate in the public sector (but not impossible).
- Several plans called for ongoing monitoring to measure the effectiveness of efforts—“Need for Wildlife and Habitat Data Collection, specifically: Lack of monitoring and landscape-level monitoring strategy to support planning and assessment” (TNC et al., 2014). This was supported by a handful of interviewees who would like to see additional water quality monitoring, trend analyses, and impairment identification.
- An interviewee from Rhode Island mentioned the state’s lack of capacity to process and synthesize water quality data from university-based monitoring programs. A Massachusetts interviewee similarly described a shortage of entities monitoring water quality and a desire to be able to conduct a trends analysis.



## Summary of Recommendations

*Improving collaboration for innovation in the region.*

*Advocate and support a holistic approach to planning through a climate change lens.*

*Prioritize data gaps, including ESVs, and plan updates to support this holistic approach.*

## 1. Recommendations

The following section contains recommendations based on observations made during the document review and based on the opinions expressed by interviewees. These recommendations keep in mind SNEP's intent to host a forum for program partners. At this meeting, partners will gain an overview on recent activities in the region and develop consensus on future efforts. These recommendations will serve to inform the forum participants.

**Improve collaborating for innovation.** SNEP has already provided an opportunity for interaction between partners that has had positive impacts, but there is still room for improvement, especially to encourage efforts in the region that align environmental, economic, and social interests in order to improve resilience.

Through the document review and interviews, the need for improved collaboration between states, between municipalities, between municipalities and state agencies, across sectors, between state agencies and municipalities, and between all agencies and the public/individual landowners were all identified. SNEP would like to give individuals and municipalities the opportunity to learn and understand the larger ecosystem that their community is a part of while also allowing state agencies to understand the smaller-scale, on-the-ground struggles and successes municipalities have managed on their own.

SNEP should look to build on existing efforts and suggestions by interviewees for

collaborative opportunities, which include the following:

- “Action Plan 5” in *Actions for Economic Development in Rhode Island* (Commerce RI, 2014): The Rhode Island Foundation is convening an emerging “Stormwater and Green Infrastructure” coalition, which includes the RI DEM, the City of Providence, the Rhode Island Nursery and Landscape Association; the University of Rhode Island; and nonprofit groups, such as Save the Bay, Conservation Law Foundation, Clean Water Action, and others.
- The *Blackstone River Watershed Five-Year Plan* mentions regular meetings of the Watershed Advisory Committee that was convened to develop this Watershed Action Plan.
- Previous work of **stormwater collaboratives** in Massachusetts.
- **Intermunicipal collaboration** to address stormwater. This type of collaboration has a proven success record in Massachusetts and Rhode Island (Mutual Aid Agreement for oil spill response, regional schools, and shared

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fire response resources). Multiple towns collaborating on stormwater projects will likely be the best option due to economies of scale (Cape Cod Commission, 2015).

- Strengthened interaction with academia, more so in Massachusetts than in Rhode Island. One interviewee in Rhode Island described a workshop they hosted that aided **academic and state management relationship-building** by bringing research and management communities together to corroborate one another's work. This interviewee and others emphasized the importance of applied research and the ability to **direct academia towards research gaps** at the state and local level.
- LID promotion and implementation is one area where both Massachusetts and Rhode Island could work more closely together; they have started that process in a **joint stormwater technical assistance project** in the Blackstone and Ten Mile River watersheds (NB NEP, 2012).

In addition, to start improving coordination and collaboration across jurisdictions in the region, SNEP could:

- Engage sectors and organizations that are not traditionally involved in environmental management such as the insurance industry, chambers of commerce, private investment firms, etc., much like the successful

engagement of diverse interests during the Cape Cod 208 Update.

- Identify partners' collaborative strengths, such as TNC's strong relationship with the private sector and the Buzzards Bay Coalition's strong relationships with municipalities and the Buzzards Bay NEP. This will allow for matchmaking between partners for particular projects.
- Award funding to projects that aim to innovatively improve ecosystem and economic health and resilience in the study area. Innovation does not necessarily have to come in the form of a specific new technology to alleviate nitrogen pollution or restore wetlands; innovation may also come in the form of new partnerships, new financing strategies, and new management approaches.

These actions will allow SNEP to create opportunities for:

- Innovative financing and leveraging of resources as new partnerships are established and successful strategies are shared.
- Connections between partners and resources that result in planning that focuses on continued economic growth and development with fewer impacts to natural processes. Less reactive partnerships "fixing" projects, and more proactive partnerships that consider economic,

environmental, and social impacts in the first place.

- Economic development plans that include consideration of climate change and improvements in environmental quality through efforts of groups like the Massachusetts Seaport Economic Council.
- Prioritized projects in the region based on environmental, economic, and societal benefits (see recommendation on ESVs). Providing a menu of options to address each priority based on the capabilities of the diverse partners involved in the region. For example, the American Shad Habitat Plan for Massachusetts Coastal Rivers (MA Division of Marine Fisheries, 2014) could be updated to include the type of economic benefits that MA DER is determining through their habitat restoration work (IEc, 2012; 2015).

SNEP can be the entity that bridges the gap between municipalities, academia, and between complementary agencies and organizations across the two states. By building partnerships that include a variety of interests, SNEP will also be pushing the region towards a more comprehensive planning perspective.

**Encourage a holistic view and systems approach through a climate change lens.** The single-species, single-habitat type of management approach often does not achieve the restoration of ecological health that is the

ultimate goal of environmental regulation. Similarly, development of the built environment, whether infrastructure or real estate, that does not consider proximity to amenities, natural hazards, or impacts to the landscape, may be money down the drain. As was the case in several of the plans reviewed for this report, there is movement in the direction of comprehensive plans that address a wider spectrum of issues. As can be seen in the Buzzard's Bay CCMP (BBNEP, 2013), a wide array of actions can be described while ultimately leaving the exact approach up to the municipalities. The strong climate change lens through which Rhode Island state agencies view management and planning activities could greatly inform efforts in Massachusetts, where organizations such as the Cape Cod Commission have admitted this is an issue area that they must explore in greater depth and incorporate into planning immediately.

SNEP would like to continue to foster this holistic, comprehensive type of planning approach by supporting organizations and partnerships that are already jointly exploring multiple focus areas, such as habitat restoration and water quality improvements, but also helping connect business sectors and other more economic-focused organizations with these efforts so they can better understand the natural synergies that exist between a quality environment and a high quality of life, including

public health and safety and recreational opportunities.

SNEP may consider endorsing the growing momentum around coastal green infrastructure as a strategy to address multiple environmental quality issues in the face of rising sea levels (National Science and Technology Council, 2015). There may be opportunities for SNEP to embrace restoration and resilience projects' economies of scale by supporting updates or even combining content found in outdated and overlapping plans; e.g., the Blackstone River Watershed Five-Year Action Plan (2004) and the Blackstone River Strategic Anadromous Fish Restoration Plan (2002). These are opportunities to take existing work, combine common approaches, and advocate for green infrastructure and other multi-benefit approaches. Knowledge of the range of ecosystem services associated with green infrastructure approaches would make the case for green infrastructure projects stronger and an easier sell to transportation and housing development agencies.

SNEP understands the uncertainty that accompanies climate change. As Massachusetts and Rhode Island begin to manage the environment and economy amidst this uncertainty, SNEP hopes to provide a competitive, yet collaborative environment with a funding stream that allows room for experimentation and mistakes.

### **Prioritize ESV information needs and other data gaps that could support this approach.**

As described in the Millennium Ecosystem Assessment (2005):

*Ecosystem services are the benefits provided by ecosystems. These include provisioning services such as food, water, timber, fiber, and genetic resources; regulating services such as the regulation of climate, floods, disease, and water quality as well as waste treatment; cultural services such as recreation, aesthetic enjoyment, and spiritual fulfillment; and supporting services such as soil formation, pollination, and nutrient cycling.*

*One interviewee gave an anecdote of their experience with SNEP and how they were able to connect URI's Wastewater Training Center with similar programs on the Cape through initial meetings; neither side had known about the counterpart efforts previously. The interviewee also mentioned the value in establishing a relationship through SNEP meetings with the Cape Cod Commission, a connection they now used frequently in their work in Rhode Island.*



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ESVs help the public and decisionmakers understand the value of a functioning ecosystem, making them more willing to invest in its restoration or conservation. When cost-benefit analyses for projects incorporate ESVs, all alternatives become comparable. Improvements in environmental quality can then be seen as valuable investments, and wetlands or restored streams come to be viewed as assets to decisionmakers, much like highways or bridges.

