Commonwealth of Massachusetts
Executive Office of Energy and Environmental Affairs
Office of Coastal Zone Management (CZM)

Section 309 Assessment and Five-Year Strategy for CZM Program Enhancement (FY2016-2020)

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Section 309 Assessment and Five-Year Strategy for CZM Program Enhancement (2016-2020)

I. Introduction

Section 309 of the federal Coastal Zone Management Act establishes a voluntary enhancement grants program that, among other things, encourages states with federally approved Coastal Management Programs (CMPs) to develop and implement program changes in one or more of the following nine coastal zone enhancement areas: Wetlands, Coastal Hazards, Public Access, Marine Debris, Cumulative and Secondary Impacts, Special Area Management Plans, Ocean & Great Lakes Resources, and Aquaculture. The Office for Coastal Management within the National Oceanic and Atmospheric Administration (NOAA) works closely with state coastal programs in prioritizing and evaluating state program needs. The Massachusetts Office of Coastal Zone Management (CZM) developed this document, titled *Section 309 Assessment and Five-Year Strategy for CZM Program Enhancement (FY2016-2020)*, pursuant to formal guidance issued by NOAA in June 2014. The purpose of the document is to evaluate and identify CZM's program needs and outline a five-year strategy for achieving program changes and associated implementation objectives. In this case, the proposed strategy covers the federal fiscal years from 2015 to 2020 and serves as an update to the previous Section 309 Assessment and Strategy published in 2011.

After a summary of completed 309 efforts from FY2010-2015, the next section of this document contains the required characterization of issues for the respective enhancement areas ("Assessment"). New for this assessment and strategy cycle, the assessments have been separated into two phases to allow CZM to target its assessments to high priority issue areas for the CMP: Phase 1 (high-level) and Phase II (in-depth). Following the Phase 1 assessment, where the issue area has been identified as a high priority for enhancement, the next sections contain an in-depth Assessment (Phase II) and Strategy where one or more projects (and respective summary work plans) are developed to address the programmatic gaps and needs documented in the Assessment. The prioritization of the enhancement areas is based on three main criteria: (1) the severity of problem, (2) the potential for program changes or further implementation activities to effectively address outstanding issues, and (3) the availability other sources of funds to address issues (i.e., if an issue area has another dedicated source of funds, it may not be rated as a priority for use of limited 309 funds).

For this Section 309 Assessment and Strategy, the following areas are identified as "High" priorities for 309 funding: Coastal Hazards, Ocean Resources / Energy and Government Facility Siting, Wetlands, Special Area Management. It should be noted that assignment of a low or medium priority rating should not be construed as an indication of the importance of an issue area for the Commonwealth; rather, it is only an indication of the relative priority of that enhancement area within the context of the Section 309 assessment. Further, it is important to understand that inclusion of a project within an approved Section 309 Assessment and Strategy does not assure funding for those proposed efforts. However, in order to expend 309 funds that may be available to state Coastal Management Programs based on annual federal appropriations and allocation formulas, projects proposed in grant applications to NOAA/OCRM must be contained in an approved Section 309 Assessment and Strategy.

In the Strategy, enhancement projects are proposed for the issue areas ranked High. The following table summarizes the projects and resource needs by enhancement area.

Enhancement Area	Proposed Project	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Wetlands	Climate change adaptation Best Management Practices for salt marshes	$67,000	$67,000	$82,000	$67,000	$67,000	$350,000
Coastal Hazards	Demonstrating effectiveness of green infrastructure to provide coastal storm damage protection	$50,000	$50,000	$80,000	$40,000	--	$220,000
Special Area Management Planning	DPA Boundary Reviews	$50,000	$75,000	$75,000	$25,000	--	$225,000
Ocean Resources	Advancing Ocean Planning	$225,000	$150,000	$150,000	$225,000	$225,000	$975,000
Total funding		**$392,000**	**$342,000**	**$387,000**	**$357,000**	**$292,000**	**$1,770,000**
Note: For the purposes of this 309 Strategy budget summary, project years all begin in Year 1. The actual starting year will be dependent on 309 funding available (including Projects of Special Merit).							

Summary of Stakeholder Input and Public Review

Preparation of this document began in July 2014 and has involved the efforts of CZM management and a team of staff professionals with expertise and experience in the respective topics. Furthermore, in order to accurately prioritize issue areas, CZM sought the input of a diverse mix of state, federal, and local officials, non-profit advocacy groups, and coastal science professionals as stakeholders in this Section 309 assessment and strategy process. In December 2014, CZM convened the advisory group of stakeholders to engage on the 309 process, review the draft assessments, and seek their input on prioritization, needs and gaps on coastal issues, and potential strategies. Included in this group were representatives from a mix of organizations, interests, and functions including the City of Boston, the Cape Cod Commission, MassAudubon, and the MA Department of Conservation and Recreation. Further input and comments were sought directly from stakeholders in separate processes (Coastal Erosion Commission, Ocean Advisory Commission, and Ocean Science Advisory Council) which also inform this process.

Public review and comment on a draft *Section 309 Assessment and Five-Year Strategy for CZM Program Enhancement (FY2016-2020)* was encouraged in order to help prepare the final document. The public comment period opened on April 8, 2015 and closed on May 7th, 2015. Public notices of the availability of the draft document for review and comment were posted in

the state's Environmental Monitor and in the Boston Globe. No comments on the draft assessment and strategy were submitted.

II. Summary of Completed Section 309 Efforts (2011 – 2015)

In the period covered by the previous Section 309 Assessment and Strategy (FY2011-2015), Section 309 grant funds were expended on five enhancement areas, ranked as either "high" or "medium" priorities in the Section 309 Assessment and Strategy: Ocean Resources / Energy Facility Siting, Coastal Hazards, and Wetlands. The table below summaries the major accomplishments within the 309-designated enhancement areas. In addition, NOAA approved two separate routine program change submittals in 2011. Through these changes, the *Massachusetts Office of Coastal Zone Management Policy Guide - October 2011* (Policy Guide) was formally adopted as the official statement of the Massachusetts coastal program policies and legal authorities, and the Massachusetts Ocean Management Plan was formally incorporated into the CZM program. The Policy Guide also includes specific guidance on the federal consistency review process, as well as updates to the program policies, the coastal zone boundary, and the underlying legal authorities. Finally, during the latter part of the FY2010-2015 period, 309 funds supported work on this new FY2016-2020 Section 309 Assessment and Strategy.

Enhancement Area(s)	Fiscal Year	Major 309 Accomplishments
Ocean Resources and Energy Facility Siting	FY11-FY14	**2015 Ocean Plan** - Since January 2013, on behalf of the Executive Office of Energy and Environmental Affairs (EEA), CZM has been working on a comprehensive update to the 2009 Massachusetts Ocean Plan. On January 6, 2015, EEA released the 2015 Ocean Plan, following the development and release of a 2014 DRAFT Ocean Plan for public review, hearings, and a 60-day public comment period. The 2015 Ocean Plan is the first formal amendment of the Commonwealth's ocean plan, developed in response to the Oceans Act of 2008. As with the first ocean plan, CZM led the review and update effort initiated in January 2013, working closely with the Ocean Advisory Commission and Ocean Science Advisory Council. In October 2014, five regional public hearings were held to receive public comment and input. The 2015 Ocean Plan includes updates to significant amounts of data, information, & maps. Drawing on the work of technical work groups, significant efforts were made on science priorities and other key data needs. **Ocean Plan Implementing Regulations** - 301 CMR 28.00 Ocean Management Plan (effective 8/2/13) - The regulation was promulgated to: implement, administer, and enforce M.G.L. c. 21A, § 4C and the Ocean Management Plan; form part of and serve as enforceable components of the Coastal Zone Management Plan; codify the jurisdiction, management areas, and standards developed by the Ocean Management Plan; and establish procedures for assessing the Ocean Development Mitigation Fee. The regulation also developed provisions for the review of the Ocean Management Plan and its baseline assessment and enforceable measures, defined the process for making updates or amendments to the Plan, and ensured regulatory consistency for pertinent agency decisions regarding ocean development.

Enhancement Area(s)	Fiscal Year	Major 309 Accomplishments
		Regional Ocean Partnerships and Planning - CZM was fully engaged in ongoing participation and work with regional ocean partnerships such as Northeast Regional Ocean Council, Gulf of Maine Council, Northeast Regional Association of Coastal and Ocean Observing Systems, Northeast Ocean Data Partnership, etc. In partnership with NROC and other New England coastal states, CZM completed a FY12 PSM project to improve regional marine habitat characterization and classification.
Coastal Hazards	FY11-FY14	**Shoreline Change Project** - In 2011, CZM kicked off work to delineate a new, contemporary oceanfront shoreline. Under contract to CZM, the USGS Woods Hole Coastal and Marine Science Center began to interpret and digitize the mean-high-water shoreline based on aerial orthophotographs and analyzed shoreline change rates. This effort served to update the Shoreline Change Project, which was launched by CZM in 1989 to identify erosion-prone areas of the coast by producing maps depicting the statistical analysis of historic locations of ocean-facing shorelines from the mid-1800s to 1978 using multiple data sources. **Coastal Hazards Clearinghouse** - The goal of this project was to produce a series of fact sheets on options for reducing erosion and storm damage on coastal properties. The fact sheets on Dune Nourishment Controlling Overland Runoff to Reduce Coastal Erosion; Planting Vegetation to Reduce Erosion and Storm Damage; Bioengineering; and Sand Fencing provided information on coastal protection approaches and best practices, including both "traditional" as well as "new and innovative" protection alternatives, oriented to certain locations, settings, and conditions.

Enhancement Area(s)	Fiscal Year	Major 309 Accomplishments
Wetlands & Coastal Hazards	FY12-FY14	**Estuarine Wetlands and Sea Level Rise: Identifying At-Risk Resources and Supporting Climate Change Adaptation Responses** (FY13 PSM grant) - Project is underway. The data and information generated will result in more accurate and informed forecasting of coastal wetland changes—including areas of forecasted loss, areas where marsh migration (transgression) may be supported, and areas that are predicted to undergo changes in wetland types—which will be communicated to managers, decision-makers, and others. **Massachusetts and Cape Cod Bays Tide Gate Inventory and Assessment for Wetlands Restoration and Hazard Mitigation Project** - This project is underway to conduct an inventory of tide gates within the 47 coastal embayments of Massachusetts and Cape Cod Bays. Poorly managed, mismanaged, and abandoned tide gates adversely affect coastal ecosystems' ability to buffer coastal infrastructure and development from sea level rise and storm surge impacts. The project brings CZM, the Massachusetts Bays National Estuary Program, and other state agency partners together with local infrastructure managers and other stakeholders to gain on-the-ground knowledge of these legacy structures to initiate, inform, and prioritize management for ecological benefit and hazard mitigation in the face of sea level rise projections, ongoing floodplain encroachment, and aging infrastructure. With associated education and outreach efforts, we anticipate a measurable increase in active and appropriate local management of tide gates compared to current management practices.
Special Area Management	FY12-FY14	**DPA Inventory** - This project inventoried infrastructure, uses, and other port resources of the Gloucester, New Bedford/Fairhaven, and East Boston DPAs. These DPAs were selected as the pilot areas to test the inventory project. CZM assessed various methodologies to determine the most suitable for use in Massachusetts. Direct, personal interviews with DPA property/business owners, questionnaires, and an intensive review of local and state records and permits were reviewed to create a database for each DPA. **Designated Port Area and Harbor Planning Rule Revisions** - The rule revision process included several working group meetings, convened by CZM. The purpose of the meetings was to revisit recommendations included in the 2009 DPA Technical Advisory Committee report and to consider whether additional regulatory modifications were needed. The final recommendations of the working group focused primarily on flexibility regarding supporting use (in DPAs generally and specifically over flowed tidelands), accessory uses, recreational boating, expanding the list of allowable water-dependent industrial uses, and DPA boundary reviews. These recommendations were incorporated into draft versions of the DPA, MHP, and Chapter 91 regulations.

III. Assessment (Phase I)

A. Wetlands

Section 309 Enhancement Objective: *Protection, restoration, or enhancement of the existing coastal wetlands base, or creation of new coastal wetlands. §309(a)(1). Note: For the purposes of the Wetlands Assessment, wetlands are "those areas that are inundated or saturated at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions." [33 CFR 328.3(b)]. See also pg. 17 of the CZMA Performance Measurement Guidance[1] for a more in-depth discussion of what should be considered a wetland.*

Phase I (High-Level) Assessment:
Purpose: To quickly determine whether the enhancement area is a high priority enhancement objective for the CMP that warrants a more in-depth assessment.

Resource Characterization:

1. Extent, Status, and Trends of Wetlands in Massachusetts

Coastal Wetlands Status and Trends[2,3]		
Current state of wetlands in 2010 (acres)	384,962 acres	
Percent net change in total wetlands (% gained or lost)	from 1996-2010	from 2006-2010
	-1.46%	-0.20%
Percent net change in freshwater (palustrine wetlands) (% gained or lost)	from 1996-2010	from 2006-2010
	-1.46%	-0.17%
Percent net change in saltwater (estuarine) wetlands (% gained or lost)	from 1996-2010	from 2006-2010
	-0.01%	-0.02%

[1] http://coastalmanagement.noaa.gov/backmatter/media/czmapmsguide11.pdf
[2] Data were derived by GIS-processing of C-CAP Regional Change data covering the nine Massachusetts coastal counties, from 1996-2010 and 2006-2010. Data were acquired from the C-CAP FTP download page. http://coast.noaa.gov/ccapftp/

[3] Excludes the C-CAP class Unconsolidated Shore, which is categorized under Barren Land in the C-CAP Land Cover Classification Scheme. Includes all palustrine and estuarine wetland classes. http://coast.noaa.gov/digitalcoast/_/pdf/ccap_class_scheme.pdf?redirect=301ocm

How Wetlands Are Changing [4,5]		
Land Cover Type	**Area of Wetlands Transformed to Another Type of Land Cover between 1996-2010 (Sq. Miles)**	**Area of Wetlands Transformed to Another Type of Land Cover between 2006-2010 (Sq. Miles)**
Development	9.39	1.39
Agriculture	0.26	0.04
Barren Land	0.41	0.34
Water	0.24	0.19

Coastal Wetlands Status and Trends by Coastal County[4]						
County	from 1996-2010			from 2006-2010		
	Total % Net Change	Palustrine % Net Change	Estuarine % Net Change	Total % Net Change	Palustrine % Net Change	Estuarine % Net Change
Barnstable	1.77	-0.56	-0.15	-0.29	-0.10	-0.02
Bristol	-1.42	-1.48	-0.26	-1.37	-1.41	0.00
Dukes	-0.11	0.42	0.77	-1.27	0.18	0.01
Essex	0.58	-2.06	0.39	-1.15	-1.83	0.19
Middlesex	-2.67	-2.64	-11.70	-2.22	-2.36	0.00
Nantucket	2.98	-0.31	1.71	0.03	0.17	0.00
Norfolk	-2.13	-2.04	-5.15	-1.63	-1.72	0.08
Plymouth	-0.88	-1.00	-0.28	-0.75	-0.90	0.06
Suffolk	-0.17	-0.71	0.00	-0.17	-0.71	0.00

Wetlands Loss by Land Cover Class and Coastal County[6]								
County	1996-2010				2006-2010			
	Develop-ment (sq mi)	Agriculture (sq mi)	Barren Land (sq mi)	Water (sq mi)	Develop-ment (sq mi)	Agriculture (sq mi)	Barren Land (sq mi)	Water (sq mi)
Barnstable	0.21	0.00	0.52	0.82	0.13	0.00	0.38	0.83
Bristol	1.97	0.02	0.04	0.01	0.19	0.00	0.01	0.01
Dukes	0.16	0.00	0.00	0.00	0.00	0.00	0.02	0.02
Essex	1.42	0.12	0.08	0.04	0.20	0.02	0.05	0.02
Middlesex	3.14	0.04	0.02	0.04	0.36	0.01	0.02	0.02
Nantucket	0.01	0.00	0.09	0.13	0.00	0.00	0.09	0.11

[4] Data were derived from the web-interactive C-CAP Land Cover Atlas. The C-CAP class Unconsolidated Shore is categorized as Wetland in the C-CAP Land Cover Atlas summary reports.

Norfolk	1.32	0.01	0.05	0.01	0.22	0.00	0.05	0.01
Plymouth	1.30	0.07	0.05	0.03	0.24	0.01	0.02	0.02
Suffolk	0.03	0.00	0.00	0.00	0.03	0.00	0.00	0.00

2. Additional state- or territory-specific data or reports on the status and trends of coastal wetlands

No new state data or reports on the status and trends of coastal wetlands were developed since the last assessment, as of this writing. Multiple state datasets were referenced in the last assessment; excluded was the Massachusetts Department of Environmental Protection (DEP) Wetland Change dataset (the DEP Wetland dataset was referenced). This dataset shows salt marsh loss of 5 acres and brackish marsh (for this exercise defined as DEP class "shallow marsh, meadow, or fen" mapped within 200 meters of salt marsh) loss of 5 acres from 1990 to 2008. For information on the methods used to develop the DEP Wetland Change dataset, visit its MassGIS layer webpage--http://www.mass.gov/anf/research-and-tech/it-serv-and-support/application-serv/office-of-geographic-information-massgis/datalayers/wetchange.html. A new DEP Wetland dataset has been developed from 2005 multispectral imagery, but it remains in draft form. Publication is expected in 2015.