ESVs were mentioned as a data gap by all interviewees with varying degrees of desire for ESVs for the region. Existing studies, such as the economic assessment work in Long Island Sound and the Massachusetts DER assessments are useful and informative, but are not completely specific to the SNEP region. The Long Island Sound and DER studies offer a good foundation to continue to build upon, as do efforts in Chesapeake Bay, Tampa Bay, and—more locally—Great Bay, New Hampshire.

As was seen in the document review, the plans that included a wide-array of partners and comprehensive scopes were often the same plans that refer to ESVs. If SNEP focuses on building partnerships for innovative, collaborative, and holistic projects in the region, ESVs will likely be brought to the surface naturally through these projects.

### 2. Next Steps

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## Appendix A – Focus Area Descriptions

The following are brief descriptions of the criteria used to identify a focus area within each plan for tallying in the matrix:

*Water quality:* The document contains goals, objectives, actions, historical or scientific information, and/or projected risks related to managing and improving water quality. “Water” includes coastal waters, freshwater, and drinking water. Documents may contain descriptions of pollutant sources (e.g., stormwater runoff, spills and dumping, agriculture) and pollutants of concern (e.g., heavy metals, nutrients). Actions to improve water quality also are discussed such as reducing fertilizer runoff, low impact development, septic system upgrades, TMDLs etc.

*Water quantity:* The document contains goals, objectives, and/or actions related to managing and improving water quantity. Goals may be related to sustaining water supplies for human consumption as well as maintaining flows to support ecosystems. Over-consumption, contamination, and a changing climate are

examples of some of the challenges addressed in the documents. Actions or strategies discussed may include water efficiency improvement to reduce consumption rates, removing obstructions like dams in rivers or streams to restore natural flows, etc. Documents may also discuss hydrological features and impacts of climate change on precipitation, snow melt, and evaporation.

*Habitat:* The document contains goals, objectives, actions, historical or scientific information, and/or projected risks related to managing and improving terrestrial and aquatic habitats for the benefit of wildlife and human use. Issues of concern or threats being managed may include destruction of habitat for land development, climate change impacts, pollution, etc. Actions or strategies to address these challenges may include land conservation, smart growth, installation of fish ladders or pathways, and habitat restoration. Documents focused on habitat may likely also discuss protection of specific species of flora or fauna.

*Recreation:* The document contains goals, objectives, actions, historical or scientific information, and/or projected risks related to managing and improving recreational opportunities. Recreational opportunities such as wildlife viewing, swimming, hiking, or boating are often considered ecosystem services that humans rarely have to pay for and are enhanced, improved, or created when habitat is has been restored or constructed. Strategies to address lack of recreational opportunities may include open space preservation, habitat restoration, public access improvement, etc. Documents that discuss strategies or actions recommended to prevent loss of value were also included.

*Land use and infrastructure:* The document contains goals, objectives, actions, historical or scientific information, and/or projected risks related to building and maintaining infrastructure such as public transportation, roads, bridges, wastewater systems, etc. and/or land use and development including housing, commercial, industrial, and green space preservation. Documents that focus on these

issues often associate these types of activities with economic growth. Land development is often viewed as the source of negative impacts to several of the other categories discussed above (water quality and quantity, habitat, and recreation). Infrastructure removal, in particular in reference to hydrologic restrictions like dams and culverts, are often discussed for improvements to streamflow and habitat restoration.

*Economic development:* The document contains goals, objectives, actions, historical or scientific information, and/or projected risks related to promoting the standard of living and economic health of a town, city, or region. Any of the above categories mention actions that can be taken that inevitably improve the economic sustainability of an area, however, they may not be explicitly analyzed or described as such. For this synthesis, any documents that acknowledge the connection between a healthy environment and economic success were designated in the “economic development” column of the matrix. Additionally, documents that only focus on traditional economic development strategies, such as infrastructure

improvements, commercial development, etc. were also included.

*Public health:* The document contains goals, objectives, actions, historical or scientific information, and/or projected risks related to promoting the well-being of people by preventing disease and exposure to poor environmental conditions that may cause disease. Many of the actions associated with improving water quality are connected to improved public health through removal of nutrients, metals, pathogens, and other pollutants from water. Fish consumption, recreation in contact with polluted water, and consuming undertreated or untreated water are all concerns that many documents discussing water quality, quantity, habitat, and other above topics address.

*Ecosystem service values (ESV):* Improving ESVs is likely not the focus of any of the management or planning documents, but may be mentioned as an additional benefit of habitat restoration or particular land use practices. ESV are values provided by the environment when it is allowed to function normally. Flooding attenuation,

water purification, nutrient cycling, and production of raw materials to create food, energy, pharmaceuticals, and other products are all types of ecosystem services. Recreation (discussed above) is a commonly identified nonmaterial benefit that ecosystems provide. Only documents that explicitly acknowledge the economic or nonmaterial benefits of improved environmental quality were included (even if the phrase “ecosystem service value” was not used).

*Climate change:* The document contains goals, objectives, actions, historical or scientific information, and/or projected risks related to climate change adaptation and mitigation. Climate change is projected to raise air and water temperatures, alter precipitation, and raise sea levels in this geographic region. The impacts to the environment from climate change discussed in the document may include increased intensity of precipitation, more frequent and widespread flooding, and loss or migration of wildlife due to changing temperatures and habitats.

## Appendix B – Annotated Bibliography

*Aquatic Habitat Restoration Task Force. 2008. Charting the Course: A Blueprint for the Future of Aquatic Habitat Restoration in Massachusetts. Aquatic Habitat Restoration Task Force, Boston, MA.*

This blueprint for aquatic restoration in Massachusetts provides a guide to maximizing restoration results in the next four year period. This document includes a history of degradation, ecosystem service value, partnerships, potential benefits, and recommendations.

Recommendations include actions to: enhance state leadership, invest strategically to maximize results, create informed constituency, increase technical and financial support directly to stakeholders, ensure efficiency in regulation, and maximize role of science and technology in restoration. The document focuses on habitat restoration and ecosystem service values, but also addresses the following priorities: water quantity, land use and infrastructure, economic development, public health, and impacts of climate change.

*Barnstable County Wastewater Cost Task Force. 2010. Comparison of Costs for Wastewater Management Systems Applicable to Cape Cod. Barnstable County Wastewater Cost Task Force, Barnstable County, MA.*

This document is an exhaustive comparison of costs to implement and maintain various wastewater management systems applicable to Cape Cod. It focuses on four types of wastewater systems—individual, cluster, satellite, and centralized—but also discusses dozens of “non-traditional”

approaches and technologies, including wetland restoration and preservation.

*Blackstone River Coalition. 2008. The Blackstone River - Clean by 2015. Blackstone River Coalition, Worcester, MA.*

This document describes a vision of the Blackstone River watershed in 2015. Major issues facing the watershed include: stormwater quantity and quality, sediments, and discharge from wastewater treatment plants. The Blackstone River Coalition lays out goals related to land use patterns, water quality, water quantity, habitat, stormwater management, and recreation, and recommends actions for homeowners, business owners, developers, and decision makers.

*Burke, K., K. Crawley, and R. Mendes. 2012. Rhode Island Water Resources Board 2012 Strategic Plan. Rhode Island Water Resources Board, West Greenwich, RI.*

This strategic plan describes the short and long term goals for Rhode Island’s water resources board, including regulation of the development, protection, conservation / management and use of the water resources of the State. This document describes the core principles and goals of the partners and the planning effort which sought to integrate many state and regional initiatives of stakeholders in Rhode Island.

## Appendix B

### *Buzzards Bay Coalition. 2007. Saving Buzzards Bay Lands—Campaign Final Report.*

This is the final report of the five-year project (2001-2006) to protect and restore lands around Buzzards Bay threatened by ongoing development. The report lists three main programmatic goals: 1) safeguarding 2,000 acres of land vital to the watershed's water quality; 2) enhance local land trusts' ability to conserve land and collaborate; and 3) establish a revolving fund to facilitate land conservation. The report highlights watershed management, land conservation, funding sources, and water quality. Collaboration is mentioned as one of the campaign's programmatic goals.

### *Buzzards Bay Coalition. 2015. Buzzards Bay Coalition Strategy 2015-2020—Executive Summary.*

This brief position paper outlines accomplishments in preserving and restoring the bay from 2009 to 2014 and lays out programmatic goals for 2015-2020. Collaboration is highlighted as a programmatic goal; ecosystem-based management is not explicitly mentioned, but ecosystem restoration and preservation are key parts of the watershed management goals laid out in this document.

### *Buzzards Bay National Estuary Program. 2013. Buzzards Bay Comprehensive Conservation and Management Plan 2013 Update. Buzzards Bay National Estuary Program, Massachusetts Executive Office of Energy and Environmental Affairs, Office of Coastal Zone Management.*

The original CCMP for Buzzards Bay focused on nitrogen management and specific recommendations. This updated CCMP has gone from 14 to 21 action plans with some new areas of concern including freshwater pollution and marine litter. Specific recommendations have been eliminated since the NEP believes there is no one-size-fits-all approach - choice of solution is up to the municipality. 21 action plans explore

impacts from nitrogen loading, bacteria, pathogens, stormwater, boat sewage, mooring & propeller damage, dredging, river obstructions (dams, etc.), water withdrawals, invasives, litter, toxic pollution (lingering), oil pollution, coastal storms, sea level rise, and temperature changes. There are several approaches generally discussed with each action which seem to be a mix of strategies already being implemented and new strategies. Action 15 mentions managing uses and activities "in an integrated manner using sound assessments of natural resources, habitat, and water quality, to ensure sustainable recreational and commercial activities while protecting and improving ecosystem health and values."

### *Cape Cod Commission. 2015. Cape Cod Area Wide Water Quality Management Plan Update (208 Plan). Cape Cod Commission, Barnstable, MA.*

The Cape Cod water quality management plan update provides an update to the 1978 Water Quality Management Plan for Cape Cod, which addresses the degradation of Cape Cod's water resources from excessive nutrients, primarily nitrogen. The update includes a technology matrix with a variety of solutions for dealing with nutrient loading (traditional and non-traditional). Estimated removal costs of N and P, and other useful facts about the technology's performance are detailed, along with performance challenges of each, including how risks of climate change may impact a particular technology. Site suitability analysis was conducted for the different approaches. Several watershed planning decision support tools developed. The Plan encourages towns to join forces to reduce costs (as a watershed would require towns to work together). Mitigating future loads is discussed as well as how the recommendations from the 208 update should be implemented.

*Central Massachusetts Regional Planning Commission. 2011. Funding Stormwater Management: Strategies to Support Stormwater Management at the Municipal Level. Central Massachusetts Regional Planning Commission, Worcester, MA.*

This handout presents a series of alternatives for communities' current stormwater management systems. It also provides a brief overview of stormwater impacts, a menu of stormwater management options, and identifies some funding sources.

*CommerceRI. 2014. Actions for Economic Development in Rhode Island—Highlights & Full Report. CommerceRI, Providence, RI.*

This document outlines Rhode Island's economic strengths, competitive advantages, long-term challenges, and actionable strategies for growth. It lists water-related industries as the first of four primary competitive advantages, although does not delve deeply into environmental issues, particularly not watershed restoration. The report includes a strong narrative about leveraging current assets and advantages, indicating a willingness to collaborate, although collaboration on environmental issues is not explicitly mentioned.

*Commonwealth of Massachusetts and State of Rhode Island. 2005. Memorandum of Understanding between the Commonwealth of Massachusetts and the State of Rhode Island to Restore the Watersheds that Drain to Narragansett Bay with an Initial Goal of Working Toward Restoring the Blackstone River to Fishable and Swimmable Conditions by the Year 2015. Commonwealth of Massachusetts and State of Rhode Island.*

This Memorandum of Understanding united Massachusetts and Rhode Island to restore watersheds that drain into Narragansett Bay. The initial milestone is the restoration of Blackstone River to fishable and swimmable conditions by 2015. Strategies include the development of an adaptive management Action Plan, coordinated watershed-based

actions, and key policy decisions. Specific actions include: construction of combined sewer overflow controls, reduction of point and non-point source pollution, protection or restoration of open space, riparian buffers and wetlands, data collection and management, and actions to ensure adequate flow.

*Crossman Engineering, Inc. 2004. Ashton-Pratt Corridor Redevelopment Plan. Town of Lincoln & Town of Cumberland, RI.*

Towns received a grant under Superfund Redevelopment Initiative to hold public workshops, interviews with stakeholders, meetings with citizens, in order to guide the direction of growth along the main stem of the Blackstone River and ensure that growth is complimentary, as well as sensitive, to the river environment. Recommended actions are focused on development mostly (improved parking, streetscape improvements, property demolition), but have a few references to green infrastructure, improving habitat for recreational value, preventing erosion of landfill, river access, cleaning up mill pond (for aesthetics, but could have other value as well). Much of the Blackstone River and its tributaries, including the Site, are impaired due to biodiversity impacts, pathogens, hypoxia, nutrients, ammonia (un-ionized), and metals (copper and lead). Redevelopment plans for each sector of project area are discussed in terms of overarching objectives.

*Dodson Associates, Ltd. (Peter Finkler, ASLA). 2003. The Rhode Island Conservation Development Manual: A Ten-Step Process for Planning and Design of Creative Development Projects. Sustainable Watersheds Office Rhode Island Department of Environmental Management and U.S. Environmental Protection Agency – New England.*

This manual outlines a ten-step process for siting, planning, and implementing new developments in Rhode Island in an environmentally conscious manner. Specifically the process efficiently sites new development and open spaces of undeveloped land, without reducing

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the number the new units being developed. This document lacks content about water issues.

*Dodson Associates, Ltd. 2004. Blackstone River Visioning. Massachusetts Audubon Society John H. Chafee Blackstone River Valley National Heritage Corridor, Grafton, MA.*

This summary document describes a visioning process conducted on the Blackstone River Valley National Heritage Corridor. The ultimate goal of the project was to guide the direction of growth along the main stem of the river and ensure that growth is complimentary, as well as sensitive, to the river environment. Results of several public workshops are described. The summary includes contacts and resources.

*Dodson Associates, Ltd. and Horsley-Witten Group. 2005. Urban Environmental Design Manual. Sustainable Watersheds Office Rhode Island Department of Environmental Management, Providence, RI.*

The manual gives guidance, appropriate for local officials as well as the development industry, community groups, and the public, on environmentally responsible urban redevelopment. The manual provides four case studies and a synthesis of best management practices. Watershed management is particularly included in four (of 18) "principles" of urban redevelopment. Other principles touch on environmental issues, while these four deal particularly with riparian buffers, stormwater management, and wastewater management.

*Earth Economics. 2015. Economic Analysis of Outdoor Recreation in Washington State. Washington State Recreation and Conservation Office, Olympia, WA.*

This study presents the economic impact of recreational land/water use in Washington State. Though this document does not cover the region of interest, the findings present applicable approaches and lessons learned. The study reviewed the literature and used the IMPLAN model. The

study analyzed the economic expenditures and contributions by activity and by land ownership (public lands, private lands, in state, out of state). Finding: participants gain more value than they pay for when recreating. In addition, recreational land is recognized as providing the following non-market goods and services: aesthetic beauty, clean water, wildlife habitat, physical health for the public, and a bridge between urban and rural economies.

*Economic Development Planning Council. 2011. Choosing to Compete in the 21<sup>st</sup> Century.*

This strategy and plan describes five broad categories for action that were identified as most important for Massachusetts to retain or improve its competitive position in the world's economy, focused on infrastructure and innovation. Within each category, the economic development planning council recognizes significant accomplishments over the last five years and then identifies critical priorities for further improvement, together with specific action steps. Environmental quality goals are not included in the plan.

*Evans, N.T. and A. C. Leschen. 2009. Eelgrass (Zostera marina) Restoration and Monitoring Technical Guidelines. Massachusetts Division of Marine Fisheries, Boston, MA.*

Due to eelgrass's function as a coastal resource in Massachusetts coastal waters, proponents of dredging and other coastal construction projects are required by permitting agencies to avoid and minimize impacts to eelgrass and finally mitigate for any unavoidable damages. This handbook provides general recommendations on methods and standards for eelgrass restoration/mitigation and associated monitoring. It is intended for use by local, State and Federal resource and permitting agencies, as well as project applicants and consultants, as a guide in the design and review of eelgrass restoration and mitigation projects. Ecosystem-based management is not mentioned explicitly.



*Fourth Economy Consulting. 2013. Economy RI: Economic Development Data Analysis & Assessment. Rhode Island Sustainable Communities Consortium.*

This report on the Rhode Island economy addresses data analysis and assessment of the business climate, financial resources, regulatory environment, and marketing environment, as background for the Sustainable Rhode Island campaign. The report identifies two market opportunity networks as strategic target clusters which are related to the environment: Culture, Fitness & Recreation Market Opportunity Network and Advanced Marine Vehicle Market Opportunity Network. A regional relationship approach is explored as a model for cluster development. In addition, regulatory policies, residential migration, and taxation are considered. Ecosystem service values are noticeably absent from this discussion of available resources, strengths, weaknesses, threats, and opportunities for the economy of the state of Rhode Island.