Management Characterization:

1. Indicate if there have been any significant changes at the state or territory level (positive or negative) that could impact the future protection, restoration, enhancement, or creation of coastal wetlands since the last assessment.

Management Category	Significant Changes Since Last Assessment (Y or N)
Statutes, regulations, policies, or case law interpreting these	Yes, new regulations were developed by the Massachusetts Department of Environmental Protection in early 2014 and are expected to be released and implemented by the end of the calendar year.
Wetlands programs (e.g., regulatory, mitigation, restoration, acquisition)	Yes, there were significant changes to wetlands programs resulting from the regulation changes.

2. *For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*

a. Describe the significance of the changes;

The changes to the wetlands regulations are significant because they establish a general permit mechanism for streamlining the permitting process for qualified restoration projects. The new general permit contains standard conditions. These make the permitting process more

predictable and consistent for qualified restoration projects, particularly since wetlands permits are issued at the local level first. Six categories of restoration projects qualify for the new general permit, including dam removal, culvert replacement to eliminate or reduce tidal restrictions, stream daylighting, freshwater culvert repair or replacement, restoration of rare species habitats, and improvement of fish passage. The regulations provide for a more predictable and consistent permitting process, thereby reducing costs and time. A more streamlined permitting process is especially important since many restoration projects are completed with public funding that may be time limited in its use for project completion--longer permitting times often lead to increasing costs. Specifically, the changes exempt defined restoration projects from the need to demonstrate compliance with provisions of the 401 water quality certification and the need to obtain a license or permit under the state waterway licensing program (Chapter 91). Restoration projects must still identify any major impacts prior to permit submittal. The regulations also allow for dredging, disposal, reuse, and placement of fill in Areas of Critical Environmental Concern (ACECs) in connection with ecological restoration projects, which are otherwise not allowed.

b. Specify if they were 309 or other CZM-driven changes; and

The changes were not driven by 309, but they did have the support and participation from CZM staff during regulation development and the public review and comment period. Most of the restoration project efforts from the past fifteen years have focused on the removal of tidal restrictions and improving tidal flow in order to enhance coastal wetland restoration and on improved fish passage.

c. Characterize the outcomes or likely future outcomes of the changes.

Outcomes of the changes include reduced permitting costs and the length of time to obtain necessary permits, which encourage ecological restoration projects and provide for a more efficient use of public restoration project funding. Future outcomes are likely to include an enhanced ability to plan for and implement coastal wetland protection and restoration efforts in response to increasing sea level and storm surge. CZM is currently undertaking a modeling and mapping effort aimed at understanding the potential effects of sea level rise on coastal wetlands, results from which will be used to guide future wetland protection and restoration efforts.

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

High

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

The Wetlands enhancement area is a high priority for CZM due to the significant ecological services at risk from climate change and development impacts within coastal watersheds. In collaboration with the wetlands regulatory, restoration, and mitigation communities, researchers, land trusts, and other stakeholders, CZM is leading an effort to (1) model the potential effects of sea level rise on coastal wetlands, and (2) explore opportunities for climate change adaptation via regulatory or policy change (e.g., increased wetland buffer zones), land conservation (e.g., acquisition of land or easements where marshes have the potential to migrate), shoreline management (e.g., alternatives to seawall repair), prioritization of ecological restoration and mitigation efforts, and education. With continued support these efforts will allow CZM and partners to implement adaptation and mitigation strategies at the local, regional, and state levels to better manage these economically, socially, and ecologically important resources for the future.

CZM organized a meeting with stakeholders from state and local agencies and officials as well as non-profit advocacy groups on December 17, 2014 to review draft enhancement area priorities and plans. Issues surrounding wetlands were discussed, including marsh migration, land conservation and restoration atlas for potential restoration sites.

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B. Coastal Hazards

Section 309 Enhancement Objective: *Prevent or significantly reduce threats to life and property by eliminating development and redevelopment in high-hazard areas, managing development in other hazard areas, and anticipating and managing the effects of potential sea level rise and Great Lakes level change. §309(a)(2)*

Note: For purposes of the Hazards Assessment, coastal hazards include the following traditional hazards and those identified in the CZMA: flooding; coastal storms (including associated storm surge); geological hazards (e.g., tsunamis, earthquakes); shoreline erosion (including bluff and dune erosion); sea level rise; Great Lake level change; land subsidence; and saltwater intrusion.

Phase I (High-Level) Assessment:
Purpose: To quickly determine whether the enhancement area is a high priority enhancement objective for the CMP that warrants a more in-depth assessment.

Resource Characterization
Flooding: *Using data from NOAA's State of the Coast "Population in the Floodplain" viewer[5] and summarized by coastal county through NOAA's Coastal County Snapshots for Flood Exposure,[6] indicate how many people were located within the state's coastal floodplain as of 2010 and how that has changed since 2000. You may to use other information or graphs or other visuals to help illustrate.*

Population in the Coastal Floodplain			
	2000	**2010**	**Percent Change from 2000-2010**
No. of people in coastal floodplain[7]	462,670	501,352	+ 8.4%
No. of people in coastal counties[8]	4,783,167*	4,924,916*	+ 3.0%
Percentage of people in coastal counties in coastal floodplain	9.7%	10.2%	----------

* Source: MassGIS Census 2010 Municipalities

Shoreline Erosion *(for all states other than Great Lakes and islands; for Great Lakes and islands, see Question 5): Using data from NOAA's State of the Coast "Coastal Vulnerability Index,"[9] indicate the vulnerability of the state's shoreline to erosion. You may use other information or graphs or other visuals to help illustrate or replace the table entirely if better data is available.*

[5] http://stateofthecoast.noaa.gov/pop100yr/welcome.html. Note FEMA is in the process of updating the floodplain data. This viewer reflects floodplains as of 2010. If you know the floodplain for your state has been revised since 2010, you can either use data for your new boundary, if available, or include a short narrative acknowledging the floodplain has changed and generally characterizing how it has changed.
[6] www.csc.noaa.gov/digitalcoast/tools/snapshots
[7] To obtain exact population numbers for the coastal floodplain, download the Excel data file on the State of the Coast "Population in the Floodplain" viewer: http://stateofthecoast.noaa.gov/pop100yr/welcome.html. Summary population data for each coastal state is available on the ftp site.
[8] To obtain population numbers for coastal counties, see spreadsheet of coastal population and critical facilities data provided or download directly from http://www.csc.noaa.gov/digitalcoast/data/stics. Summary population data for each coastal state is available on the ftp site.
[9] http://stateofthecoast.noaa.gov/vulnerability/welcome.html (see specifically "Erosion Rate" drop-down on map). The State of the Coast visually displays the data from USGS's Coastal Vulnerability Index.

Note: For New York and Pennsylvania that have both Atlantic and Great Lakes shorelines, fill out the table below for the Atlantic shoreline only.

Vulnerability to Shoreline Erosion		
Vulnerability Ranking	**Miles of Shoreline Vulnerable**[11]	**Percent of Coastline**[10]
Very low (>2.0m/yr) accretion	66.9 NOAA State of the Coast (Erosion Rate)	Total coastline = 830.9 8.0
Low (1.0-2.0 m/yr) accretion)	3.8 NOAA State of the Coast (Erosion Rate)	0.5
Moderate (-1.0 to 1.0 m/yr) stable	523.7 NOAA State of the Coast (Erosion Rate)	63.0
High (-1.1 to -2.0 m/yr) erosion	105.3 NOAA State of the Coast (Erosion Rate)	12.7
Very high (<-2.0 m/yr) erosion	131.2 NOAA State of the Coast (Erosion Rate)	15.8

Sea Level Rise *(for all states other than Great Lakes and islands; for Great Lakes and islands, see Question 5): Using data from NOAA's State of the Coast "Coastal Vulnerability Index",*[11] *indicate the vulnerability of the state's shoreline to sea level rise. You may provide other information or use graphs or other visuals to help illustrate or replace table entirely if better data is available. Note: For New York and Pennsylvania that have both Atlantic and Great Lakes shorelines, fill out the table below for your Atlantic shoreline only.*

Coastal Vulnerability to Historic Sea Level Rise		
Vulnerability Ranking	**Miles of Shoreline Vulnerable**[11]	**Percent of Coastline** Total coastline = 830.9
Very low	0 NOAA State of the Coast (USGS Coastal Vulnerability Index)	0
Low	590.7 NOAA State of the Coast (USGS Coastal Vulnerability Index)	71.1
Moderate	158.1 NOAA State of the Coast (USGS Coastal Vulnerability Index)	19.0
High	43.8 NOAA State of the Coast (USGS Coastal Vulnerability Index)	5.3
Very high	38.3 NOAA State of the Coast (USGS Coastal Vulnerability Index)	4.6

[10] To obtain exact shoreline miles and percent of coastline, mouse over the colored bar for each level of risk or download the Excel data file.
[11] http://stateofthecoast.noaa.gov/vulnerability/welcome.html (see "Vulnerability Index Rating" drop-down on map). The State of the Coast visually displays the data from USGS's Coastal Vulnerability Index.

Other Coastal Hazards: *In the table below, indicate the general level of risk in the coastal zone for each of the coastal hazards. The state's multi-hazard mitigation plan is a good additional resource to support these responses.*

Type of Hazard	General Level of Risk[12] (H, M, L)
Flooding (riverine, stormwater)	H
Coastal storms (including storm surge)[13]	H
Geological hazards (e.g., tsunamis, earthquakes)	M
Shoreline erosion[14]	H
Sea level rise[13,14,15]	H
Great Lake level change[14]	n/a
Land subsidence	M
Saltwater intrusion	M
Other (please specify)	

If available, briefly list and summarize the results of any additional data or reports on the level of risk and vulnerability to coastal hazards within your state since the last assessment.

Statewide

State Hazard Mitigation Plan (2013): A natural hazards risk matrix was developed to assess risk to all natural hazards that have occurred or could occur in Massachusetts. Information on each hazard contained in the matrix includes hazard frequency, severity, area of impact, and area of occurrence. Coastal hazards are assessed as high frequency, extensive severity (under the worst case scenario), and regional area of impact and occurrence. This process is similar to risk ranking methods found in local hazard mitigation plans. All local plans that include an analysis of coastal hazards list coastal hazards as being of moderate or greater impact and frequency.

Massachusetts Climate Change Adaptation Report (2011): This report is the first broad overview of climate change impacts in Massachusetts and includes a coastal zone chapter on vulnerabilities and potential adaptation strategies to address sea level rise and coastal storm impacts. A wide range of issues and strategies are presented in three categories within the coastal zone: residential and commercial development, ports, and infrastructure; coastal engineering structures; and, coastal, estuarine, and marine resources and ecosystem services.

Coastal Inundation Report (draft, 2015): CZM is evaluating critical infrastructure along the Massachusetts coast that would be inundated under various static sea level rise (SLR) and

[12] Risk is defined as "the estimated impact that a hazard would have on people, services, facilities and structures in a community; the likelihood of a hazard event resulting in an adverse condition that causes injury or damage." *Understanding Your Risks: Identifying Hazards and Estimating Losses. FEMA 386-2. August 2001*

[13] In addition to any state- or territory-specific information that may help respond to this question, the U.S. Global Change Research Program has an interactive website that provides key findings from the 2014 National Climate Assessment for each region of the country, including regions for the coasts and oceans, and various sectors. The report includes findings related to coastal storms and sea level rise that may be helpful in determining the general level of risk. See http://nca2014.globalchange.gov/.

[14] See NOAA State of the Coastal Vulnerability to Sea Level Rise Tool (select "Erosion Rate" from drop-down box) http://stateofthecoast.noaa.gov/vulnerability/welcome.html. The State of the Coast visually displays the data from USGS's Coastal Vulnerability Index.

"worst case" hurricane surge scenarios. Inundation levels are measured in feet and calculated for all facilities to allow direct comparisons between SLR and hurricane storm surge. The maps and tables are designed to be used as a planning tool for coastal managers, planners, decision-makers, and technical users charged with managing the Commonwealth's coastal resources.

Updated FEMA flood zone maps: Flood zone maps were updated for all Massachusetts coastal communities and now include a "Coastal A" zone which represents the area where base flood wave heights are between 1.5 and 3 feet.

Updated hurricane inundation maps: The US Army Corps of Engineers has updated hurricane inundation maps for coastal communities in Massachusetts as part of an update to the New England Hurricane Evacuation Study. The maps were created using output from the National Weather Service's Sea Lake and Overland Surges from Hurricanes (SLOSH) model to calculate potential surge heights from Category 1 – 4 hurricanes.

Regional

Potential expansion of the FEMA 100-year Floodplain (2014): The Buzzards Bay National Estuary Program and CZM are evaluating the potential expansion of the FEMA 100-year floodplain with 1-foot incremental increases in sea level up to 4 feet. Using a recent assessor's data set, the number of buildings, their assessed values, and municipal structures are being enumerated within these various sea level rise expansion scenarios.

Climate Change Vulnerability Assessment for Water Quality Infrastructure in New Bedford, Fairhaven, and Acushnet (2014): The Buzzards Bay National Estuary Program and SeaPlan assessed potential climate change vulnerability and mitigation strategies for water quality infrastructure in three communities surrounding New Bedford Harbor. Hypothetical worst case inundation scenarios were modeled using a combination of hurricane parameters and sea level rise scenarios. The results of the vulnerability analysis showed that at a Category 3 hurricane with 4-foot sea level rise, maximum inundation depths in the area would reach 32 feet and result in inundation at the site of 100% of Designated Port Areas, 36% of publicly-owned structures, 26 pump stations, and one wastewater treatment facility. It would also affect over 30,000 residents of environmental justice communities. Damage quantification analyses estimated $3.5 billion in projected economic damages to buildings and substantial damage to 1,399 buildings.

Climate Change and Extreme Weather Vulnerability Assessment and Adaptation Options of the Central Artery in Boston, MA (2014): MassDOT and the Federal Highway Administration are evaluating potential climate impacts to and the adaptive capacity of Boston's Central Artery. The study will assess the combined impact of sea level rise, storm events (tropical and extra-tropical), winds, tides, and waves through use of an ADCIRC-SWAN coupled model. Results of the model will be used to assess risk to various assets throughout the project area and to subsequently investigate adaptation options to reduce the identified vulnerabilities and establish an emergency response plan for tunnel protection and/or shutdown.

Scituate-Marshfield-Duxbury Sea Level Rise Study (2013): This study identifies inundation areas for 25, 50, and 75 years with sea level rise alone, and sea level rise with a Category 1 hurricane storm surge. Potential risks to public infrastructure, natural resources (e.g., marshes, beaches, wildlife, and shellfish), transportation and emergency access infrastructure are identified in each Town. Potential adaptation strategies are recommended, including increasing setbacks, acquiring properties, siting buildings outside flood zones, and elevating structures. Between 1978 and 2013 these three communities' combined total flood claims was $78.3 million; 23% of the total flood claims in all of Massachusetts.

Boston Harbor Sea Level Rise Maps (2010): These maps show the impact of 2.5 feet, 5 feet, and 7.5 feet of flooding above mean high tide on the Boston Harbor coastline. These scenarios are based on scientific research indicating a sea level rise range from 2.5 feet by mid-century to over 6 feet by the end of the century.

Management Characterization:
Indicate if the approach is employed by the state or territory and if significant state- or territory-level changes (positive or negative) have occurred that could impact the CMP's ability to prevent or significantly reduce coastal hazards risk since the last assessment.

Management Category	Employed by State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
Statutes, regulations, policies, or case law interpreting these that address:			
elimination of development/redevelopment in high-hazard areas[15]	Y	Y	N
management of development/redevelopment in other hazard areas	Y	Y	N
climate change impacts, including sea level rise or Great Lake level change	Y	Y	Y
Hazards planning programs or initiatives that address:			
hazard mitigation	Y	Y	Y
climate change impacts, including sea level rise or Great Lake level change	Y	Y	Y
Hazards mapping or modeling programs or initiatives for:			
sea level rise or Great Lake level change	Y	Y	Y
other hazards: erosion	Y	Y	Y

Briefly state how "high-hazard areas" are defined in your coastal zone.
We do not have a formal definition for high hazard areas in Massachusetts. Traditionally, Velocity Zones, the highest hazard flood zone mapped by FEMA have been considered high

[15] Use state's definition of high-hazard areas.

hazard areas. However, we recognize that there are a number of natural forces along the coast that have the potential to threaten development, infrastructure and natural resources. Therefore high hazard areas include areas subject to frequent flood inundation and erosion and at risk to larger storm events and future sea level rise.

1. *For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*
   a. *Describe the significance of the changes;*
   b. *Specify if they were 309 or other CZM-driven changes; and*
   c. *Characterize the outcomes and likely future outcomes of the changes.*

Sea Level Rise

The reports issued by the International Panel on Climate Change, National Climate Assessments, and others in the past few years indicate that there is high confidence that climate change will result in increasing rates of sea level rise. The significance of this is that as sea level rises, high water elevations will move landward, areas of coastal shorelines will retreat, and low-lying areas will be increasingly exposed to coastal erosion, tidal inundation, and coastal storm flooding. This will lead to increasing impacts to development, infrastructure and businesses as well as coastal habitats. In 2011, The Executive Office of Energy and Environmental Affairs issued the Massachusetts Climate Change Adaptation Report, which provides a framework for assessing a suite of strategic, long-term solutions designed to enable our neighborhoods and natural resources to adapt to climate change at the same time we strive to mitigate the greenhouse gas emissions that are contributing to it. Several regional studies regarding the likely impacts of sea level rise have been conducted or are currently underway, as listed under #5 above, which include modeling and mapping of the potential hazards in each study area. Although 309 funds were not used to fund these efforts, CZM staff participated in the studies and provided technical assistance to support them. The Climate Change Adaptation Report has resulted in action by several state agencies to update their regulations and planning documents to address the effects of sea level rise. In December, 2013, CZM issued *Sea Level Rise: Understanding and Applying Trends and Future Scenarios for Analysis and Planning*. It is expected that the various efforts described here will result in more resilient development, as well as an increase in mitigation and adaptation projects.

Hazard Mitigation

Due to the a higher number of Presidentially declared disasters in Massachusetts over the past five years, there has been more funding available for hazard mitigation projects through FEMA Hazard Mitigation Grant Programs. In addition, the Commonwealth of Massachusetts established two new grant programs, the Coastal Community Resilience Grant Program and Green Infrastructure Grant Program, in January, 2014. These programs offer funding and technical assistance to coastal communities to reduce or eliminate risks associated with coastal storms, erosion and sea level rise. The first round of grants awarded over $2.2 million for nineteen projects. In August, a total of three million dollars was allocated to fund a second

round for each grant program. The projects funded through the Coastal Community Resilience Grant Program will increase awareness of sea level rise and other impacts of climate change, identify community vulnerabilities and risks, develop targeted strategies, and implement on-the-ground measures to increase community resilience. The projects funded through the Green Infrastructure Grant Program will reduce risks associated with coastal storms, erosion and sea level rise through natural and nonstructural approaches.

Climate Change Impacts

As indicated above under Sea Level Rise, the Massachusetts Climate Change Adaptation Report includes information and recommendations to address the impacts of climate change. This has resulted in several agencies taking actions to pro-actively address the effects of climate change in their planning and regulatory programs. Details regarding some of these efforts are articulated under Sea Level Rise above and under responses to #5 above.

Coastal Erosion

CZM's Shoreline Change Project was updated in 2013, through continued collaboration with USGS. The project included adding a new contemporary shoreline (2007-2009), a 2000 shoreline derived by USGS as well as a 2001 shoreline for the south shore. Statistical analysis was conducted at over 26,000 shore perpendicular transects, which produced short- and long-term (30- and 150-year) shoreline change rates and uncertainty values. The data were incorporated into MORIS, the Massachusetts Ocean Resources Information System, and a customized Shoreline Change Browser within the MORIS web-based coastal management tool. The Browser can be accessed through the main webpage for the Shoreline Change Project, where general information is provided about the project as well important caveats for interpreting the data, directions for using the browser, and a link to the USGS Open File Report for the project. This data provides more current information for coastal managers, shorefront landowners, and potential property buyers regarding shoreline trends, including erosion and accretion rates. The update to the Shoreline Change Project was funded by a grant from X.

Policies and Guidance to Address Development

CZM worked with the MA Department of Environmental Protection to develop a guidance document for local Conservation Commissions: *Applying the Massachusetts Coastal Wetlands Regulations: A Practical Guide for Conservation Commissions to Protect the Storm Damage Prevention and Flood Control Functions of Coastal Resource Areas*. This guidance document provides direction to Conservation Commissions and project applicants for addressing the impacts of proposed projects that are likely to affect the storm damage prevention and flood control functions of coastal resource areas. The guidance helps interpret existing Wetlands Protection Act Regulations, clarifies the delineation of coastal resource areas, expands on the description of their beneficial functions, and guides applicants and Conservation Commissions on how to apply and meet performance standards to protect the existing function. In addition, the manual explains in detail how Commissions should use the best available tools, data and information for a complete and accurate project review. The guidance document was completed in 2012, but a decision was made to hold off on finalizing it and distributing it until after DEP completed some significant regulatory changes that directly affect the content of the

document. The new regulations become effective on October 24, 2014. CZM will work with DEP to update the guidance to reflect the final regulatory language and move forward with a final quality control review and distribution in 2015. This project received funding under Section 309 of our grant.

Tools for Coastal Property Owners

CZM developed the StormSmart Properties Fact Sheet Series to give coastal property owners important information on a range of measures that can effectively reduce erosion and storm damage while minimizing impacts to shoreline systems. This information is intended to help property owners work with consultants and other design professionals to select the best option or combination of options for their circumstances. The first six fact sheets include: *Artificial Dunes and Dune Nourishment*; *Controlling Overland Runoff to Reduce Coastal Erosion*; *Planting Vegetation to Reduce Erosion and Storm Damage*; *Bioengineering – Coir Rolls on Coastal Banks*; *Bioengineering – Natural Fiber Blankets on Coastal Banks*; *and Sand Fencing.* As part of the project, CZM also developed a comparison chart with the relative costs of various shoreline stabilization options. Various state agencies assisted CZM in the development of the fact sheets, and extensive input was received from a Technical Advisory Committee of environmental consultants who provided their expertise and experience with shoreline stabilization projects. This project received funding under Section 309 of our grant.

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

High

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

The priority level is based on the severity of the problem and the potential for program changes or further implementation activities to effectively address outstanding issues. The impacts of erosion, flooding, storm surge and sea level rise on development and infrastructure are increasing along the Massachusetts coast over the last few years. In particular, the effects of three storms during the winter of 2012-2013 (Hurricane Sandy, the Blizzard of 2013 and a strong northeaster in March) caused more damage to homes and infrastructure than any storm since the October 1991 so called “perfect storm”.

In recognition of existing coastal hazard issues and the emerging impacts of sea level rise, the 2014 Budget Bill established a Coastal Erosion Commission which is charged specifically with investigating and documenting the levels and impacts of coastal erosion in the Commonwealth and to prepare recommendations to minimize adverse affects on property, infrastructure, public safety, and natural resources. CZM is a member of the Commission and staff co-lead Working Groups on science/technology, erosion impacts, and legal and regulatory issues.

CZM organized a meeting with stakeholders from state and local agencies and officials as well as non-profit advocacy groups on December 17, 2014 to review draft enhancement area priorities and plans. Some of the following issues were discussed: formal vulnerability assessment; adaptation legislation – formalizing a management plan for adaptation in law; policy and program surrounding coastal buy-back; future trends – taking a closer look at Green and Coastal Resiliency grants – case studies / successes and failures.

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C. Public Access

Section 309 Enhancement Objective: *Attain increased opportunities for public access, taking into account current and future public access needs, to coastal areas of recreational, historical, aesthetic, ecological, or cultural value. §309(a)(3)*

Phase I (High-Level) Assessment: *Purpose: To quickly determine whether the enhancement area is a high priority enhancement objective for the CMP that warrants a more in-depth assessment.*

Resource Characterization:

1. Use the table below to provide data on public access availability within the coastal zone.

Public Access Status and Trends			
Type of Access	**Current number[16]**	**Changes or Trends Since Last Assessment[17] (↑, ↓, –, unkwn)**	**Cite data source**
Beach access sites	Data to differentiate between beach and shoreline (other than beach) access sites not available. Number of beach/shoreline access sites within 100 meters of shoreline: 1,631	↑ by 83 (1,548 beach/shoreline access sites within 100 meters of shoreline reported in last assessment)	Massachusetts Office of Geographic Information. Protected and Recreational OpenSpace, August 2014. "Coastal Public Access Sites" [Esri shapefile]. Created by Massachusetts Office of Coastal Zone Management, using ArcGIS 10.2.2., as a subset of the original dataset. September 24, 2014.
Shoreline (other than beach) access sites	See above	See above	See above
Recreational boat (power or nonmotorized) access sites	158	↑ by 2 (156 sites reported in last assessment)	Massachusetts Department of Fish and Game, Division of Marine Fisheries, 2014. *Massachusetts Saltwater Recreational Fishing Guide*.
Number of designated scenic vistas or overlook points	No statewide data available	unkwn	n/a

[16] Be as specific as possible. For example, if you have data on many access sites but know it is not an exhaustive list, note "more than" before the number. If information is unknown, note that and use the narrative section below to provide a brief qualitative description based on the best information available.

[17] If you know specific numbers, please provide. However, if specific numbers are unknown but you know that the general trend was increasing or decreasing or relatively stable or unchanged since the last assessment, note that with a ↑ (increased), ↓ (decreased), – (unchanged). If the trend is completely unknown, simply put "unkwn."

Public Access Status and Trends			
Type of Access	**Current number[16]**	**Changes or Trends Since Last Assessment[17] (↑, ↓, –, unkwn)**	**Cite data source**
Number of fishing access points (i.e. piers, jetties)	62	↑ by 12 (50 piers and jetties recorded in 2009)	Massachusetts Department of Fish and Game, Division of Marine Fisheries, 2014. *Massachusetts Saltwater Recreational Fishing Guide*.
Coastal trails/ boardwalks	No. of Trails/ boardwalks No statewide data available	unkwn (no comparable data reported in last assessment)	Massachusetts Department of Conservation and Recreation. 1) Bicycle Trails, September 2004. 2) DCR Roads and Trails, March 2014. 3) Long Distance Trails, July 1999. "Coastal Trails" [Esri shapefile]. Created by Massachusetts Office of Coastal Zone Management, using ArcGIS 10.2.2., as a subset of the original three datasets. September 23, 2014.
	Miles of Trails/boardwalks 309 miles		
Number of acres parkland/open space	Total sites Number of parkland/open space sites in coastal zone: 3,598 Number of acres parkland/open space in coastal zone: 112,097	↑ by 194 sites (3,404 sites reported in last assessment) ↑ by 5,592 acres (106,505 acres reported in last assessment)	Massachusetts Office of Geographic Information. Protected and Recreational OpenSpace, August 2014. "Coastal Public Access Sites" [Esri shapefile]. Created by Massachusetts Office of Coastal Zone Management, using ArcGIS 10.2.2., as a subset of the original dataset. September 24, 2014.
	Sites per miles of shoreline 3,598 sites divided by 1,519 miles of shoreline = 2.4 sites/mile of shoreline	↑ by 0.2 sites/mile (3,404 sites divided by 1,519 miles of shoreline = 2.2 sites/mile of shoreline reported in last assessment)	
Other (please specify)			

2. *Briefly characterize the demand for coastal public access and the process for periodically assessing demand. Include a statement on the projected population increase for your*

coastal counties.[18] There are several additional sources of statewide information that may help inform this response, such as the Statewide Comprehensive Outdoor Recreation Plan,[19] the National Survey on Fishing, Hunting, and Wildlife Associated Recreation,[20] and your state's tourism office.

The population within the state's coastal shoreline counties is projected to increase by 5 percent between 2010 and 2020 (source: NOAA's National Coastal Population Report: Population Trends from 1970 to 2020).

3. *If available, briefly list and summarize the results of any additional data or reports on the status or trends for coastal public access since the last assessment.*

Management Characterization:

1. *Indicate if the approach is employed by the state or territory and if there have been any significant state- or territory-level management changes (positive or negative) that could impact the future provision of public access to coastal areas of recreational, historical, aesthetic, ecological, or cultural value.*

Management Category	Employed by State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
Statutes, regulations, policies, or case law interpreting these	Y	Y	N
Operation/maintenance of existing facilities	Y	Y	N
Acquisition/enhancement programs	Y	Y	N

2. *For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*
   a. *Describe the significance of the changes;*
   b. *Specify if they were 309 or other CZM-driven changes; and*
   c. *Characterize the outcomes or likely future outcomes of the changes.*

[18] See NOAA's Coastal Population Report: 1970-2020 (Table 5, pg. 9): http://stateofthecoast.noaa.gov/coastal-population-report.pdf
[19] Most states routinely develop "Statewide Comprehensive Outdoor Recreation Plans", or SCROPs, that include an assessment of demand for public recreational opportunities. Although not focused on coastal public access, SCORPs could be useful to get some sense of public outdoor recreation preferences and demand. Download state SCROPs at www.recpro.org/scorps.
[20] The National Survey on Fishing, Hunting, and Wildlife Associated Recreation produces state-specific reports on fishing, hunting, and wildlife associated recreational use for each state. While not focused on coastal areas, the reports do include information on saltwater and Great Lakes fishing, and some coastal wildlife viewing that may be informative and compares 2011 data to 2006 and 2001 information to understand how usage has changed. See www.census.gov/prod/www/fishing.html.

3. *Indicate if your state or territory has a publically available public access guide. How current is the publication and how frequently it is updated?*[21]

Public Access Guide	Printed	Online	Mobile App
State or territory has? (Y or N)	N	Y	Y
Web address (if applicable)	n/a	http://www.mass.gov/eea/agencies/czm/program-areas/public-access-and-coast-guide/coast-guide/coast-guide-online.html	http://www.mass.gov/eea/agencies/czm/program-areas/public-access-and-coast-guide/coast-guide/coast-guide-online.html
Date of last update	n/a	July 11, 2013	July 11, 2013
Frequency of update	n/a	As needed	As needed

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

Low

2. *Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.*

While ensuring access to the coast is an important issue area, in consideration of other priority 309 enhancement areas and that there are other agencies and programs working on access and land conservation, public access is a low priority in this assessment. This prioritization was supported by input from stakeholders.

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[21] Note some states may have regional or local guides in addition to state public access guides. Unless you want to list all local guides as well, there is no need to list additional guides beyond the state access guide. However, you may choose to note that the local guides do exist and may provide additional information that expands upon the state guides.

D. Marine Debris

Section 309 Enhancement Objective: *Reducing marine debris entering the nation's coastal and ocean environment by managing uses and activities that contribute to the entry of such debris. §309(a)(4)*

Phase I (High-Level) Assessment:
Purpose: To quickly determine whether the enhancement area is a high priority enhancement objective for the CMP that warrants a more in-depth assessment.

Resource Characterization:
1. *In the table below, characterize the existing status and trends of marine debris in the state's coastal zone based on the best available data.*

Source of Marine Debris	Existing Status and Trends of Marine Debris in Coastal Zone		
	Significance of Source (H, M, L, unknwn)	**Type of Impact[22] (aesthetic, resource damage, user conflicts, other)**	**Change Since Last Assessment (↑, ↓, –, unkwn)**
Land-based			
Beach/shore litter	M	Aesthetic, resource damage	-
Dumping	L	Aesthetic, resource damage	-
Storm drains and runoff	M	Aesthetic, resource damage	-
Fishing (e.g., fishing line, gear)	L	Aesthetic, resource damage	-
Other (please specify)	L		N/A
Ocean or Great Lake-based			
Fishing (e.g., derelict fishing gear)	M	Resource damage	-
Derelict vessels	L	Aesthetic, resource damage, user conflicts	-
Vessel-based (e.g., cruise ship, cargo ship, general vessel)	L	Aesthetic, resource damage	-
Hurricane/Storm	L	Aesthetic, resource damage	-
Tsunami	L	Aesthetic, resource damage	N/A
Other (please specify)	L		N/A

[22] You can select more than one, if applicable.

2. If available, briefly list and summarize the results of any additional state- or territory-specific data or reports on the status and trends or potential impacts from marine debris in the coastal zone since the last assessment.

The primary data that Massachusetts gathers is through COASTSWEEP, Massachusetts' annual volunteer beach cleanup program, which is part of an international campaign organized by Ocean Conservancy in Washington, DC. Participants all over the world collect marine debris and record the types of material they find. This information is then used by the Ocean Conservancy to help reduce future marine debris problems. Each fall, cleanups are held all along the Massachusetts coastline. Each spring the Ocean Conservancy publishes a report of the data from the previous year's cleanups. This report places the debris collected into activity categories that do not match up with the requested categories above. For the 2013 cleanups (the latest data available), 150,176 items were collected in Massachusetts. The Most Likely to Find Items category (categories have changed since the last §309 assessment), which includes cigarette butts, food wrappers, take out containers, bottles, cans, bags, cups, and plates, accounted for 67% of the items collected. Items from Fishing Activities, which includes fishing gear, buoys, rope, etc., made up about 5% of items collected. Packaging materials were 4% and Personal Hygiene (materials, such as diapers, condoms, syringes, and tampon and tampon applicators, which are dumped into storm drains, sewer systems, and toilets) was 2%. Tiny trash less than 2.5 cm, a new category for 2013 was 19%.