*GeoSyntec Consultants. 2004. 2004 Blackstone River Watershed Five-Year Action Plan. Massachusetts Executive Office of Environmental Affairs, Boston, MA.*

This locally developed Five Year Action Plan includes recommendations which will receive prioritization for funding from state grant programs and other funding sources. Participants include watershed stakeholders and appointed representatives from each of 38 towns. Several other plans and goals of other organizations are mentioned, including specific percent reductions in loadings to the Bay. This plan includes a summary of existing and previous plans, other information sources. Priority actions include water quality improvement and protection, Water Quantity/Streamflow Protection & Management, and Habitat Improvement & Protection.

*GeoSyntec Consultants. 2006. Five-Year Watershed Action Plan for the Taunton River Watershed. Massachusetts Executive Office of Environmental Affairs, Boston, MA.*

This five-year watershed action plan was developed cooperatively by localized watershed communities in the Taunton River Watershed. The plan prioritizes water quality improvement and protection, wildlife habitat and ecology protection, recreation and access, open space, land use and sustainable development, and public outreach and education. Identified high priority actions included identifying sites for low impact development storm water retrofits, increasing water quality monitoring, protecting and restoring established priority habitat areas, identifying and designating new unique areas for mapping and protection, development of recreational areas, and developing maps and signs for public outreach and education.

*Hasbrouck, E.C., J. Scotti, J. Stent, E. G. Hasbrouck, and K. Gerbino 2011. Rhode Island Commercial Fishing and Seafood Industries–The Development of an Industry Profile. Cornell Cooperative Extension Marine Program and Commercial Fisheries Research Foundation.*

This report presents the results of a study intended to develop a preliminary profile of the Rhode Island commercial fishing and seafood industries to include every pertinent activity and level of the current related function and participation by industry, government agencies, research institutions and fishery management from all quarters. Targeted information areas included: 1) Harvesting and processing capacity; 2) Available resources; 3) Economic significance of fishing industry; 4) Geographic distribution; 5) Demographic characteristics of fishing industry participants; and 6) Fisheries management and research investments. No environmental health information is included. Table of infrastructure includes Narragansett Bay (piers, connections to wastewater treatment systems, etc.) and table of State agencies, academic institutions, and private organizations involved in supporting the commercial fishing industry included.

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*ICF. 2014. Estimates of Ecosystem Values from Ecological Restoration Projects in Massachusetts--Summary of Report Findings. Massachusetts Department of Fish and Game Division of Ecological Restoration, Boston, MA.*

This document summarizes the measured economic benefit of four ecosystem restoration projects conducted in Massachusetts. Each project focused on a different ecosystem service: flood protection, water quality, carbon sequestration, and landscape appeal. While the synopsis focuses projects that address a single issue, rather than ecosystem-wide management, addressing the ecosystem is clearly a priority.

*Industrial Economics, Inc. (IEc) 2012. The Economic Impacts of Ecological Restoration in Massachusetts. Massachusetts Department of Fish and Game Division of Ecological Restoration, Boston, MA.*

This study sought to identify the beneficial effects of ecological restoration projects on the Massachusetts's economy. This study used the IMPLAN model to determine 'per restoration dollar' effects of four projects involving dam and culvert removal and wetland, salt marsh and tidal creek restoration.

*Industrial Economics, Inc. 2015. Economic & Community Benefit from Stream Barrier Removal Projects in Massachusetts--Report & Summary. Massachusetts Department of Fish and Game Division of Ecological Restoration, Boston, MA.*

This document evaluates six recent stream barrier removal projects in Massachusetts. The analysis compared recorded financial and ecosystem service benefits to estimated ecosystem service values in scenarios in which the projects were not implemented.

*Industrial Economics, Inc. n.d. White paper: Valuing ecosystem services provided by Massachusetts Division of Ecological Restoration projects. Massachusetts Division of Ecological Restoration, Boston, MA.*

This white paper describes methods to evaluate the ecosystem service benefits of two typical types of restoration projects, identifies level of effort for benefits evaluation and identifies the service categories. The two typical types of restoration projects focused on tidal wetland restoration projects (via culvert replacements and fill removal) and river restoration projects (via dam and barrier removals). This paper describes the InVEST tool, including the nutrient retention model.

*Kashiwagi, M. and T.Richards. 2009. Development of Target Fish Community Models for Massachusetts Mainstem Rivers—Technical Report. Massachusetts Department of Fish and Game, Boston, MA.*

This technical report describes first state-wide effort to characterize the condition of the fish communities in Massachusetts's mainstem river systems. The effort reviewed the application of the Target Fish Community (TFC) approach to 19 rivers across Massachusetts. The TFCs describe expected fish community composition, which can be compared to collected data on fish communities. Rivers with high similarity in actual compared to expected fish populations are determined to be in good condition. The TFC focuses on the species that are expected to be most common, and in the future, it may be useful for guiding restoration, protection, and management efforts, especially adaptive management strategies.

*Kocian, M., A. Fletcher, G. Schundler, D. Batker, A. Schwartz, and T. Briceno. 2015. The Trillion Dollar Asset: The Economic Value of the Long Island Sound Basin. Earth Economics, Tacoma, WA.*

This study provides useful economic information intended to enhance effective natural asset investments. It identifies natural assets within the

Long Island basin and highlights the importance of these assets to sustained economic development; assigns monetary value to the ecosystem services in the basin within an economic framework of built and natural capital; updates a valuation study that was conducted over 20 years ago; and presents recommendations of effective natural asset investments.

*Lautzenheiser, T., J. Collins, E.H. Ricci, and J. Clarke. 2014. Losing Ground: Planning for Resilience: Patterns of Development and their Impact on the Nature of Massachusetts. Massachusetts Audubon Society.*

This document describes land use trends in Massachusetts from 2005 to 2013. The document describes changes in land use, conservation efforts, development, protection, development impacts on habitat, planning for climate resiliency, planning tools and programs in Massachusetts. The document cites useful datasets. Discussed priorities include: drinking water quality, habitat, recreation, land use, climate change planning, and ecosystem service values.

*Lighthouse Consulting Group, Inc. 2015. Retrospective Governance Analysis for the Narragansett Bay Watershed and Airshed Project Eleven Governance Stories in the Narragansett Bay Watershed. U.S. Environmental Protection Agency Atlantic Ecology Division (AED).*

This analysis document provides historical context for watershed management in the Narragansett Bay area. This analysis describes eleven governance stories to illustrate actions taken to achieve change via applied management approaches. These stories focus on comprehensive conservation and management plan (CCMPs), Blackstone River management, open space and regional land capacity planning, conflict and cooperation, Section 208 comprehensive water quality management, TMDL and nutrient controls, the mercury TMDL and metals in the Narragansett Bay, a historic fish kill, and successful commissions. The efforts focus on many of the common priorities,

including water quality, quantity, habitat, recreation, infrastructure, economic development, and public health.

*Map. Mitigation planning review status in Region 1 as of June 9, 2014.*

This map provides the status of mitigation planning by county throughout Massachusetts. Counties are color coded to show statuses of: ready for APA, received, resubmitted, in review, returned for revision, adoption and final plan received, awaiting final documents, approved, adoption never submitted, expired, or not in AMPS. This map is a snap shot in time at June 9, 2014. However, this snap shot indicates which counties have active or in process plans, in addition to, which counties have opportunities to redevelop expired plans.

*Massachusetts Bays Program. 2010. State of the Bays. Massachusetts Bays Program, Boston, MA.*

The focus of the indicators described in the document include living resources, water quality, and human uses and planning and each section was developed collaboratively with multiple agencies and organizations. There are no priorities explicitly identified, just several indicators for each of the three categories discussed (not all are relevant to study geographic area).

*Massachusetts Division of Ecological Restoration. 2011. 2011-2016 Strategic Report.*

DER defines what ecological restoration means and outlines the division's guiding principles which include fostering community stewardship, assisting natural recovery of degraded systems to become self-sustaining, enhancing ecosystem services (e.g., water purification, fisheries production, and storm damage prevention), building and sustaining strong partnerships including creative partnering across sectors, committing to science and monitoring, planning strategically to

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address stressors at multiple scales in a holistic manner, and being responsive to citizen and colleague needs.

*Massachusetts Division of Ecological Restoration. 2012. Massachusetts Stream Crossings Handbook. Massachusetts Department of Fish and Game, Boston, MA.*

This handbook provides technical information, standards, and suggestions for stream crossings that do not negatively impact fish and wildlife. The handbook focuses on construction of stream crossing and culverts that allow fish passage up- and down-river. Focuses on projects that address a single issue, rather than ecosystem-wide management, but addressing the ecosystem is clearly an organizational priority.