Regarding derelict fishing gear, the "Outer Cape Derelict Gear Assessment and Retrieval" project , which was conducted by the Center for Coastal Studies through a National Fish and Wildlife Foundation grant, demonstrated the effectiveness of conducting side-scan sonar surveys in certain areas to enhance a derelict fishing gear recovery effort. Over two winters, high-resolution sonar surveys were conducted to identify potential derelict fishing gear targets in Provincetown and Wellfleet harbors. Commercial fishing vessels outfitted with steel grapples were then enlisted to recover gear located in those and other areas and record bycatch and trap characteristics. Recovered gear included over 660 lobster traps, half of which were deemed "fishable" and returned to their owners. Additionally, over 16 tons of recovered steel cable, monofilament and polypropylene net, rope and other non-fishable gear was recycled or burned for energy.

No specific data is available for marine debris originating from stormwater, other fishing gear, derelict vessels, waste from vessels, or hurricanes. CZM makes an effort to prevent recreational vessel debris, however, through publication of the Massachusetts Clean Marina Guide (2001) in partnership with the recreational boating industry. The Guide provides "best environmental practice" information for marina facilities, including a fact sheet that encourages proper handling of trash by boaters.

Management Characterization:

2. *Indicate if the approach is employed by the state or territory and if there have been any significant state- or territory-level management changes (positive or negative) for how*

marine debris is managed in the coastal zone.

Management Category	Employed by State/Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
Marine debris statutes, regulations, policies, or case law interpreting these	N	N	N
Marine debris removal programs	Y	Y	N

3. *For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*
   a. *Describe the significance of the changes;*
   b. *Specify if they were 309 or other CZM-driven changes; and*
   c. *Characterize the outcomes and likely future outcomes of the changes.*

Enhancement Area Prioritization:

1. *What level of priority is the enhancement area for the coastal management program?*

Low

2. *Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.*

State efforts have been focused primarily on educating the public on marine debris problems. Given the limited availability of resources, when compared to the priorities of other 309 categories, the priority level for this enhancement area remains low. This prioritization was supported by input from stakeholders.

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E. Cumulative and Secondary Impacts

Section 309 Enhancement Objective: *Development and adoption of procedures to assess, consider, and control cumulative and secondary impacts of coastal growth and development, including the collective effect on various individual uses or activities on coastal resources, such as coastal wetlands and fishery resources. §309(a)(5)*

Phase I (High-Level) Assessment: *Purpose: To quickly determine whether the enhancement area is a high priority enhancement objective for the CMP that warrants a more in-depth assessment.*

Resource Characterization:

1. *Using National Ocean Economics Program Data on population and housing,[23] please indicate the change in population and housing units in the state's coastal counties between 2012 and 2007. You may wish to add additional trend comparisons to look at longer time horizons as well (data available back to 1970), but at a minimum, please show change over the most recent five year period (2012-2007) to approximate current assessment period.*

Trends in Coastal Population and Housing Units				
Year	Population		Housing	
	Total (# of people)	% Change (compared to 2007)	Total (# of housing units)	% Change (compared to 2007)
2007	4,855,948	+3.28%	2,054,736	3.49%
2012	5,012,707		2,126,387	

2. *Using provided reports from NOAA's Land Cover Atlas[24] or high-resolution C-CAP data[25] (Pacific and Caribbean Islands only), please indicate the status and trends for various land uses in the state's coastal counties between 2006 and 2011. You may use other information and include graphs and figures, as appropriate, to help illustrate the information.*

What is clear in the county land cover type tables below, is that over the last five years, most counties in Massachusetts lost forested lands and gained low intensity development. One notable exceptions are Dukes county, where grassland had larger losses than forested lands and erosion on Martha's Vineyard led to more open water. Plymouth County had the largest loss of forested lands at 4.57 acres. Also, there were minor gains in barren land in Essex, Nantucket, and Suffolk counties.

[23] www.oceaneconomics.org/. Enter "Population and Housing" section. From drop-down boxes, select your state, and "all counties." Select the year (2012) and the year to compare it to (2007). Then select "coastal zone counties." Finally, be sure to check the "include density" box under the "Other Options" section.
[24] www.csc.noaa.gov/ccapatlas/. Summary data on land use trends for each coastal state is available on the ftp site.
[25] www.csc.noaa.gov/digitalcoast/data/ccaphighres. Summary data on land use trends for each coastal state is available on the ftp site.

Distribution of Land Cover Types in All Coastal Counties in Massachusetts		
Land Cover Type	**Land Area Coverage in 2010 (square miles)[26]**	**Gain/Loss Since 2006 (Acres)**
Developed, High Intensity	381.03	7.46
Developed, Low Intensity	356.25	10.76
Developed, Open Space	198.47	-0.51
Grassland	59.35	-1.02
Scrub/Shrub	51.03	1.81
Barren Land	120.38	5.94
Open Water	2450.53	-3.32
Agriculture	148.23	-6.04
Forested	980.41	-14.29
Woody Wetland	358.99	-0.52
Emergent Wetland	131.84	-0.32

Barnstable County Distribution of Land Cover Types		
Land Cover Type	**Land Area Coverage in 2010 (square miles)**	**Gain/Loss Since 2006 (Acres)**
Developed, High Intensity	45.11	0.79
Developed, Low Intensity	63.55	1.48
Developed, Open Space	34.98	0.16
Grassland	11.49	0.12
Scrub/Shrub	10.84	0.45
Barren Land	63.29	1.12
Open Water	868.83	-1.19
Agriculture	5.77	-0.22
Forested	151.44	-2.59
Woody Wetland	16.91	-0.02
Emergent Wetland	33.37	-0.12

Bristol County Distribution of Land Cover Types		
Land Cover Type	**Land Area Coverage in 2010 (square miles)**	**Gain/Loss Since 2006 (Acres)**
Developed, High Intensity	70.53	1.40
Developed, Low Intensity	62.57	1.92
Developed, Open Space	36.09	-0.46
Grassland	11.10	0.02
Scrub/Shrub	4.87	0.19
Barren Land	7.14	0.54
Open Water	131.76	-0.10
Agriculture	39.29	-1.15
Forested	200.59	-2.25
Woody Wetland	114.01	-0.15
Emergent Wetland	13.24	0.04

[26] Data from the NOAA website is in square miles, not in acres. Also, the most recent data are from 2010.

Dukes County Distribution of Land Cover Types		
Land Cover Type	**Land Area Coverage in 2010 (square miles)**	**Gain/Loss Since 2006 (Acres)**
Developed, High Intensity	1.89	0.02
Developed, Low Intensity	5.06	0.08
Developed, Open Space	5.55	0.03
Grassland	10.09	-0.38
Scrub/Shrub	8.85	0.33
Barren Land	8.86	-0.01
Open Water	371.73	0.15
Agriculture	2.16	-0.02
Forested	54.88	-0.20
Woody Wetland	3.74	0.01
Emergent Wetland	5.88	-0.02

Essex County Distribution of Land Cover Types		
Land Cover Type	**Land Area Coverage in 2010 (square miles)**	**Gain/Loss Since 2006 (Acres)**
Developed, High Intensity	88.08	1.60
Developed, Low Intensity	66.92	1.56
Developed, Open Space	30.21	-0.10
Grassland	6.82	-0.16
Scrub/Shrub	3.56	0.31
Barren Land	9.00	2.27
Open Water	315.30	-2.21
Agriculture	28.62	-1.25
Forested	162.62	-1.91
Woody Wetland	64.07	-0.09
Emergent Wetland	40.51	-0.03

Nantucket County Distribution of Land Cover Types		
Land Cover Type	**Land Area Coverage in 2010 (square miles)**	**Gain/Loss Since 2006 (Acres)**
Developed, High Intensity	2.82	0.08
Developed, Low Intensity	4.00	0.14
Developed, Open Space	2.65	0.28
Grassland	4.34	-0.31
Scrub/Shrub	11.23	0.06
Barren Land	14.95	0.45
Open Water	245.30	-0.13
Agriculture	1.21	-0.15
Forested	9.57	-0.45
Woody Wetland	3.86	-0.01
Emergent Wetland	3.75	0.03

Norfolk County Distribution of Land Cover Types		
Land Cover Type	**Land Area Coverage in 2010 (square miles)**	**Gain/Loss Since 2006 (Acres)**
Developed, High Intensity	76.57	1.59
Developed, Low Intensity	70.94	2.37
Developed, Open Space	39.47	-0.09
Grassland	2.53	0.06
Scrub/Shrub	3.60	-0.09
Barren Land	2.31	0.26
Open Water	40.79	-0.02
Agriculture	11.78	-1.51
Forested	130.85	-2.27
Woody Wetland	53.28	-0.15
Emergent Wetland	8.89	-0.15

Plymouth County Distribution of Land Cover Types		
Land Cover Type	**Land Area Coverage in 2010 (square miles)**	**Gain/Loss Since 2006 (Acres)**
Developed, High Intensity	54.06	1.95
Developed, Low Intensity	75.95	3.11
Developed, Open Space	46.30	-0.20
Grassland	12.29	-0.35
Scrub/Shrub	8.01	0.55
Barren Land	13.77	1.23
Open Water	424.52	0.18
Agriculture	59.11	-1.74
Forested	267.81	-4.57
Woody Wetland	102.62	-0.11
Emergent Wetland	23.54	-0.05

Suffolk County Distribution of Land Cover Types		
Land Cover Type	**Land Area Coverage in 2010 (square miles)**	**Gain/Loss Since 2006 (Acres)**
Developed, High Intensity	41.97	0.03
Developed, Low Intensity	7.26	0.10
Developed, Open Space	3.22	-0.13
Grassland	0.69	-0.02
Scrub/Shrub	0.07	0.01
Barren Land	1.06	0.08
Open Water	52.30	0.00
Agriculture	0.29	0.00
Forested	2.65	-0.05
Woody Wetland	0.50	0.00
Emergent Wetland	2.66	-0.02

3. *Using provided reports from NOAA's Land Cover Atlas[27] or high-resolution C-CAP data[28] (Pacific and Caribbean Islands only), please indicate the status and trends for developed areas in the state's coastal counties between 2006 and 2011 in the two tables below. You may use other information and include graphs and figures, as appropriate, to help illustrate the information.*

There was relatively little change (<1%) in the percent of Massachusetts that is developed land or impervious surface in the last five years. As seen in the tables below, the largest change in land use is the loss of forested lands (9.47 square miles) and the loss of agricultural lands (3.81 square miles) to development.

Development Status and Trends for Coastal Counties			
	2006	**2011**	**Percent Net Change**
Percent land area developed	20.80	21.13	0.33
Percent impervious surface area	9.44	9.58	0.14

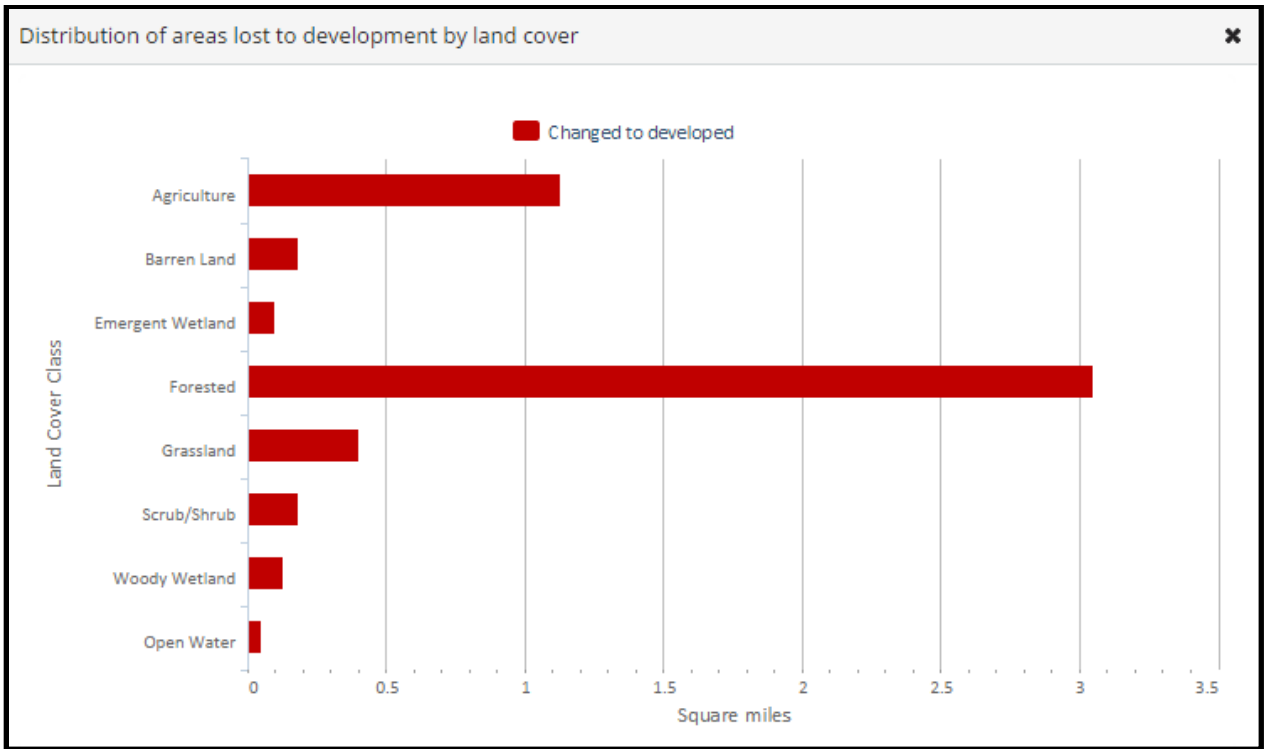
** Note: Islands likely have data for another time period and may only have one time interval to report. If so, only report the change in development and impervious surface area for the time period for which high-resolution C-CAP data are available. Puerto Rico and CNMI do not need to report trend data.*

How Land Use Is Changing in Coastal Counties	
Land Cover Type	**Areas Lost to Development Between 2006-2011 (Square miles)**
Barren Land	0.81
Emergent Wetland	0.52
Woody Wetland	0.58
Open Water	0.34
Agriculture	3.81
Scrub/Shrub	1.35
Grassland	1.41
Forested	9.47

** Note: Islands likely have data for another time period and may only have one time interval to report. If so, only report the change in land use for the time period for which high-resolution C-CAP data are available. Puerto Rico and CNMI do not report.*

The greatest local change in land cover between 2006 and 2010 was the loss of over three square miles of forested land in Plymouth County, MA (http://www.csc.noaa.gov/ccapatlas/#).

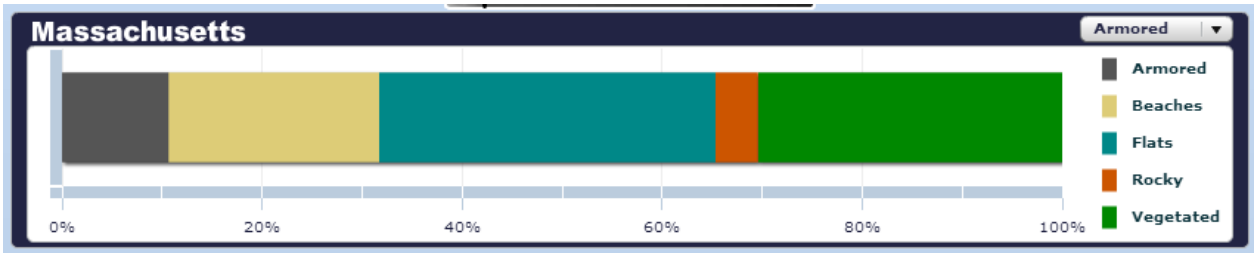
[27] www.csc.noaa.gov/ccapatlas/. Summary data on land use trends for each coastal state is available on the ftp site.
[28] www.csc.noaa.gov/digitalcoast/data/ccaphighres. Summary data on land use trends for each coastal state is available on the ftp site.



4. *Using data from NOAA's State of the Coast "Shoreline Type" viewer,[29] indicate the percent of shoreline that falls into each shoreline type.[30] You may provide other information or use graphs or other visuals to help illustrate.*

Currently, just over 10% of the Massachusetts coastline is armored.

Shoreline Types	
Surveyed Shoreline Type	**Percent of Shoreline**
Armored	11%
Beaches	21%
Flats	33%
Rocky	5%
Vegetated	30%



[29] http://stateofthecoast.noaa.gov/shoreline/welcome.html
[30] Note: Data are from NOAA's Environmental Sensitivity Index (ESI) Maps. Data from each state was collected in different years and some data may be over ten years old now. However, it can still provide a useful reference point absent more recent statewide data. Feel free to use more recent state data, if available, in place of ESI map data. Use a footnote to convey data's age and source (if other than ESI maps).

http://stateofthecoast.noaa.gov/shoreline/welcome.html

5. *If available, briefly list and summarize the results of any additional state- or territory-specific data or reports on the cumulative and secondary impacts of coastal growth and development, such as water quality and habitat fragmentation, since the last assessment to augment the national data sets.*

CZM has created GIS data layers of shoreline classifications (e.g., seawall, revetment, coastal bank, beach, dune, salt marsh) that can be used in the future for assessing changes over time intervals.

Management Characterization:

1. *Indicate if the approach is employed by the state or territory and if there have been any significant state-level changes (positive or negative) in the development and adoption of procedures to assess, consider, and control cumulative and secondary impacts of coastal growth and development, including the collective effect on various individual uses or activities on coastal resources, such as coastal wetlands and fishery resources, since the last assessment.*

Management Category	Employed by State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
Statutes, regulations, policies, or case law interpreting these	Y	Y	Y
Guidance documents	Y	Y	Y
Management plans (including SAMPs)	Y	Y	Y

2. *For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*
   a. Describe the significance of the changes;
   b. Specify if they were 309 or other CZM-driven changes; and
   c. *Characterize the outcomes or likely future outcomes of the changes.*

Statues, Regulations, Policies, and Case Law

- In 2011, the Massachusetts ocean management plan and its enforceable policies were formally incorporated into the Massachusetts Coastal Management Program. This was a 309 change.

- In 2013, CZM and its partner agencies drafted regulations to implement the ocean plan and after public comment, the Commonwealth promulgated these regulations (301 CMR 28.00).
- In 2013, the Massachusetts legislature again amended the ocean sanctuaries act, this time to allow ocean outfalls for municipal sewage treatment facilities in ocean sanctuaries. The communities proposing ocean outfalls to mitigate nearshore eutrophication issues would need to meet 12 specific conditions developed to ensure that the ecology and appearance of ocean sanctuaries is not seriously altered.
- MassDEP developed 17 TMDLs for nutrients for coastal waterbodies on Cape Cod and the Islands.
- In Massachusetts, the sole authority for regulating the application of fertilizers resides with the Department of Agriculture (DAR), thus the Massachusetts Attorney General ruled a 2013 bylaw by the Town of Falmouth to regulate nitrogen fertilizer application illegal. Recognizing that proper fertilizer management is an important tool in reducing eutrophication in coastal communities, the Massachusetts legislature passed a provision to allow communities on Cape Cod to develop, and pass by town vote, bylaws to regulate the use of nitrogen and/or phosphorus by homeowners and country clubs by December 2014. After that time, the authority to regulate fertilizers will revert to DAR. The Towns of Falmouth and Orleans are in the process of developing fertilizer application bylaws.

Guidance Documents

- CZM assisted executive branch agencies in developing a guidance document for the types of alternative nitrogen removal strategies that could be permitted by coastal municipalities as they perform their long-term comprehensive wastewater management planning. This was a 309 change.
- CZM , in coordination with other executive branch agencies, drafted an ocean development fee guidance document. The purpose of the fee is to compensate the Commonwealth for unavoidable impacts of ocean development projects in the ocean planning area. This was a 309 change.

Management Plans

- In 2012, CZM began revising the recreational boating human use area in its ocean plan. This was a 309 change.
- In 2013, CZM began updating its ocean management plan including updating the spatial extent of the 12 special, sensitive, or unique resources. This was a 309 change.

Enhancement Area Prioritization:

1. *What level of priority is the enhancement area for the coastal management program?*

Medium

2. *Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.*

While cumulative and secondary impacts continue to be an important issue for the Commonwealth as it seeks to protect coastal and marine habitat and water quality and sustainable water-dependent uses, it is a medium a priority for 309 because progress has been made since the last assessment. The implementation several CZM programs are working to address issues related to cumulative and secondary impacts, including Ocean Management and Planning, Coastal Water Quality, Coastal Habitat, and Port and Harbor Planning. Strategies proposed under Wetlands and Ocean Resources will advance the development of tools which will help serve to address issues of cumulative and secondary impact. This prioritization was supported by input from stakeholders.

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F. Special Area Management Planning

Section 309 Enhancement Objective: *Preparing and implementing special area management plans for important coastal areas. §309(a)(6)*

The Coastal Zone Management Act defines a Special Area Management Plan (SAMP) as "a comprehensive plan providing for natural resource protection and reasonable coastal-dependent economic growth containing a detailed and comprehensive statement of policies; standards and criteria to guide public and private uses of lands and waters; and mechanisms for timely implementation in specific geographic areas within the coastal zone. In addition, SAMPs provide for increased specificity in protecting natural resources, reasonable coastal-dependent economic growth, improved protection of life and property in hazardous areas, including those areas likely to be affected by land subsidence, sea level rise, or fluctuating water levels of the Great Lakes, and improved predictability in governmental decision making."

Phase I (High-Level) Assessment: *Purpose: To quickly determine whether the enhancement area is a high priority enhancement objective for the CMP that warrants a more in-depth assessment.*

Resource Characterization:

1. *In the table below, identify geographic areas in the coastal zone subject to use conflicts that may be able to be addressed through a special area management plan (SAMP). This can include areas that are already covered by a SAMP but where new issues or conflicts have emerged that are not addressed through the current SAMP.*

Geographic Area	Opportunities for New or Updated Special Area Management Plans Major conflicts/issues
Ocean Planning Area	Protection of natural resources and existing human uses while achieving policy goals through allowing emerging human uses (e.g., renewable energy)
Designated Port Areas	Balancing the preservation of existing/historic infrastructure and land for water-dependent industrial use with local land use planning, changing economies/industries
Areas of Critical Environmental Concern	Protection of environmental resources in state-designated areas from potential development impacts to habitat and water quality

2. *If available, briefly list and summarize the results of any additional state- or territory-specific data or reports on the status and trends of SAMPs since the last assessment.*

No reports on status and trends of SAMPS are available.

Management Characterization:

1. *Indicate if the approach is employed by the state or territory and if there have been any significant state- or territory-level management changes (positive or negative) that could help prepare and implement SAMPs in the coastal zone.*

Management Category	Employed by State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
SAMP policies, or case law interpreting these	Y	Y	Y
SAMP plans	Y	Y	Y

2. *For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*
   a. *Describe the significance of the changes;*
   b. *Specify if they were 309 or other CZM-driven changes; and*
   c. *Characterize the outcomes or likely future outcomes of the changes.*

Ocean Plan

On January 6, EEA released the first update to the Massachusetts Ocean Management Plan, which was originally released in 2009 as a landmark blueprint for the protection and sustainable use of state ocean waters. Authorized by the Oceans Act of 2008, the Ocean Plan protects critical marine habitat and important water-dependent uses and sets standards for ocean-based development. The Oceans Act requires that the plan be reviewed at least every five years. In January 2013, EEA initiated a review and update process, which was led by CZM and guided by input and advice from the Ocean Advisory Commission and Ocean Science Advisory Council. The review and update included a comprehensive assessment of ocean plan progress to date, as well as extensive public and expert participation efforts. The *2015 Massachusetts Ocean Management Plan* contains the following updates to the original plan: new data and trends on ocean habitats and ecosystems, human uses, economics, cultural and archeological aspects, and climate change; preliminary offshore wind transmission corridor routes for further investigation; initial planning and analysis for appropriate potential locations for offshore sand areas for beach nourishment; and a fee structure and guidance for required mitigation fees for ocean development projects. The development and content of the 2015 Ocean Plan is described more fully in the Ocean Resources section of this assessment.

Designated Port Areas

CZM provided technical assistance to the City of Gloucester in the development of the City's Designated Port Area (DPA) Master Plan renewal. Funding from the Seaport Advisory Council (state funds) was used to help complete this plan. Additionally, CZM reconvened a DPA Working Group which met several times throughout 2014 to review policy recommendations

for the DPA program. The purpose of the Working Group was to review the Commonwealth's DPA policies and tools to ensure they are up-to-date and to reflect a balance between preserving critical water-dependent industrial assets and providing municipal flexibility to pursue economic development. The DPA policy recommendations include revisions to the Chapter 91, Municipal Harbor Plan, and DPA Boundary regulations to activate the water's edge and watersheet and promote additional economic opportunities by allowing new and expanded uses while ensuring the protection of current and future marine industrial opportunities. Specifically, the proposed changes would provide greater flexibility in the location of allowable non-maritime uses on the project site, allow recreational boating slips under limited circumstances, and clarify DPA boundary review criteria.

On April 23, 2014, CZM issued the *Designation Decision for the Gloucester Inner Harbor Designated Port Area (DPA)*, concluding the comprehensive DPA boundary review process for the City of Gloucester initiated in March 2013 at the request of the City. The decision affirms the findings and proposed DPA boundary modifications in CZM's February 3, 2014, designation report, Boundary Review of the Gloucester Inner Harbor Designated Port Area. The boundary modification was made in accordance with criteria governing the suitability of contiguous lands and waters to accommodate water-dependent industrial use pursuant to 301 CMR 25.00: Designation of Port Areas.

Areas of Critical Environmental Concern

The Areas of Critical Environmental Concern (ACEC) program is administered by the Department of Conservation and Recreation (DCR) on behalf of the Secretary of Energy and Environmental Affairs. The purpose and goals of ACECs are implemented through a variety of state agency programs and regulations which contain specific provisions regarding ACECs. CZM coordinates closely with DCR regarding all aspects of the ACEC program within the coastal zone through technical assistance, state environmental review, and federal consistency review. CZM is the primary agency lead on the Straits Pond Restoration Project. Straits Pond is a 94-acre tidally restricted costal salt pond which is located within the Weir River ACEC. This restoration project entails the reconstruction of a causeway and enlargement of the associated culvert and tide gate system which links Straits Pond to the larger estuary. At the time the construction was completed in December, 2010 this initiative was the largest tidal restoration project in the Commonwealth. Since the new automated tide gates became operational CZM has facilitated the ongoing implementation of an adaptive management strategy which includes incremental tide gate adjustments to increase tidal exchange, water quality and biological monitoring to determine efficacy, facilitation of periodic interagency consultation as described in the Tide Gate Operation and Maintenance Plan, and public outreach to inform residents and stakeholders about the status and benefits of the project.

CZM is also participating in the interagency working group providing oversight and technical assistance on the Ellisville Harbor Inlet Relocation project. This project is a local stewardship association sponsored initiative which, as a short-term management action, seeks to restore low marsh vegetation by altering hydrology to the 55-acer wetland/barrier beach system through relocation of a tidal channel through an accreting barrier beach. Activities associated

with this project include pre-permitting consultation to refine project elements, developing a monitoring protocol to determine project efficacy and identify potential ecological impacts, documenting annual dredging activities, reviewing periodic monitoring data submittals, and synthesizing monitoring data for use by the working group. CZM has worked with DCR and other agency partners to include Ellisville Harbor barrier beach and wetland resource management into a regional Resource Management Plan for the long-term ecological and wetland benefit of this resource area.

Enhancement Area Prioritization:

1. *What level of priority is the enhancement area for the coastal management program?*

High

2. *Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.*

This 309 enhancement Area is a high priority for 309 because CZM program is interested in building on progress of two elements of Special Area Management Planning: the DPA program and ocean planning. Ocean planning is covered by the Ocean Resources assessment and under a separate strategy. With regards to the Commonwealth's DPA program, CZM's experience and stakeholder input have highlighted the need for additional program change work in the comprehensive reviews of specific port DPAs, using the designation standards found at 301 CMR 25.00, to determine whether the boundaries should remain as currently established or whether they should be modified. This prioritization was supported by input from stakeholders.

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G. Ocean and Great Lakes Resources

Section 309 Enhancement Objective: *Planning for the use of ocean [and Great Lakes] resources. §309(a)(7)*

Phase I (High-Level) Assessment: *(Must be completed by all states and territories.)*
Purpose: To quickly determine whether the enhancement area is a high priority enhancement objective for the CMP that warrants a more in-depth assessment. The more in-depth assessments of Phase II will help the CMP understand key problems and opportunities that exist for program enhancement and determine the effectiveness of existing management efforts to address those problems.

Resource Characterization:

Understanding the ocean and Great Lakes economy can help improve management of the resources it depends on. Using Economics: National Ocean Watch (ENOW),[31] indicate the status of the ocean and Great Lakes economy as of 2010, as well as the change since 2005, in the tables below. Include graphs and figures, as appropriate, to help illustrate the information. Note ENOW data are not available for the territories. The territories can provide alternative data, if available, or a general narrative, to capture the value of their ocean economy.

Status of Ocean and Great Lakes Economy for Coastal Counties (2010)				
	Establishments (# of Establishments)	**Employment** (# of Jobs)	**Wages** (Millions of Dollars)	**GDP** (Millions of Dollars)
Living Resources	*603*	*5,399*	*290*	*562.9*
Marine Construction	*129*	*1062*	*59.2*	*87.9*
Marine Transportation	*310*	*15,836*	*1,200*	*2,400*
Offshore Mineral Extraction	*96*	*126*	*6.9*	*8.0*
Tourism & Recreation	*3,880*	*56,946*	*1,200*	*2,700*
All Ocean Sectors	*5,060*	*79,827*	*2,800*	*5,700*

[31] www.csc.noaa.gov/enow/explorer/. If you select any coastal county for your state, you receive a table comparing county data to state coastal county, regional, and national information. Use the state column for your responses.

Change in Ocean and Great Lakes Economy for Coastal Counties (2005-2010)				
	Establishments (% change)	**Employment** (% change)	**Wages** (% change)	**GDP** (% change)
Living Resources	*-5.78*	*7.49*	*13.17*	*10.11*
Marine Construction	*-7.19*	*-1.21*	*0.33*	*-13.57*
Marine Transportation	*-7.46*	*12.11*	*34.87*	*69.58*
Offshore Mineral Extraction	*-15.04*	*-89.29*	*-87.66*	*-90.88*
Tourism & Recreation	*2.51*	*8.94*	*19.93*	*24.2*
All Ocean Sectors	*0.02*	*7.79*	*21.74*	*33.53*

In the table below, characterize how the threats to and use conflicts over ocean and Great Lakes resources in the state's or territory's coastal zone have changed since the last assessment.

Significant Changes to Ocean and Great Lakes Resources and Uses	
Resource/Use	**Change in the Threat to the Resource or Use Conflict Since Last Assessment** (↑, ↓, –, unkwn)
Resource	
Benthic habitat (including coral reefs)	↑
Living marine resources (fish, shellfish, marine mammals, birds, etc.)	↑
Sand/gravel	↑
Cultural/historic	unkwn
Other (please specify)	
Use	
Transportation/navigation	-
Offshore development[32]	-
Energy production	-
Fishing (commercial and recreational)	↑
Recreation/tourism	-
Sand/gravel extraction	-
Dredge disposal	↓
Aquaculture	-

[32] Offshore development includes underwater cables and pipelines, although any infrastructure specifically associated with the energy industry should be captured under the "energy production" category.

Other (please specify)	

For the ocean and Great Lakes resources and uses in Table 2 (above) that had an increase in threat to the resource or increased use conflict in the state's or territory's coastal zone since the last assessment, characterize the major contributors to that increase.

Major Contributors to an Increase in Threat or Use Conflict to Ocean and Great Lakes Resources												
Resource	**Major Reasons Contributing to Increased Resource Threat or Use Conflict** (Note All that Apply with "X")											
	Land-based development	Offshore development	Polluted runoff	Invasive species	Fishing (Comm & Rec)	Aquaculture	Recreation	Marine Transportation	Dredging	Sand/Mineral Extraction	Ocean Acidification	Other (Specify)
Example: Living marine resources		*X*	*X*	*X*	*X*	*X*		*X*	*X*			
Benthic habitat (including coral reefs)	X				X					X		
Living marine resources (fish, shellfish, marine mammals, birds, etc.)		X			X			X		X	X	
Sand/gravel	X									X		
Fishing (Commercial and recreational)		X	X		X				X		X	

If available, briefly list and summarize the results of any additional state- or territory-specific data or reports on the status and trends of ocean and Great Lakes resources or threats to those resources since the last assessment to augment the national data sets.

Massachusetts Ocean Management Plan

The Massachusetts Ocean Management Plan promulgated in 2009 addressed several issue areas. These include protection of ocean habitats and species, including listed species, fisheries, energy generation, and the balancing of trade-offs between existing human uses (commercial and recreational fishing, commerce, and recreational activities) and emerging uses (renewable energy, aquaculture, etc). Statute requires the ocean plan to be reviewed and updated at least every five years. In January 2013 EEA and CZM initiated a formal review and update of the 2009 ocean plan to meet this requirement.

Review of the 2009 Ocean Plan – The process began with a comprehensive assessment of progress and performance to achieve the requirements and commitments established by the Oceans Act and the 2009 ocean plan. EEA released the findings and results of this assessment in Review of the Massachusetts Ocean Management Plan which provides a summary of the background and context for ocean planning in Massachusetts and reports on the ocean plan development process, including the policies and management framework, plan administration

and implementation, work on science and data priorities identified in the Science Framework, and incorporation of the ocean plan into the Massachusetts Coastal Program. The document also synthesizes the views and opinions of the members of the state's Ocean Advisory Commission and Ocean Science Advisory Council on the ocean planning and implementation process, and summarizes stakeholder and public input received during a public review process in June 2013.