*Massachusetts Division of Ecological Restoration. 2014. 2014 Annual Impact Report--Personal Connections. Massachusetts Department of Fish and Game Division of Ecological Restoration, Boston, MA.*

This annual report focuses on personal stories of how restoration projects in 2014 touched people's lives. It includes some economic information and planning information for 2015, as well as a useful set of project maps.

*Massachusetts Department of Fish and Game. 2015. Commonwealth of Massachusetts State Wildlife Action Plan--Draft for Public Comment: Executive Summary. Massachusetts Department of Fish and Game; Massachusetts Executive Office of Energy and Environmental Affairs, Boston, MA.*

This is the draft executive summary of the annual update of the State Wildlife Action Plan (SWAP), as required by the Massachusetts Comprehensive Wildlife Conservation Strategy. The 2015 SWAP includes five major updates: 1) Greater discussion of climate-change impacts to Species of Greatest Conservation Need (SGCN); 2) Identification of accomplishments towards reaching the goals of the 2005 SWAP; 3)

Additions and deletions to the list of SGCN, including, for the first time, state-listed and uncommon plants; 4) Increased recognition of the importance of regional conservation needs and the role for the DFW in meeting those needs; and 5) BioMap2, an update to the earlier BioMap and Living Waters projects. BioMap2 is the conservation footprint needed to conserve the biodiversity of the Commonwealth, with an emphasis on SGCN and on climate change. The document lists collaboration as one of eight required fields to be addressed.

*Massachusetts Department of Transportation. 2014. weMove Massachusetts Planning for Performance. Massachusetts Department of Transportation, Boston, MA.*

This planning document discusses transportation in Massachusetts, present and future. The document recognizes the importance of protecting the environment and the role of the Department of Transportation in preparing for the demands of climate change. Strategies focus on roadways and transit infrastructure development and public health associated with alternative transportation. The document also includes an extensive list of public comments.

*Massachusetts Department of Transportation. 2012. GreenDOT Implementation Plan. Massachusetts Department of Transportation, Boston, MA.*

GreenDOT is MassDOT's internal policy to make sustainability a part of every employee's job. Three primary objectives are reducing GHG emissions; promote healthy transportation options; and support smart growth development. Goals are related to air; energy; land; materials; planning, policy & design; waste; and water.

***Massachusetts Division of Marine Fisheries. 2014. American Shad Habitat Plan for Massachusetts Coastal Rivers. Atlantic States Fisheries Commission.***

This document is a habitat plan for three Massachusetts coastal rivers. The plan addresses the barriers to migration of American Shad. For each river, this document describes the watershed, American Shad status, fish ladder specifications, regulatory authority, water withdrawal permissions, water discharge data, water quality monitoring, and recommendations for action. Recommendations include further habitat assessments, fish census, fish passage efficiency assessments, and feasibility studies on improvements.

***Massachusetts Technology Collaborative John Adams Innovation Institute. 2010. 2010 Index of the Massachusetts innovation economy. Massachusetts Technology Collaborative John Adams Innovation Institute.***

This report describes the performance of the Massachusetts innovation economy/ecosystem and the key industry sectors therein. This report focuses on solely on economics and economic development. However, this represents an opportunity to broaden the discussion to include ecosystem service values.

***Narragansett Bay Estuary Program. 2012. Comprehensive Conservation and Management Plan Update 2012: Envisioning an Ecological Future for the Narragansett Bay Region. Narragansett Bay Estuary Program, Providence, RI.***

This CCMP is a compilation of existing state and local plans that is updated every 5 years. The original plan contained 500 recommended actions to protect and restore watershed resources while supporting key human uses. Nonpoint pollution and stormwater are still acknowledged as a challenge that continue to be addressed through low impact development. Climate change and sea level rise are adding a whole other

layer to the impacts felt in the Bay. Some high priority actions identified include financial assistance for septic upgrades; retrofitting stormwater BMPs; incentivize compact, mixed-use development; land conservation; dam removal; manage waterfowl to reduce pollution; improve early detection of invasives; developing a habitat restoration program similar to MA; develop a SAMP in response to sea level rise; and design stormwater facilities in anticipation of intensified flow regimes.

Section 1 & 2 discuss all the actions (beyond priority actions identified in the Executive Summary) to support the Protect and Restore Clean Water goal and the Manage Land for Conservation and Community goal. Some actions integrate multiple issues, e.g., retrofitting BMPs and including habitat restoration where feasible.

Section 3 & 4 discuss all the actions to support the Protect and Restore Fish, Wildlife, and Habitats goal and the Manage Climate Change Impacts to Natural Systems goal. Rhode Island benefits by strong community and NGO support and action to restore habitats; much of the actual restoration activity has focused on fish runs and coastal habitats.

***Plocinski, L., W. VanDoren, and E. Walberg. 2013. Taunton River Watershed Climate Change Adaptation Plan. Manomet Center for Conservation Sciences, Plymouth, MA.***

This adaptation plan takes a comprehensive look at climate change adaptation, with a focus on green infrastructure and its ability to mitigate flooding (in addition to the many ecosystem services natural habitats provide). Other strategies identified in response to rising sea levels and more frequent flooding include habitat restoration, water efficiency measures, flood proofing structures, riparian buffers, exploring opportunities for new crops, and transit oriented development. The impacts of a changing climate on public health and vulnerable population is also described. It is one of the few documents reviewed that identifies potential new opportunities for agriculture in the region with a changing climate.

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*Provincetown Center for Coastal Studies. 2009 State of the Bay 2009 Cape Cod Bay Ocean Sanctuary Program Cape Cod Bay Monitoring Program.*

This report presents an analysis of water quality data collected in monitoring efforts between 2006 and 2008 in the Cape Cod Bay. Findings include temporal and special trends in water quality which reveal a significant increase in offshore nitrate levels in the bay and higher levels of impairment inshore than offshore.. The baseline provided by the data in this report will inform expectations for threats to ecosystems in response to climate change and human interactions. This report also provides information about eelgrass ecosystems and the presence of invasive species.

*Regina Villa Associates, Inc. and Cambridge Systematics, Inc. 2012. Stakeholder Summary Report: Report on Questionnaire and Interview Outreach for the MA Multimodal Project. Massachusetts Department of Transportation, Boston, MA.*

Summary of interviews and questionnaire results related to strategic planning for MassDOT.

*Rhode Island Agricultural Partnership. 2011. A Vision for Rhode Island Agriculture--Five-Year Strategic Plan.*

This five-year plan outlines the key points of the Rhode Island Agricultural Partnership's plan to spur on the economic viability of the state's agricultural sector. The plan makes passing mention of the environmental issues and benefits that agriculture faces in the state, including bioremediation of brownfields, stormwater management, and general water use. Ecosystem-based management is not included in the plan, however, watershed management may be extremely important to the agricultural sector and the Rhode Island Agricultural Partnership may be a willing collaborator.

*Rhode Island Department of Environmental Management. 2014. Rhode Island Nonpoint Source Management Program Plan.*

This update to the original Nonpoint Source Pollution Management Plan (1995) addresses the protection and restoration of all waters (surface and ground) in the state current impaired or under threat of impairment from nonpoint source pollution. Two long term goals of the program include: Protect the existing quality of RI's waters and aquatic habitats and prevent further degradation due to NPS pollution; and restore the quality of waters and aquatic habitats degraded by NPS pollution to conditions that support the intended uses of these waters and habitats.

*Rhode Island Department of Environmental Management. 2002. Strategic Plan for the Restoration of Anadromous Fishes to Rhode Island Coastal Streams.*

This strategic plan provides a tool to help identify watersheds where anadromous fisheries restoration activities should be conducted in Rhode Island coastal streams. This document takes a holistic ecosystem approach, considering species needs related to water quality, quantity, temperatures, flow velocity, vegetation, and predation. The primary goals are to minimize passage induced mortality and allow expansion into underutilized habitats in the most cost-effective way. The strategic plan suggests a number of actions ranging from dam removal to restore the entire ecosystem, to fish passageways, transplanting and stocking. The strategy also includes land acquisition, regulation, increased public awareness, cooperation, and consideration of socioeconomic and historic issues.

*Rhode Island Division of Planning; Rhode Island Department of Environmental Management. 2009. Ocean State Outdoors: Rhode Island's Comprehensive Outdoor Recreation Plan.*

This comprehensive plan for recreation, conservation, and open spaces is a cornerstone of Rhode Island's statewide plan to protecting its

natural resources. The 2009 update assesses the present situation, reaffirms previously established goals, and provides action steps to be undertaken over five years (2009-2014). This includes goals and action steps to protect water resources across the state as well as an update to the Wetlands Priority Plan as required under the federal Emergency Wetlands Conservation Act. The plan lists ecosystem protection as a priority goal, as is continuation of support for watershed associations.

*Rhode Island Division of Planning. 2012. A Sustainable Rhode Island Three-Year Work Plan 2012 - 2015. Rhode Island Division of Planning.*

This three-year work plan strives to advance sustainability and equity in Rhode Island. Key activities include foci on housing and economic development, using livability principals, identifying geographic areas suitable for infill and infrastructure development, build capacity for sustainable development, utilize public participation in the planning process, establish a social equity advisory committee, develop a communication strategy, and develop meaningful performance measures. Themes include water quality, land use and infrastructure development, and economic development.

*Rhode Island Division of Planning. 2012. Rhode Island Water 2030: State Guide Plan Element 721.*

This report examines issues that directly affect the availability of, demand for, management, and protection of drinking water, as well as the operation and maintenance of water systems. As an element of the State Guide Plan, this Plan sets forth goals and policies that must, under state law, be reflected in future updates of local comprehensive plans. It discusses interagency collaboration and ecosystem-based management.

*Rhode Island Economic Policy Council. 2001. A Rhode Island Economic Strategy: 10 Ways to Succeed Without Losing our Soul. Rhode Island Economic Policy Council.*

Four main themes for the council are places, people, clusters, and connections. This is the strategy published prior to the 2008 strategy document also reviewed here. Strategies included adult literacy, walkable places, and sustainable use of Narragansett Bay. The sustainable use of the Bay is mentioned, however the focus is on marine-related industry and tourism. Additionally, there is a focus on social resilience through education and creating career pathways.

*Rhode Island Economic Policy Council. 2008. A Rhode Island Economic Strategy: Grow the Top, Build a New Middle and Move the Bottom up. Rhode Island Economic Policy Council.*

This piece focuses on economic strategy, naming four distinct imperatives for planning: innovation, environment, government reform, and "whole place." The document lays out four major actions associated with those imperatives: adapt education and workforce systems for the innovation age; build Rhode Island to make whole places and enable high wage growth; and accelerate new value creation discovery, collaboration, commercialization, and entrepreneurship. The environmental imperative particularly notes the challenge of sea-level rise to Rhode Island, and points it out as an opportunity for economic development for the state. The body of the document, however, only briefly discusses sea-level rise, instead focusing on ensuring access to fresh water. Partners and partner programs are listed at the end of the document for each strategy addressing the four imperatives.

*Rhode Island Rivers Council. 2004. Rhode Island Rivers Policy and Classification Plan.*

This plan establishes policies and suggested courses of action for the maintenance or the restoration of fresh and estuarine waters, and their

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associated watersheds, in the state. It also sets forth the procedures for the designation of local watershed councils or associations. The plan focuses on rivers policy, rivers classifications and devotes an entire section to watershed management.

*RI Statewide Planning Program. 2012. Transportation 2035: State of Rhode Island and Providence Plantations state guide plan element 611 report number 112. State Planning Council.*

The plan closely examines the condition and extent of all components of the state's transportation system and compares that information with future needs. Impacts to natural systems and financing mechanisms are also key components of the plan. The plan fulfills federal transportation planning requirements for statewide and metropolitan planning by providing a forum for public input and direction to the Transportation Improvement Program's list of funded projects. This plan's goals are structured differently compared with other plans and are generally divided by key components or issues within the system. Goals are related to bicycles, design, economic development, emergency response, and the environment.

*Rhode Island Division of Planning. 2014. Rhode Island Rising (Economic Development). State Planning Council.*

This Economic Development Plan was prepared as part of RhodeMap RI, a coordinated, long-range planning effort led by the RI Division of Planning. The goal of this planning grant program is to help communities and regions foster a more sustainable economy by coordinating planning and investment in housing, job creation, workforce training, and transportation. The vision refers to a sustainable economy that "preserves, sustains, and restores the natural environment," and contains goals connected to environmental quality such as "Create a stronger, more resilient Rhode Island" which includes policies related to wastewater, fiscal resilience in response to climate change, rebuilding infrastructure in more resilient ways, innovation associated with

resilience, etc. In addition to serving as a State Guide Plan Element, it serves to meet a 2013 legislative requirement calling for the adoption of a state-level economic development plan every four years.

*RTI International. 2014. Strengthening the Resilience of the Taunton River Watershed: A Tool to Prioritize Local Action. U.S. Environmental Protection Agency.*

This report describes a decision support tool used to prioritize local action/conservation projects to strengthen resilience of ecosystem services in the Taunton River watershed. The tool links specific landscape features to ecosystem services which include: protection from extreme events/floods, water quality protection, water quantity protection, and open space preservation. Landscapes are divided into six focus area categories: riparian freshwater wetland, upland freshwater wetlands, saltwater wetlands, riparian forests, upland forests, and stream segments.

*RTI International. 2014. Strengthening the Resilience of the Taunton River Watershed: A Tool to Prioritize Local Action: Table C-1. Inventory of datasets, assessments, and a few town ordinances relevant to informing the protection of resiliency in the Taunton River Watershed. U.S. Environmental Protection Agency.*

This table presents an inventory of datasets, assessments and town ordinances in the Taunton River Watershed. The resources listed in this document may inform planning for resilience in this watershed.



*Southeastern Regional Planning and Economic Development District (SRPEDD). 2012. Taunton River Watershed Pilot Project, 2010-2011: Integrating biodiversity and infrastructure considerations to prioritize transportation projects. Southeastern Regional Planning and Economic Development District.*

This pilot project report describes a partnership between SPREDD and The Nature Company to assess the impact of road infrastructure on aquatic life and public safety in environmentally sensitive ecosystems. This effort analyzed data and maps to make recommendations for ten current and proposed projects described within the Taunton River Watershed. These projects include the following strategic actions: culvert replacements, dam removal, dam restoration, stormwater remediation, and stormwater management assessment.

*Southeastern Regional Planning and Economic Development District. 2014. Town of Dighton Zoning Bylaw and Master Plan Implementation Study.*

This letter and attached summary of five major findings of a zoning bylaw study for the Town of Dighton, RI, identifying major plan incompatibilities, largely around smart and compact growth, compared to sprawl. The document is, in and of itself, a collaboration. Conservation and ecosystem-related goals are supported, though as a part of a larger process. Watershed management is not explicitly mentioned. This document focuses on a local management plan. It could be considered more regional if viewed as the regional planning office turning down a local plan that does not integrate state-established best management practices.

*Staudinger, M.D., T.L. Morelli, and A.M. Bryan. 2015. Integrating Climate Change into Northeast and Midwest State Wildlife Action Plans. DOI Northeast Climate Science Center, USGS, UMass Amherst.*

This synthesis report on climate change in the northeast and midwest provides guidance for the revised state wildlife action plans. This report has a particular focus on the responses and vulnerabilities of Regional Species of Greatest Conservation Need (RSGCN) and the habitats they depend on. Using case studies, this report describes a range of climate change adaptation approaches, processes, tools, and potential partnerships that are available to State natural resource managers across the Northeast and Midwest regions of the United States.

*The Nature Conservancy, State of Rhode Island Department of Environmental Management, University of Rhode Island. 2014. Rhode Island Wildlife Action Plan: Chapter 4: Actions to Conserve Rhode Island's SGCN and Key Habitats. State of Rhode Island Department of Environmental Management.*

This chapter of the Rhode Island wildlife action plan describes the conservation planning efforts in Rhode Island. Other sections of the larger document cover the species in need of conservation, how key species and habitats are identified and how threats are identified. This chapter focuses on priority conservation actions that address threats to species and their habitats. Actions are statewide and taxa focused. Research and monitoring needs are also discussed. Performance measures are listed.

*Thompson, J., K.F. Lambert, D. Foster, M. Blumstein, E. Broadbent, and A.A. Zambrano. 2014. Changes to the Land: Four scenarios for the future of the Massachusetts landscape. Harvard University.*

This document summarizes the Harvard Forest project to evaluate potential futures for MA landscapes, especially forests. The four scenarios presented include: recent trends, opportunistic growth (with



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minimal government oversight), self-reliance (harvesting for independence), forest as infrastructure (management and protection). This summary describes key findings and policy implications.