2014 Draft Massachusetts Ocean Management Plan – In June 2013, through four public meetings and a formal 60-day comment period, EEA gathered input on a proposed scope for updates to the 2009 ocean plan, which initiated the process for development of an updated/revised ocean plan. In June 2013 EEA convened six technical work groups (habitat, fisheries, transportation and navigation, sediment resource management, recreational and cultural services, and energy and infrastructure) to review scientific data and information and identify and characterize important trends in ocean resources and uses. At meetings in the fall and winter of 2013-2014, the Ocean Advisory Commission and Ocean Science Advisory Council reviewed draft technical work group reports. In March 2014, CZM, with support from SeaPlan (formerly the Massachusetts Ocean Partnership) held two public workshops to share information and solicit input and feedback on the findings and recommendations of the work groups. New data were incorporated and used to update and refine management areas, revise protected resources and uses, and incorporate new information for pro-active planning and siting for future projects. Based on the work group technical reports and input from advisory bodies, workshops, and public and stakeholder meetings, efforts over the spring and summer 2014 were focused on the development of the 2014 draft ocean plan, which was released for public review and comment on September 24, 2014. Five regional public hearings were held in Ipswich, Hyannis, New Bedford, Vineyard Haven, and Boston to solicit feedback. More than 75 organizations and individuals provided written and oral comments on the draft plan during the 60-day comment period. With consensus guidance from the Ocean Advisory Commission and Ocean Science Advisory Council, the draft ocean plan was revised to incorporate comments and the final 2015 Massachusetts Ocean Management Plan was released on January 6, 2015.

2015 Massachusetts Ocean Management Plan – The 2015 MA ocean plan was released on January 6, 2015. The ocean plan describes changes in six of the twelve special, sensitive, or unique (SSU) areas including: whale core habitat, hard/complex seafloor, eelgrass, and intertidal flats, and a new SSU resource for sea duck core habitat were developed. All five mapped areas of concentration of water-dependent use areas were updated, including commercial and recreational fishing, commercial traffic, and recreational boating. New information is used to conduct pro-active planning and siting of emerging projects. Although the plan does not include a formal threat assessment, an in-depth analysis was conducted to identify (and minimize) potential conflicts of emerging uses, and minimization of threats to marine resources and existing water-dependent uses. These projects include: potential transmission corridors to bring renewable energy from projects in federal waters across state waters to landside grid tie-in locations; and potential sand resources sites for further characterization, investigation, and assessment work based on integration of spatial data on

ocean sediments with SSU resources and use areas. Revision of the baseline assessment which reports on current condition, status and trends in Massachusetts marine waters.

Massachusetts Ocean Management Plan – Baseline Assessment

An important component of the ocean plan released in December 2009 was the Baseline Assessment which provided an extensive characterization of the Massachusetts Ocean Management Planning Area and surrounding area, cataloging the state of knowledge regarding human uses, natural and cultural resources, the physical environment, and economic value in Massachusetts and adjacent federal ocean waters. The Oceans Act of 2008 and section 301 CMR 28.07 of the implementing regulations for the ocean plan require that the Baseline Assessment is reviewed at least once every five years. Accordingly, the 2015 ocean plan includes a document that reports on the current conditions, status, and trends in Massachusetts marine waters, with a particular focus on climate change and the special, sensitive, or unique (SSU) estuarine and marine life and habitats and concentrations of water-dependent uses identified in the ocean plan. Relevant data from various state-specific and research reports were used to assess and summarize the changes in conditions and on significant trends observed in ecosystem resources and uses in the ocean planning area since 2009. Some of the changes were used to revise the maps of SSU areas and water-dependent uses in the ocean plan. Some examples are provided below:

- Benthic habitat - Additional data were gathered since 2009 and used to revise the hard/complex seafloor SSU including: updated CZM/*MarineFisheries* sediment database, USGS interpreted sediment maps, rocky intertidal shores from MassDEP wetlands data, Artificial reefs, Biogenic reefs (specifically *Crepidula* and worm reefs identified in seafloor photos, Board of Underwater Archaeological Resources recreational shipwreck sites designated as "exempted sites" (member sites of the NOAA/U.S. Department of the Interior National System of Marine Protected Areas), and NOAA Automated Wreck and Obstruction Information System (AWOIS) data . The hard/complex seafloor SSU resources map presented in the 2009 ocean plan covered a total of 904 km^2 (16% of the planning area). The updated map for the 2015 ocean plan, including artificial and biogenic reefs, wrecks, and obstructions, covers a total area of 756 km^2 (14% of the planning area). This reduction in the mapped area is the result of additional data points and increased accuracy. This is an important piece of information that is used in the review of permits for ocean development and helps reduce potential conflicts and impacts on important resources.
- Living Resources: Fisheries - The *MarineFisheries* annual spring and fall bottom trawl survey reports provide a state-specific perspective on trends in fisheries resources. In the spring 2013 bottom trawl survey, *MarineFisheries* found a record low aggregated biomass per tow in Cape Cod Bay and east of Cape Cod. Ocean pout were recorded at record low biomass and were absent from the 61-90 foot depth strata for the first time in state waters north of Cape Cod. Windowpane flounder were recorded at record low biomass in both the Gulf of Maine and Southern New England stock areas. Atlantic cod were recorded at record low biomass in the Gulf of Maine stock areas, and winter flounder were found at record low biomass in the Southern New England stock area. In the fall 2013 bottom trawl, *MarineFisheries* again found that catches were lighter than

historic catches. Record low biomass of both little and winter skates and low windowpane flounder catches were observed south of Cape Cod. Winter skate and winter flounder catches were low in state waters north of Cape Cod. Bay anchovy and smooth dogfish juveniles were relatively abundant in Buzzards Bay and Nantucket Sound, while juvenile haddock were abundant east of Cape Cod. Single individuals of the cownose ray, *Rhinoptera bonasus*, and the sharksucker, *Echeneis naucrates*, species that are more common in warmer waters, were recorded for the first time.

- Living Resources: Avifauna - In 2010, a joint USGS and Bureau of Ocean Energy Management (BOEM) Outer Continental Shelf (OCS) report (Compendium) compiled 65 datasets and over 400,000 seabird occurrences from studies between Florida and Canada in the time period 1978-2009.The data demonstrated that Nantucket Sound and the waters around Nantucket and Martha's Vineyard were of regional importance to sea ducks in winter. These and other data sources from the U.S. Fish and Wildlife Service (2008-2012), the College of Staten Island funded by the Massachusetts Clean Energy Center, and Mass Audubon were used to revise the Long-tailed Duck SSU to incorporate additional species and develop a more comprehensive sea duck SSU.
- Fisheries (Commercial and Recreational): In 2010, *MarineFisheries* implemented trip-level reporting for commercial fishermen with state permits, partly in response to the 2009 ocean plan recommendations. Before 2010, a permit holder could potentially have to fill out 18 species-specific annual catch reports. Now, under the new system, catch reporting is streamlined and *MarineFisheries* can more easily generate the data to update the concentrations of water-dependent use area (i.e., the high commercial fishing effort and value map in the ocean plan). Fisheries in the Northeast saw a huge change in management between 2009 and 2013 as the region's multispecies fishery moved to sector-based management instead of "days-at-sea."
- Ocean disposal: Since 2009, several dredging events resulted in nearshore or offshore sediment disposal at sites permitted by the U.S. Army Corps of Engineers. Material placed close to shore is often used for beach nourishment, which is considered a beneficial reuse. From 2009 to 2014, over 1.3 million cubic yards of dredged sediment was directed toward beneficial reuse.

Management Characterization:

Indicate if the approach is employed by the state or territory and if any significant state- or territory-level changes (positive or negative) in the management of ocean and Great Lakes resources have occurred since the last assessment?

Management Category	**Employed by State or Territory** (Y or N)	**CMP Provides Assistance to Locals that Employ** (Y or N)	**Significant Changes Since Last Assessment** (Y or N)
Statutes, regulations, policies, or case law interpreting these	Y	Y	Y

Management Category	Employed by State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
Regional comprehensive ocean/Great Lakes management plans	Y	Y	Y
State comprehensive ocean/Great Lakes management plans	Y	Y	Y
Single-sector management plans	N	N	N

For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:

a. Describe the significance of the changes;
b. Specify if they were 309 or other CZM-driven changes; and
c. Characterize the outcomes or likely future outcomes of the changes.

State Comprehensive Ocean Plan and Regulations

In December 2009, the Executive Office of Energy and Environmental Affairs (EEA) issued the Commonwealth's first-ever Massachusetts Ocean Management Plan. The release of the plan was the culmination of an intensive planning process launched with the signing of the Oceans Act in May 2008 by Governor Deval Patrick. The Oceans Act gave the EEA Secretary formal oversight, coordination, and planning authority for the Commonwealth's ocean waters and ocean-based development. It also required EEA to develop an integrated ocean management plan that: defined the Commonwealth's goals, siting priorities, and standards for ensuring effective stewardship of ocean waters and resources held in trust for the benefit of the public; reflected the importance of these waters to the Commonwealth's citizens who derive livelihoods and recreational benefits from fishing; valued biodiversity and ecosystem health; identified and protected special, sensitive, or unique estuarine and marine life and habitats; and identified appropriate locations and performance standards for activities, uses, and facilities allowed by the Ocean Sanctuaries Act [M.G.L. c. 132A §12-18].

Since December 2009 key ocean plan implementation progress includes:

- Incorporation of the Plan into the Massachusetts Coastal Program - One of the requirements of the Oceans Act is that "upon adoption, an ocean management plan shall formally be incorporated into the Massachusetts coastal zone management program." After significant consultation with and preliminary review by the National Oceanic and Atmospheric Administration (NOAA), which administers all state coastal management programs, CZM submitted a formal request to NOAA to incorporate the ocean plan and its enforceable policies into the Massachusetts Coastal Management Program (CMP) on August 19, 2011. On September 23, 2011, NOAA approved the change to the Massachusetts CMP. This work was supported by 309.

- Development of Implementing Regulations - The Oceans Act specifically requires the EEA Secretary to promulgate regulations to implement and administer the ocean plan. In August 2011, an advisory group consisting of a broad cross-section of stakeholders and interests was convened by EEA to review and provide feedback on drafts of these regulations. Chaired by CZM, the advisory group held seven meetings, and in April 2012, the draft rules were presented to and reviewed by the Ocean Advisory Commission. After formal public comment and public hearings in March and April 2013, the final regulations (contained in 301 CMR 28.00 *et seq*.) were promulgated in August 2013. This work was supported by 309.

- Guidance for Ocean Development Mitigation Fee –The Oceans Act includes a requirement that any project subject to the ocean plan shall be assessed an ocean development mitigation fee. Section 301 CMR 28.06 of the ocean plan regulations establishes that the purpose of the fee is to compensate the Commonwealth for unavoidable impacts of ocean development projects to the broad public interests and rights in the lands, waters, and resources of the planning area as well as to support the planning, management, restoration, or enhancement of marine habitat, resources, and uses pursuant to the Oceans Act. As mandated by 301 CMR 28.06 a fee structure for ocean development projects was developed to reflect differences in the scope and scale of projects and their effects on protected resources or uses. With input from an advisory working group comprised of representatives from the regulated community (including an energy utility and a legal firm representative), commercial fishing and environmental interests, and state agencies, a fee structure and accompanying guidance were developed and issued in the 2015 ocean plan. This work was supported by 309.

Regional Ocean Management Planning

In response to the Presidential Executive Order (#13547) of July 2010 that established the National Policy for Stewardship of the Ocean, our Coasts, and the Great Lakes to enhance ocean and coastal management efforts, the Northeast Regional Planning Body (RPB) was convened in November 2012 and includes representatives from the six New England states, 10 federal agencies, 10 federally recognized tribes, and the New England Fishery Management Council. While the RPB is not a regulatory body its mandate is to develop a regional ocean plan to guide future agency decision-making, consistent with existing authorities. Based on deliberations during several formal meetings and informed by public comments, stakeholder meetings and work shop outcomes, the RPB developed a framework that identified the goals, objectives, actions, and products to produce a regional ocean plan by early 2016. Work is underway on a number of projects designed to support the planning effort by compiling detailed information on human activities in ocean areas, such as commercial fishing, marine transportation and commerce, recreational boating, and other activities, as well as information on ocean ecosystems, such as areas used by marine mammals, fish, and birds.

Insight and knowledge provided by the Massachusetts ocean planning process enables the Commonwealth to play an important role on the RPB. The Northeast regional ocean planning

initiative continues to benefit the Commonwealth by expanding the scope and scale of data and information available on marine resources and uses, utilizing and building on stakeholder engagement efforts, and advancing governmental coordination. This work was supported by 309.

Indicate if your state or territory has a comprehensive ocean or Great Lakes management plan.

Comprehensive Ocean/Great Lakes Management Plan	State Plan	Regional Plan
Completed plan (Y/N) (If yes, specify year completed)	Y - Completed 2009 and 2015	N
Under development (Y/N)		Y – Expected early 2016
Web address (if available)	http://www.mass.gov/eea/waste-mgnt-recycling/coasts-and-oceans/mass-ocean-plan/2014-draft-ocean-plan.html http://www.mass.gov/eea/waste-mgnt-recycling/coasts-and-oceans/mass-ocean-plan/2015-final-ocean-plan.html	http://neoceanplanning.org/about/northeast-rpb/
Area covered by plan	Massachusetts state waters from approximately 1500 ft below mean high water.	Maine-Canada border south to Long Island Sound

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

High

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

Ocean planning provides an opportunity for innovative approaches to manage ocean resources and existing and new ocean-based uses and activities. The ocean plan provides a framework for strategies that are being implemented to address emerging threats and conflicts. However, as this continues to evolve, reliable data are needs to support science-based policies and management strategies that balance protection of ocean resources with human use. This prioritization was supported by stakeholders convened to review draft enhancement area priorities and plans. Topics of concerns that were raised, included offshore sand extraction for beach nourishment, offshore energy facilities, ocean outfalls, and climate change. For this 309 assessment and strategy, offshore energy issues are included within the Ocean Resources

enhancement area. Input from stakeholders supported this inclusion of offshore energy under Ocean Resources.

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H. Energy and Government Facility Siting

Section 309 Enhancement Objective: *Adoption of procedures and enforceable policies to help facilitate the siting of energy facilities and Government facilities and energy-related activities and Government activities which may be of greater than local significance. §309(a)(8)*

Phase I (High-Level) Assessment: *Purpose: To quickly determine whether the enhancement area is a high priority enhancement objective for the CMP that warrants a more in-depth assessment.*

Resource Characterization:

1. *In the table below, characterize the status and trends of different types of energy facilities and activities in the state's or territory's coastal zone based on best available data. If available, identify the approximate number of facilities by type. The MarineCadastre.gov may be helpful in locating many types of energy facilities in the coastal zone.*

Status and Trends in Energy Facilities and Activities in the Coastal Zone				
Type of Energy Facility/Activity	**Exists in CZ**		**Proposed in CZ**	
	(# or Y/N)	**Change Since Last Assessment** (↑, ↓, –, unkwn)	**(# or Y/N)**	**Change Since Last Assessment** (↑, ↓, –, unkwn)
Energy Transport				
Pipelines[33]	4	None	1	None
Electrical grid (transmission cables)	6	↑	1	↑
Ports	3	None	N	None
Liquid natural gas (LNG)[34]	1	None	N	None
Other (please specify)	N	None	N	None
Energy Facilities				
Oil and gas	10	↓	1	↑
Coal	1	↓	N	None
Nuclear[35]	1	None	N	None
Wind	17	↑	1	None
Wave[36]	N	None	N	None
Tidal[36]	N	None	N	None
Current (ocean, lake, river)[36]	N	None	1	None
Hydropower	N	None	N	None
Ocean thermal energy conversion	N	None	N	None

[33] For approved pipelines (1997-present): www.ferc.gov/industries/gas/indus-act/pipelines/approved-projects.asp
[34] For approved FERC jurisdictional LNG import/export terminals: www.ferc.gov/industries/gas/indus-act/lng/exist-term.asp
[35] The Nuclear Regulatory Commission provides a coarse national map of where nuclear power reactors are located as well as a list that reflects there general locations: www.nrc.gov/reactors/operating/map-power-reactors.html
[36] For FERC hydrokinetic projects: www.ferc.gov/industries/hydropower/gen-info/licensing/hydrokinetics.asp

Status and Trends in Energy Facilities and Activities in the Coastal Zone				
Type of Energy Facility/Activity	Exists in CZ		Proposed in CZ	
	(# or Y/N)	Change Since Last Assessment (↑, ↓, –, unkwn)	(# or Y/N)	Change Since Last Assessment (↑, ↓, –, unkwn)
Solar	14	↑	unkwn	None
Biomass	N	None	N	None
Municipal Solid Waste	1	None	N	None

2. *If available, briefly list and summarize the results of any additional state- or territory-specific information, data, or reports on the status and trends for energy facilities and activities of greater than local significance in the coastal zone since the last assessment.*

Energy Generation

Since the last assessment, energy generation patterns in Massachusetts have shifted, while generation capacity has remained steady. The energy generation fuel mix has changed, with a notable increase in the amount of natural gas utilized for energy generation from 38% in 2010 to 48% in 2012. While the total capacity of generating plants in Massachusetts has remained steady (~13,300 megawatts [MW] in 2010 and 13,100 MW in 2012), peak demand has increased slightly from 11,890 MW in 2009 to 12,429 MW in 2012.[37]

Since the last assessment, there have been several important changes in coastal energy generating facilities, including the following:

- In January 2010, NRG Energy ceased operations of the Somerset Station.
- In May 2011, Dominion announced that the coal-fired Salem Harbor Station power plant would shut down by June 2014. In 2012, Footprint Power acquired Salem Harbor Station and proposed a quick-start, natural gas-fired power plant at the site. In September 2013, Salem Station received what is expected to be its final shipment of coal. The proposed Footprint plant is a natural gas facility and is being designed with closed-cycle cooling, so there will no longer be an intake or discharge flow. In October 2013, the Energy Facilities Siting Board approved the petition of Footprint Power to construct the 692 MW power plant.
- In 2012, Brayton Point Power Station completed retrofits of its once-through cooling to utilize closed-cycle cooling, so its permitted intake/discharge flow is now only 70 million gallons per day (mgd). In October 2013, Dominion Energy—owner of the coal-fired Brayton Point Power Station—filed papers with Independent System Operator New England (ISO-NE) indicating that the plant would cease energy generation in May 2017.
- According to ISO-NE, as of July 2013, New Boston Station and Somerset Station no longer operate and are classified as "retired."
- Kendall Station will be reducing its intake and discharge by 95% to 3 mgd and will be selling its heat as steam.