*Thompson, J., K.F. Lambert, D. Foster, M. Blumstein, E. Broadbent, and A.A. Zambrano. 2014. Executive Summary - Changes to the land: Four scenarios for the future of the Massachusetts landscape. Harvard University.*

This executive summary describes the main points of the *Changes to the land: Four scenarios for the future of the Massachusetts landscape*. In addition, this document includes a policy addendum not included in full document.

*U.S. Army Corps of Engineers. 2015. North Atlantic Coast Comprehensive Study: Resilient Adaptation to Increasing Risk (Final Report & Appendix D - state and District of Columbia analyses). U.S. Army Corps of Engineers.*

This study describes a step by step process / framework to pursue solutions to minimize coastal storm threats for vulnerable coastal populations in the region. This report discusses findings, outcomes, and opportunities, institutional and other barriers, integrated coastal investments, activities warranting additional analysis, and provides comparison with plans developed by other organizations. The study uses a systems approach to managing coastal risk

## Appendix C – Interviewee list

Interviewee	Organization
Tom Borden	Narragansett Bay N EP
Caitlin Chaffee	RI CRMC
Joe Costa	Buzzards Bay NEP
Hunt Durey	MA Div. of Ecological Restoration
Jon Kachmar & Cathy Bozek	The Nature Conservancy
Sue Kiernan	RIDEM
Paul Niedzwiecki, Erin Perry, & Kristy Senatori	Cape Cod Commission
Rebecca Weidman	MassDEP

### Selected short answers to interview questions:

Interviewees	<i>At my organization/agency, our planning goals focus on:</i>		<i>Our strategies/implemented approaches tend to focus on:</i>		<i>Any issue areas your organization struggles to address or would like to address?</i>	
	Environmental mgt/resilience	Economic/Social resilience	Environmental mgt/resilience	Economic/Social resilience	Environmental mgt/resilience	Economic/Social resilience
Tom Borden (NB NEP)	✓		✓			✓
Joe Costa (BB NEP)	✓		✓			
Cape Cod Commission	✓	✓	✓	✓	✓	✓

# Appendix C

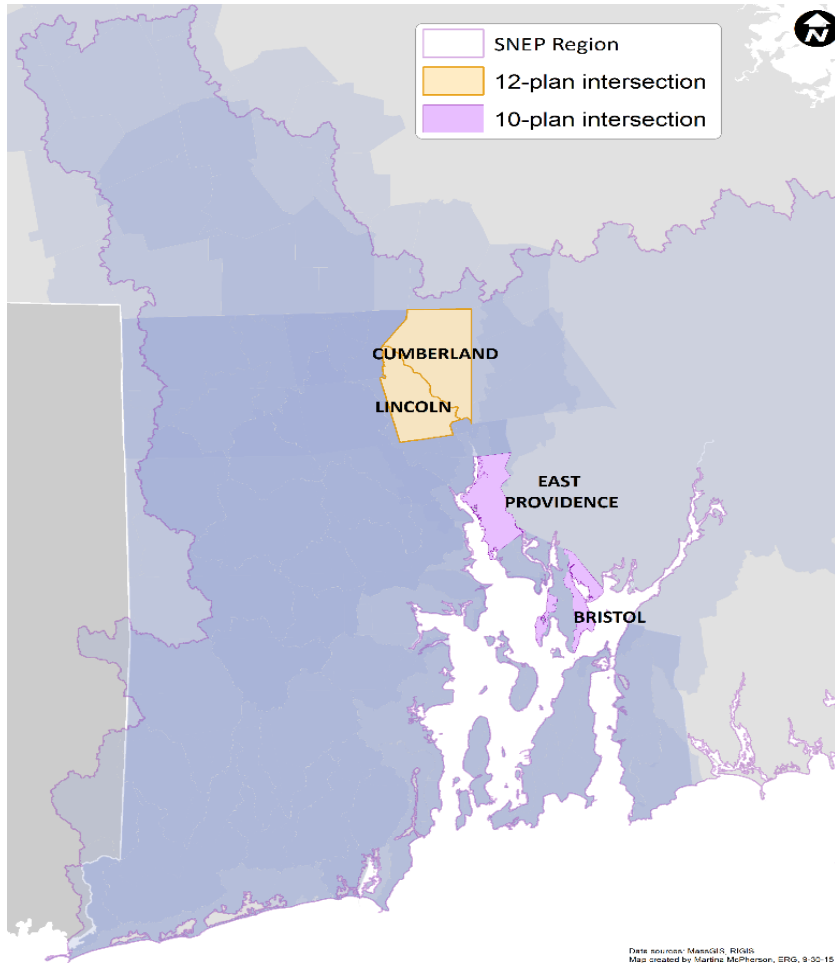
## Selected short answers to interview questions:

Interviewees	At my organization/agency, our planning goals focus on:		Our strategies/implemented approaches tend to focus on:		Any issue areas your organization struggles to address or would like to address?	
	Environmental mgt/resilience	Economic/Social resilience	Environmental mgt/resilience	Economic/Social resilience	Environmental mgt/resilience	Economic/Social resilience
Cathy Bozek & Jon Kachmar (TNC)	✓	✓	✓	✓		✓
Caitlin Chaffee (RI CRMC)	✓		✓			✓
Sue Kiernan (RI DEM)	✓		✓	✓		
Hunt Durey (MA DER)	✓		✓		✓	✓
Becky Weidman (MA DEP)	✓		✓		✓	
Dave Janik (MA CZM)	✓		✓	✓	✓	✓

At my organization/agency, our planning goals focus on:	Water quality	Water quantity	Habitat/wildlife	Land use	Recreation	Climate change	Other
Tom Borden (NB NEP)	✓		✓	✓		✓	
Joe Costa (BB NEP)	✓		✓	✓		✓	Ecological health
Cape Cod Commission	✓	✓	✓	✓	✓	✓	
Cathy Bozek & Jon Kachmar (TNC)	✓	✓	✓	✓	✓	✓	Forest health
Caitlin Chaffee (RI CRMC)			✓	✓	✓	✓	Aquaculture, marine resources, coastal hazards

<i>At my organization/agency, our planning goals focus on:</i>	Water quality	Water quantity	Habitat/wildlife	Land use	Recreation	Climate change	Other
Sue Kiernan (RI DEM)	✓	✓	✓		✓	✓	
Hunt Durey (MA DER)	✓	✓	✓			✓	Ecological processes
Becky Weidman (MA DEP)	✓	✓	✓			✓	
Dave Janik (MA CZM)	✓		✓			✓	

<i>My organization struggles to address or would like to address:</i>	Water quality	Water quantity	Habitat/wildlife	Land use	Recreation	Climate change	Other
Tom Borden (NB NEP)				✓			
Joe Costa (BB NEP)	✓		✓	✓			Always room to improve across all areas
Cape Cod Commission						✓	
Cathy Bozek & Jon Kachmar (TNC)	✓						Economics of natural infrastructure
Caitlin Chaffee (RI CRMC)			✓			✓	
Sue Kiernan (RI DEM)	✓		✓				
Hunt Durey (MA DER)			✓	✓			Ecological health/systems approach
Becky Weidman (MA DEP)							
Dave Janik (MA CZM)	✓		✓				



## Map of Rhode Island, 12 plan overlap:

- A Sustainable Rhode Island Three-Year Work Plan 2012 – 2015
- Ashton-Pratt Redevelopment Plan (2004)
- Blackstone - Clean by 2015 (2008)
- Blackstone River 5-Year Plan (2004)
- Blackstone River Visioning (2004)
- NB NEP CCMP (2012)
- Rhode Island Nonpoint Source Management Program Plan (2014)
- Rhode Island Rising (Economic Development for State Guide Plan)
- Rhode Island Water Resources Board 2012 Strategic Plan
- RI State Guide Plans: Water 721 (2012)
- RI State Guide Transportation Element (2008)