[37] http://www.mass.gov/eea/docs/czm/oceans/ocean-plan-updates/energy-infrastructure.pdf

Renewable Energy

Significant changes since the last assessment have occurred in Massachusetts renewable energy generation. Major increases in the amount of installed solar- and wind-generated energy have been realized (though all installations have occurred outside of the planning area):

- In 2009, the total installed solar capacity was 18.5 MW, and as of June 2014, the total capacity was 518 MW. In May 2013, the Patrick Administration met its 2017 goal to have 250 MW of solar power installed in Massachusetts and announced a new goal of 1,600 MW of solar energy by 2020.
- In 2009, the total installed wind capacity was 14 MW, and as of June 2014, the total capacity was 103 MW. The Patrick Administration has set a goal of 2000 MW of wind energy by 2020.
- The Department of Public Utilities approved two 15-year contracts (one for 234 MW and the other for 127.5 MW) between Cape Wind and two Massachusetts electric distribution companies.

Offshore Wind Development

Significant progress has been made in the planning, analysis, and leasing stages of offshore wind development in federal waters adjacent to Massachusetts. This work is led by BOEM in close coordination and consultation with EEA, CZM, and other agencies through two Offshore Wind Intergovernmental Task Forces and state-led working groups on both fisheries and habitat. Major milestones and outcomes since 2009, include:

- December 2010 - BOEM issued a Request for Interest (RFI) for an offshore wind lease area off of Massachusetts, seeking developer interest and input as to resources and concerns.
- May 2011 - At the request of the Patrick Administration, the RFI area was reduced to protect areas critical to commercial fisheries, marine fauna, and navigation.
- February 2012 - BOEM identified a Wind Energy Area adjacent to Rhode Island and Massachusetts (RI-MA).
- May 2012 - BOEM identified a second Wind Energy Area adjacent to Massachusetts.
- May 2013 - A ground-breaking event marked the launch of construction on the state's New Bedford Marine Commerce Terminal. Once constructed, the terminal will be the first facility in the nation designed to support the construction, assembly, and deployment of offshore wind projects. The terminal will also be able to handle high-volume bulk and container shipping, as well as large specialty marine cargo.
- June 2013 - BOEM issued a Finding of No Significant Impact for the Environmental Assessment and Final Sale Notice for the RI-MA Wind Energy Area.
- July 2013 - BOEM held the first-ever competitive lease sale for offshore wind renewable energy in federal waters for two lease areas in the RI-MA Wind Energy Area. Deepwater Wind New England LLC was awarded both areas.
- June 2014 - BOEM released the Proposed Sale Notice for the Massachusetts Wind Energy Area.

Telecommunication Cables

- Following thorough pre-application consultation and comprehensive marine surveys and characterization, the Comcast/NStar bundled submarine fiber optic communications/electric cable completed its final MEPA review. The Secretary's Certificate in September 2012 confirmed that the proponent had satisfactorily demonstrated that the project would not significantly alter SSU resources or concentrations of water-dependent uses defined in the ocean plan. MassDEP issued a Chapter 91 license and 401 Water Quality Certification in October 2013. Installation of the bundled cables took place in May 2014.

Power Cables

- In addition to the Comcast/NStar bundled communications/electric cable, since 2009 there was also a major transmission upgrade project to address system reliability concerns in the lower southeastern Massachusetts area. The project included adding a new 345 kilovolt (kV) transmission line from a substation in Carver to a new 345/115 kV substation west of Barnstable on Cape Cod.

Natural Gas Pipelines

- The Neptune and Northeast Gateway LNG pipelines were used minimally since 2009 as ship-delivered natural gas markets were more lucrative outside of the United States. On July 24, 2012, the U.S. Department of Transportation's Maritime Administration approved a request from Neptune LNG LLC to amend its federal Deepwater Port License to include a five-year temporary suspension of port operations. Neptune's request indicated that recent conditions within the Northeast region's natural gas market had significantly impacted the Neptune Port's operational status and its ability to receive a consistent supply of natural gas imports. As a result, the Neptune Port has remained inactive over the past several years and will likely remain inactive for the foreseeable future. The suspension period became effective on June 26, 2013, and will extend for a period of five years.
- The Northeast Gateway Deepwater Port opened in 2009 and remains open. There were six visits to the port by specialized Energy Bridge Regasification Vessels (EBRV) between February 2008 and December 2009. There was no natural gas delivery on the first visit in February 2008 (it was strictly a commissioning event), there was a 33% cargo delivery in May 2008, a full cargo delivery that began in January 2009 and was not completed until May 2009 due to a methane hydrate blockage, a < 5% cargo delivery in November 2009, a full cargo delivery in December 2009, and a second delivery in December 2009 that was not successful because of an equipment malfunction.

3. *Briefly characterize the existing status and trends for federal government facilities and activities of greater than local significance[38] in the state's coastal zone since the last assessment.*

[38] The CMP should make its own assessment of what Government facilities may be considered "greater than local significance" in its coastal zone, but these facilities could include military installations or a significant federal government complex. An individual federal building may not rise to a level worthy of discussion here beyond a very cursory (if any at all) mention).

There was no significant change or trend identified in the last five years.

Management Characterization:

1. *Indicate if the approach is employed by the state or territory and if significant state- or territory-level changes (positive or negative) that could facilitate or impede energy and government facility siting and activities have occurred since the last assessment.*

Management Category	Employed by State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
Statutes, regulations, policies, or case law interpreting these	Y	y	Y
State comprehensive siting plans or procedures	Y	Y	Y

2. *For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*
   a. *Describe the significance of the changes;*
   b. *Specify if they were 309 or other CZM-driven changes; and*
   c. *Characterize the outcomes or likely future outcomes of the changes.*

Comprehensive Siting Through MA Ocean Plan

In December 2009, the Executive Office of Energy and Environmental Affairs (EEA) issued the Commonwealth's first-ever Massachusetts Ocean Management Plan. The release of the plan was the culmination of an intensive planning process launched with the signing of the Oceans Act in May 2008 by Governor Deval Patrick. The Oceans Act gave the EEA Secretary formal oversight, coordination, and planning authority for the Commonwealth's ocean waters and ocean-based development. It also required EEA to develop an integrated ocean management plan that: defined the Commonwealth's goals, siting priorities, and standards for ensuring effective stewardship of ocean waters and resources held in trust for the benefit of the public; reflected the importance of these waters to the Commonwealth's citizens who derive livelihoods and recreational benefits from fishing; valued biodiversity and ecosystem health; identified and protected special, sensitive, or unique estuarine and marine life and habitats; and identified appropriate locations and performance standards for activities, uses, and facilities allowed by the Ocean Sanctuaries Act [M.G.L. c. 132A §12-18].

In January 2013, EEA and CZM initiated a formal review and update of the 2009 Massachusetts Ocean Management Plan, beginning with a comprehensive assessment of the progress in meeting the requirements and commitments established by the Oceans Act and the initial

ocean plan. The results of this assessment were released in the document, *Review of the Massachusetts Ocean Management Plan, January 2014*, which provides a summary of the background and context for ocean planning in Massachusetts and reports on the plan development process, including the policies and management framework, plan administration and implementation, and work on science and data priorities identified in the 2009 ocean plan's Science Framework. As identified and described in *Review of the Massachusetts Ocean Management Plan, January 2014*, key ocean plan implementation progress includes:

Incorporation of the Plan into the Massachusetts Coastal Program - One of the requirements of the Oceans Act is that "upon adoption, an ocean management plan shall formally be incorporated into the Massachusetts coastal zone management program." After significant consultation with and preliminary review by the National Oceanic and Atmospheric Administration (NOAA), which administers all state coastal management programs, CZM submitted a formal request to NOAA to incorporate the ocean plan and its enforceable policies into the Massachusetts Coastal Management Program (CMP) on August 19, 2011. On September 23, 2011, NOAA approved the change to the Massachusetts CMP.

Development of Implementing Regulations - The Oceans Act specifically requires the EEA Secretary to promulgate regulations to implement and administer the ocean plan. In August 2011, an advisory group consisting of a broad cross-section of stakeholders and interests was convened by EEA to review and provide feedback on drafts of these regulations. Chaired by CZM, the advisory group held seven meetings, and in April 2012, the draft rules were presented to and reviewed by the Ocean Advisory Commission. After formal public comment and public hearings in March and April 2013, the final regulations (contained in 301 CMR 28.00 *et seq*.) were promulgated in August 2013.

Enhancement Area Prioritization:

1. *What level of priority is the enhancement area for the coastal management program?*

Medium

2. *Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.*

Energy facility siting is a medium priority enhancement area for CZM. Given the advancement of the federal offshore wind energy program as well as other known and potential offshore energy projects, approaches that support the planning, assessment, siting, resource and use effects, and other issues are needed. However, for this 309 assessment and strategy, these issues are adequately covered within the Ocean Resources enhancement area. Input from stakeholders supported this prioritization and the inclusion of offshore energy under Ocean Resources.

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I. Aquaculture

Section 309 Enhancement Objective: *Adoption of procedures and policies to evaluate and facilitate the siting of public and private aquaculture facilities in the coastal zone, which will enable states to formulate, administer, and implement strategic plans for marine aquaculture. §309(a)(9)*

Phase I (High-Level) Assessment: *Purpose: To quickly determine whether the enhancement area is a high priority enhancement objective for the CMP that warrants a more in-depth assessment.*

Resource Characterization:

1. *In the table below, characterize the existing status and trends of aquaculture facilities in the state's coastal zone based on the best available data. Your state Sea Grant Program may have information to help with this assessment.*[39]

Type of Facility/Activity	Status and Trends of Aquaculture Facilities and Activities		
	# of Facilities[40]	Approximate Economic Value	Change Since Last Assessment (↑, ↓, –, unkwn)
Shellfish	29	More than 10 million dollars	– At the end of 2009, shellfish aquaculture was performed in 29 coastal communities by 309 license holders. Seven species of shellfish were grown on approximately 1,027 acres, with production valued at over 8.5 million dollars. By 2014, the same 29 communities had 331 license holders growing the same seven species on 1,060 acres. Estimated value of the harvest had grown to over 10 million dollars.

2. *If available, briefly list and summarize the results of any additional state- or territory-specific data or reports on the status and trends or potential impacts from aquaculture activities in the coastal zone since the last assessment.*

[39] While focused on statewide aquaculture data rather than just within the coastal zone, the *Census of Aquaculture* (www.agcensus.usda.gov/Publications/2002/Aquaculture/) may help in developing your aquaculture assessment. The 2002 report, updated in 2005, provides a variety of state-specific aquaculture data for 2005 and 1998 to understand current status and recent trends. The next census is scheduled to come out late 2014 and will provide 2013 data.

[40] Be as specific as possible. For example, if you have specific information of the number of each type of facility or activity, note that. If you only have approximate figures, note "more than" or "approximately" before the number. If information is unknown, note that and use the narrative section below to provide a brief qualitative description based on the best information available.

Massachusetts Department of Fish and Game. 2012. Massachusetts Marine Fisheries 2012 Annual Report.

The primary species grown in state waters was the eastern oyster, accounting for approximately 87% of the landed value. During the previous six years, the value of oysters grown in Massachusetts waters has grown an average of 22% per year. Over the same period, the value of quahogs has fluctuated between a high of 2 million dollars in 2008 to a low of 800,000 dollars in 2012. In 2011, DMF relaxed the 3 inch size limit on oysters to 2 ½ inches, to allow growers to bring oysters to market prior to succumbing to the diseases MSX and Dermo. In 2012, DMF developed a Vibrio Control Plan in response to increasing concern over this naturally occurring pathogen. CZM played no part in its development.

A recent development is the establishment of long-line mussel farms in state and federal waters offshore of Massachusetts. These farms consist of multiple lines up to 1200 feet long, anchored to the bottom with large mooring blocks. Both surface and subsurface floats are used to suspend as many as 300 30 foot socked mussel grow lines hanging off of each longline. Plans call for as many as 40 of these longlines deployed in each far. Impacts to, including but not limited to, whales, sea turtles, and vessel navigation are possible.

Management Characterization:

1. Indicate if the approach is employed by the state or territory and if there have been any state- or territory-level changes (positive or negative) that could facilitate or impede the siting of public or private aquaculture facilities in the coastal zone.

Management Category	Employed by State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
Aquaculture comprehensive siting plans or procedures	N	N	N
Other aquaculture statutes, regulations, policies, or case law interpreting these	Y	N	N

1. *For any management categories with significant changes, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information:*
   a. *Describe the significance of the changes;*
   b. *Specify if they were 309 or other CZM-driven changes; and*
   c. *Characterize the outcomes or likely future outcomes of the changes.*

As discussed in the last assessment, the purpose of the Massachusetts aquaculture regulations [322 CMR15.00], promulgated in 2007 by the Massachusetts Division of Marine Fisheries, is to

establish a procedural and legal framework for marine aquaculture, including the possession, propagation, culture, sale and disposition of living marine organisms. The purposes of the regulations are to regulate the possession, transport, and sale of marine organisms for purposes of aquaculture; to establish operational guidelines for aquaculture facilities; to establish aquaculture license categories and procedures; and to provide a code of conduct for responsible marine aquaculture in the territorial waters of Massachusetts. It is intended that this regulation will facilitate the development of a viable marine aquaculture industry, while protecting wild populations of marine organisms and their natural habitat from degradation or introduction of invasive aquatic species, parasites or diseases. No additional regulations have been promulgated since the last assessment.

Enhancement Area Prioritization:

1. What level of priority is the enhancement area for the coastal management program?

Low

2. Briefly explain the reason for this level of priority. Include input from stakeholder engagement, including the types of stakeholders engaged.

Shellfish aquaculture that occurs in Massachusetts is a growing industry that is consolidating on two to three species, with the primary emphasis on eastern oysters. The largest areas used by growers are concentrated in five coastal communities. Broadening the industry into additional species or geographical extent is difficult due to expenses, disease, existing uses and water quality issues. Input from stakeholders supported this prioritization.