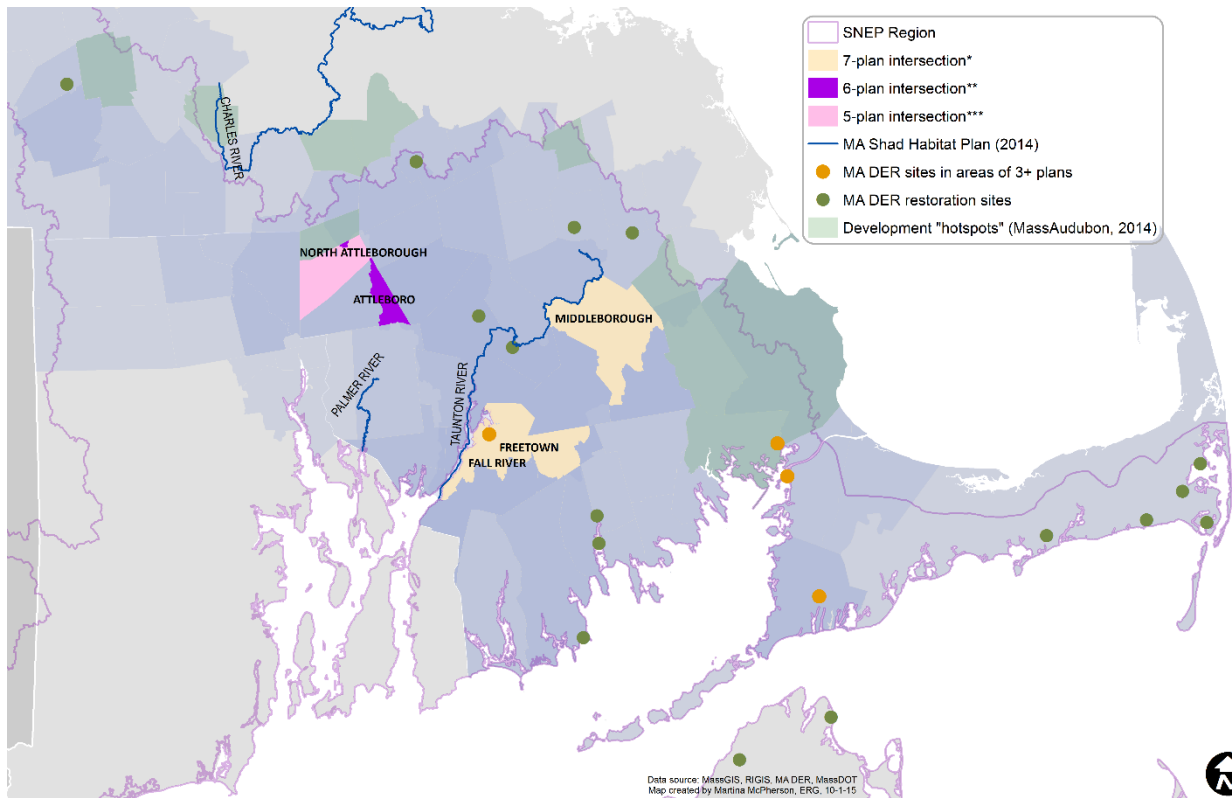
## 10 plan overlap (E. Providence):

- Blackstone - Clean by 2015 (2008)
- Blackstone River 5-Year Plan (2004)
- BPW Watershed Plan
- NB NEP CCMP (2012)
- RI State Guide Plans: Water 721 (2012)
- Rhode Island Nonpoint Source Management Program Plan (2014)
- Rhode Island Rising (Economic Development for State Guide Plan)
- Rhode Island Water Resources Board 2012 Strategic Plan
- RI State Guide Transportation Element (2008)
- A Sustainable Rhode Island Three-Year Work Plan 2012 – 2015

## 10 plan overlap (Bristol):

- RI State Guide Plans: Water 721 (2012)
- RI State Guide Plan: Rhode Island Rivers Policy and Classification Plan (Element 162)
- NB NEP CCMP (2012)
- BPW Watershed Plan
- BKR Watershed Plan
- Rhode Island Nonpoint Source Management Program Plan (2014)
- Rhode Island Rising (Economic Development for State Guide Plan)
- Rhode Island Water Resources Board 2012 Strategic Plan
- RI State Guide Transportation Element (2008)

# Appendix D



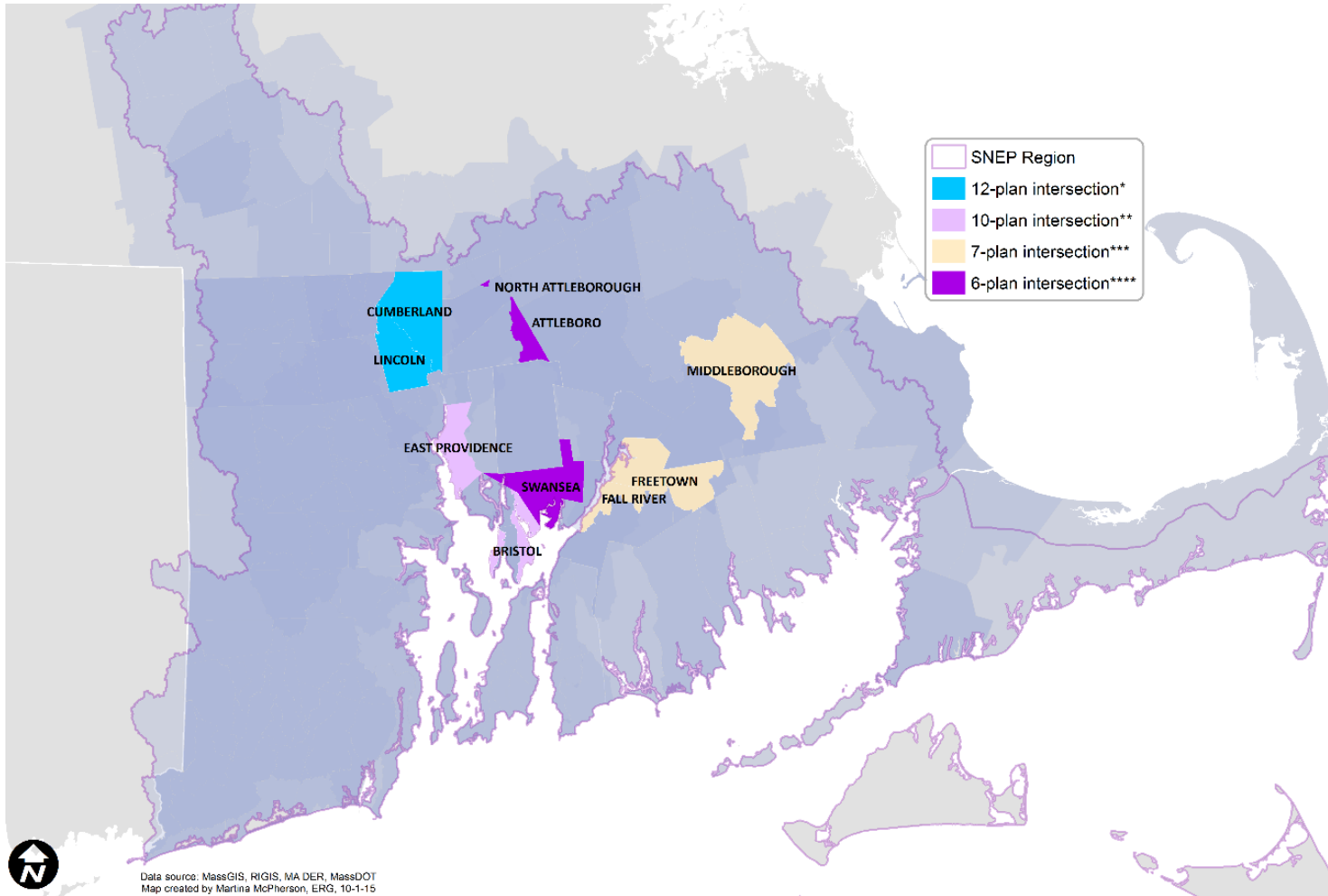
## Map of Massachusetts, plan overlaps:

\*Taunton River 5-Year Watershed Action Plan (2006), Taunton River Watershed Climate Change Adaptation Plan (2013), SRPEDD Taunton River Watershed Pilots (2012), GreenDOT Implementation Plan (2012), MA Shad Habitat Plan (2014), Buzzards Bay CCMP (2013), Buzzards Bay Coalition Strategy (2015)

\*\*Blackstone River 5-Year Plan (2004), Clean by 2015 (2008), SRPEDD Taunton River Watershed Pilots (2012), GreenDOT Implementation Plan (2012), Taunton River 5-Year Watershed Action Plan (2006), Taunton River Watershed Climate Change Adaptation Plan (2013),

\*\*\* Blackstone River 5-Year Plan (2004), Clean by 2015 (2008), GreenDOT Implementation Plan (2012), SRPEDD Taunton River Watershed Pilots (2012), Taunton River 5-Year Watershed Action Plan (2006)

# Appendix D



**Joint Map (MA & RI), plan overlap in Swansea (not mentioned above):**

- NB NEP CCMP (2012)
- BPW Watershed Plan
- BKR Watershed Plan
- Taunton River 5-Year Watershed Action Plan (2006)
- SRPEDD Taunton River Watershed Pilots (2012)
- GreenDOT Implementation Plan (2012)