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IV. Assessment (Phase II)

A. Wetlands

In-Depth Resource Characterization:
Purpose: To determine key problems and opportunities to improve the CMP's ability to protect, restore, and enhance wetlands.

a) *What are the three most significant existing or emerging physical stressors or threats to wetlands within the coastal zone? Indicate the geographic scope of the stressor, i.e., is it prevalent throughout the coastal zone or specific areas that are most threatened? Stressors can be development/fill; hydrological alteration/channelization; erosion; pollution; invasive species; freshwater input; sea level rise/Great Lake level change; or other (please specify). When selecting significant stressors, also consider how climate change may exacerbate each stressor.*

	Stressor/Threat	**Geographic Scope** (throughout coastal zone or specific areas most threatened)
Stressor 1	Sea Level Rise	Throughout coastal zone
Stressor 1	Pollution	Throughout coastal zone
Stressor 2	Invasive species	Throughout coastal zone

b) *Briefly explain why these are currently the most significant stressors or threats to wetlands within the coastal zone. Cite stakeholder input and/or existing reports or studies to support this assessment.*

While most direct anthropogenic threats to wetland resources have been eliminated or reduced through state and federal regulatory programs, it is clear from stakeholder input that indirect threats have a great impact on wetland resources. Sea level rise is anticipated to have severe impacts that will alter the ability of wetlands to function as an ecological and protective resource. For example, salt marshes unable to accumulate sediments at a high enough rate to compensate for rising sea levels will eventually convert to intertidal flats, representing a wholesale change in ecosystem. [41]

Pollution, specifically non-point source pollution, continues to be the major source of reduced water quality in the coastal zone and elsewhere. Nutrient inputs in particular can lead to nuisance levels of aquatic vegetation, low dissolved oxygen available for estuarine life, and reduced water clarity. In salt marshes, excessive nutrient levels have been linked to shifts in

[41] Morris JT, Sundareshwar PV, Nietch CT, Kjerfve B, and Cahoon DR. 2002. Responses of coastal wetlands to rising sea level. Ecology 83(10):2867-2877.

plant community growth and production – leading to cascading impacts of bank destabilization and hastening erosion.[42]

Invasive species have wide ranging impacts on species and communities. The invasive plant *Phragmites australis* continues to colonize wide expanses of marsh, changing the dominant plant community and organisms on which they depend.[43] Non-native invertebrate species such as green crabs and Asian shore crabs prey heavily on native species, including commercially and recreationally important shellfish. The burrowing activity of green crabs in salt marshes has just begun to be explored but appears to be extensive, potentially destabilizing the marsh and increasing susceptibility to erosion.

c) *Are there emerging issues of concern but which lack sufficient information to evaluate the level of the potential threat? If so, please list. Include additional lines if needed.*

Emerging Issue	Information Needed
Other - Climate Change	Ocean acidification, thermal modification, freshwater input/salinity changes, resultant from climatic changes will impact coastal wetland resources dramatically. As of now there is not enough information to assess, predict, and manage these impacts to wetland ecosystems and organisms.
Erosion	While some monitoring information exists on the presence of green crabs in wetlands, more information is needed on the impact of the extensive burrowing behavior of this species.

In-Depth Management Characterization:
Purpose: To determine the effectiveness of management efforts to address identified problems related to the wetlands enhancement objective.

1. *For each additional wetland management category below that was not already discussed as part of the Phase I assessment, indicate if the approach is employed by the state or territory and if significant state- or territory-level changes (positive or negative) have occurred since the last assessment.*

[42] Deegan LA, Johnson DS, Warren RS, Peterson BJ, Fleeger JW, Fagherazzi S, and Wollheim WM. 2012. Coastal eutrophication as a driver of salt marsh loss. Nature 490: 388-392.

[43] Meyerson LA, Saltonstall K, Windham L, Kiviat E, and Findlay S. 2000. A comparison of *Phragmites australis* in freshwater and brackish marsh environments in North America. Wetlands Ecology and Management 8:89-103.

Management Category	Employed By State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
Wetland assessment methodologies	Y	N	Y
Wetland mapping and GIS	Y	Y	Y
Watershed or special area management plans addressing wetlands	Y	N	N
Wetland technical assistance, education, and outreach	Y	Y	N
Other (please specify)			

2. *For management categories with significant changes since the last assessment, briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information.*

Wetland assessment methodologies

a. Describe significant changes since the last assessment.

Draft Indices of Biological Integrity (IBIs) have been developed by UMass Amherst, CZM, and DEP through high level statistical analysis of vegetation and macroinvertebrate data collected and processed by CZM using our Site Level Assessment Method (SLAM) (developed as an EPA Level 2/3 field assessment) for 130 salt marsh sites from 2009-2011. Final IBIs are being developed using data collected and processed by CZM from an additional 45 sites in 2012, bringing the total IBI source dataset to 175 salt marsh sites collected from 2009-2012.

The final IBIs will be used to verify, calibrate, and improve the Conservation Assessment and Prioritization System (CAPS), our EPA Level 1 landscape assessment. CAPS is a landscape level model that predicts ecological integrity based on GIS-derived metrics representing stressors on the landscape (e.g. habitat loss, buffer zone impacts, road traffic intensity, non-native invasive plants) or resiliency (i.e. connectedness, aquatic connectedness and similarity). One output of CAPS is the Index of Ecological Integrity (IEI), a weighted combination of metric outputs yielding a score ranging from 0 to 1 for each 30 m^2 point on the landscape. The CAPS IEI values approximate the generalized stressor gradient used in the 'Biological Condition Gradient' model for waters. The goal is to produce a CAPS model that can be used statewide across all wetland types to assess the condition and integrity of wetlands. Draft IBIs have also been developed by UMass and DEP for forested wetlands and wadeable streams.

Since the last assessment CZM has also developed additional coastal metrics for inclusion in the CAPS model. Previously, metrics on the magnitude of hydrologic alteration due to tidal

restriction and measures of the density of tidal ditching had been developed. CZM has since developed a boat traffic intensity metric for estuarine systems to be included in CAPS, and has participated in development of other human disturbance metrics, such as those pertaining to beach pedestrian and off road vehicle stressors, as well as nutrient loading metrics for nitrogen and phosphorous.

A 2013 project of special merit award helped to initiate a CZM project to model the effects of sea level rise on coastal wetlands. Using long-term marsh monitoring data (where available) and complex geometric and numeric models, we are predicting wetland distribution by type over time, and identifying areas of potential loss, gain from landward migration, and barriers to landward migration. This project will provide the data, maps, and narrative that lay the foundation to improve our collective ability to enhance planning, management, and regulation of coastal wetlands in the face of sea level rise.

b. Specify if they were 309 or other CZM-driven changes.

The change that formed the basis of the modeling the effects of sea level rise on coastal wetlands project was driven by 309 and a 2013 project of special merit. Other changes were driven by CZM and DEP, with CZM leading development for coastal wetlands. Program needs were documented in the EPA-approved 5-year Massachusetts Wetland Program Plan (WPP) from 2011-2015, the updated WPP from 2013-2017, and DEP's *Massachusetts Wetlands: Monitoring and Assessment Strategy* and *Development and Use of Aquatic Life Use Standards for Wetlands in Massachusetts.*

c. Characterize the outcomes or likely future outcomes of the changes.

CZM, with DEP and UMass, will continue developing and implementing a Wetlands Monitoring and Assessment Program for the Commonwealth. Likely outcomes include establishment of a formal program to monitor and assess wetlands on a 5-yr rotating basin schedule (coupled with longstanding DEP programs for rivers and streams, and lakes and ponds); reports on the condition of wetlands to EPA under Sections 303(d), 305(b), and 314 of the Clean Water Act; prioritization of restoration and mitigation efforts of wetland resources; evaluation and enhancement, as needed, of existing state regulations and policies, as well as enforcement of said regulations; exploration of the feasibility of developing and implementing water quality standards for wetlands; and land acquisition and management efforts, among others.

Wetland Mapping and GIS

a. Describe significant changes since the last assessment.

DEP has recently developed new draft wetland map data for Massachusetts. These new data were created using the previous version data (based on 1:12,000 scale, 1990-1993 source imagery) as a base upon which modifications were made from interpretation of 1:5,000 scale, 0.5 m, 2005 source imagery. The new draft dataset delivers a more realistic picture of wetland

distribution both spatially and temporally--the difference between source imagery dates being up to 25 years--while retaining the same DEP wetland classification system employed in previous editions. We anticipate the final dataset will be published in early 2015.

Additionally, the US Fish and Wildlife Service's National Wetland Inventory (NWI) program, responsible for producing standardized wetland maps for the nation, completed a rapid update of their wetland map dataset for Massachusetts. This update yielded a much improved dataset from previous versions, with better spatial resolution, thanks to the incorporation of DEP's wetland map data. The rapid update was completed using aerial imagery captured in 2008 and 2011. These data use the longstanding NWI classification system.

b. Specify if they were 309 or other CZM-driven changes.

These changes were not 309 or other CZM-driven changes. CZM works closely with DEP wetland map developers in review of products and regularly utilizes both the DEP and NWI wetland map datasets in support of programs.

c. Characterize the outcomes or likely future outcomes of the changes.

Outcomes of these changes include contemporary wetland map datasets with greater spatial accuracy from previous versions, as well as an additional time step for wetland trends analysis.

3. *Identify and describe the conclusions of any studies that have been done that illustrate the effectiveness of the state's or territory's management efforts in protecting, restoring, and enhancing coastal wetlands since the last assessment. If none, is there any information that you are lacking to assess the effectiveness of the state's or territory's management efforts?*

In 2012 and 2014, the Massachusetts Department of Fish and Game, Division of Ecological Restoration released documents examining the success and benefits of wetland restoration in the Commonwealth. The documents *Economic Impacts of Ecological Restoration in Massachusetts* and *Estimates of Ecosystem Service Values from Ecological Restoration Projects in Massachusetts* highlight DER's effectiveness in coastal wetland restoration, specifically salt marshes. Some of the highlights of wetland restoration include: leveraging of state dollars and attraction of federal funds into the Massachusetts economy, creation of jobs, support of a number of economic sectors, "ripple effects" through the economy, increased flood protection, improved water quality, carbon sequestration, and increased property values.

In 2013 CZM staff re-sampled salt marsh restoration sites that were sampled over 10 years ago using our assessment tools to determine whether the restoration efforts were successful. Conclusions of this study are pending.

Since the last assessment, CZM, DEP, and UMass have explored the development and use of aquatic life use standards for wetlands. Working within the Wetlands Monitoring and

Assessment Program framework, we could develop a rigorous and quantitative system for establishing criteria for aquatic life based on the relationship between CAPS Indices of Ecological Integrity (representing the constraints of biological condition due to the nature of the surrounding landscape) and SLAM Indices of Biological integrity (representing actual condition of a site based on field assessments). Having numeric criteria for biological condition of wetlands based on a site's particular landscape context would better position regulators to evaluate the effectiveness of wetlands protection, restoration, and management efforts over time, as well as predict the success of certain efforts during planning stages (e.g., recovery potential).

Identification of Priorities:

1. *Considering changes in wetlands and wetland management since the last assessment and stakeholder input, identify and briefly describe the top one to three management priorities where there is the greatest opportunity for the CMP to improve its ability to more effectively respond to significant wetlands stressors. (Approximately 1-3 sentences per management priority.)*

Management Priority 1: **Development of climate change adaptation strategies for wetlands.**
Description: There is a need to develop adaptation strategies for climate change impacts and examine management techniques that can be used to protect, restore, and help wetlands adapt. Old and new techniques are being proposed and their feasibility, including likelihood for success, time horizon, cost benefit, and impacts need to be carefully examined and understood.

Management Priority 2: **Support the establishment of aquatic life use standards for wetlands through the use of numeric criteria to assess biological condition.**
Description: Since the last assessment, CZM, DEP, and UMass have explored the development and use of aquatic life use standards for wetlands. Working within the Wetlands Monitoring and Assessment Program framework, we could develop a rigorous and quantitative system for establishing criteria for aquatic life based on the relationship between CAPS Indices of Ecological Integrity (representing the constraints of biological condition due to the nature of the surrounding landscape) and SLAM Indices of Biological integrity (representing actual condition of a site based on field assessments). Having numeric criteria for biological condition of wetlands based on a site's particular landscape context would better position regulators to evaluate the effectiveness of wetlands protection, restoration, and management efforts over time, as well as predict the success of certain efforts during planning stages (e.g., recovery potential).

Management Priority 3: **Monitoring wetlands to detect impacts from climate change and other stressors.**
Description: Long term data on wetlands and the species which depend on them is vital in order to track and analyze current and future threats and stressors. Efforts will include monitoring for species sensitive to climatic changes, developing a long-term dataset to assess trends and impacts.

2. *Identify and briefly explain priority needs and information gaps the CMP has to help it address the management priorities identified above. The needs and gaps identified here do not need to be limited to those items that will be addressed through a Section 309 strategy but should include any items that will be part of a strategy.*

Priority Needs	Need? (Y or N)	Brief Explanation of Need/Gap
Research	Y	More research is needed on impacts of stressors on wetland habitats and effective climate change adaptation strategies.
Mapping/GIS	Y	Higher resolution mapping of wetland plant communities is needed to better track changes and detect impacts from climate change effects and other stressors.
Data and information management	N	
Training/capacity building	N	
Decision-support tools	Y	Decision tools are needed to evaluate best management practices for wetland climate change adaptation.
Communication and outreach	Y	Communication of science products are needed to explain and clarify climate change impacts on wetland resources. Outreach on adaptation best management practices will be needed for coastal managers.
Other (Specify)	N	

Enhancement Area Strategy Development:

1. *Will the CMP develop one or more strategies for this enhancement area?*

Yes

2. *Briefly explain why a strategy will or will not be developed for this enhancement area.*

A strategy will be developed for this enhancement area because there is a need to continue work to address coastal wetland habitat issues related to climate change and support opportunities for restoration and protection of sensitive wetland resources.

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B. Coastal Hazards

In-Depth Resource Characterization:
Purpose: To determine key problems and opportunities to improve the CMP's ability to prevent or significantly reduce coastal hazard risks by eliminating development and redevelopment in high-hazard areas and managing the effects of potential sea level rise and Great Lakes level change.

1a. **Flooding In-depth** (for all states besides territories): Using data from *NOAA's State of the Coast* "Population in the Floodplain" viewer[44] and summarized by coastal county through NOAA's Coastal County Snapshots for Flood Exposure,[45] indicate how many people at potentially elevated risk were located within the state's coastal floodplain as of 2010. These data only reflect two types of vulnerable populations. You can provide additional or alternative information or use graphs or other visuals to help illustrate or replace the table entirely if better data are available. *Note: National data are not available for territories. Territories can omit this question unless they have similar alternative data or include a brief qualitative narrative description as a substitute.*

2010 Populations in Coastal Counties at Potentially Elevated Risk to Coastal Flooding[46]				
	Under 5 and Over 65 years old		In Poverty	
	# of people	% Under 5/Over 65	# of people	% in Poverty
Inside Floodplain	112,820(1)	22.5%(2)	36,659(3)	7.3%(2)
Outside Floodplain	n/a	n/a	433,517(3)	9.8%(4)

(1) Source: NOAA, Population Living in the Coastal Floodplain, 1970-2010
(2) Calculated using 501,352 for the total population inside the floodplain (from the Coastal County Snapshots)
(3) Source: NOAA, Coastal County Snapshots for Flood Exposure, Massachusetts
(4) Calculated using 4,423,564 for the total population outside the floodplain (from the Coastal County Snapshots)

1b. **Flooding In-depth** (for all states besides territories): Using summary data provided for critical facilities, derived from FEMA's HAZUS[47] and displayed by coastal county through NOAA's Coastal County Snapshots for Flood Exposure,[48] indicate how many different establishments (businesses or employers) and critical facilities are located in the FEMA floodplain. You can provide more information or use graphs or other visuals to help illustrate or replace the table entirely if better information is available.

[44] http://stateofthecoast.noaa.gov/pop100yr/welcome.html
[45] http://www.csc.noaa.gov/digitalcoast/tools/snapshots
[46] To obtain exact population numbers for the coastal floodplain, download the excel data file from the State of the Coast's "Population in Floodplain" viewer.
[47] http://www.fema.gov/hazus; can also download data from NOAA STICS http://www.csc.noaa.gov/digitalcoast/data/stics. Summary data on critical facilities for each coastal state is available on the ftp site.
[48] http://www.csc.noaa.gov/digitalcoast/tools/snapshots

Critical Facilities in the FEMA Floodplain[44]						
	Schools	**Police Stations**	**Fire Stations**	**Emergency Centers**	**Medical Facilities**	**Communication Towers**
Inside Floodplain	45	12	8	3	2	24
Coastal Counties (Outside Floodplain)	1,938	246	212	68	85	111

2. *Based on the characterization of coastal hazard risk, what are the three most significant coastal hazards[49] within the coastal zone? Also indicate the geographic scope of the hazard, i.e., is it prevalent throughout the coastal zone or are specific areas most at risk?*

	Type of Hazard	**Geographic Scope** (throughout coastal zone or specific areas most threatened)
Hazard 1	Shoreline Erosion	Coast-wide
Hazard 2	Flooding/Coastal Storms	Coast-wide
Hazard 3	Sea Level Rise	Coast-wide

3. *Briefly explain why these are currently the most significant coastal hazards within the coastal zone. Cite stakeholder input and/or existing reports or studies to support this assessment.*

Shoreline erosion and flooding occur frequently along the coast of Massachusetts and damages to natural resources, property, and infrastructure have resulted. Over the last 30 years, some coastal communities have experienced very high rates of erosion (i.e., greater than 6 feet per year). Since 1978, FEMA payments for coastal disaster declarations in Massachusetts total more than $600 million. In addition, total costs from FEMA's National Flood Insurance Program claims for all coastal events since 1978 was nearly $370 million. When approximately 71% of the shoreline is comprised of coastal beach resource areas and 27% has been armored to manage erosion and flooding, sea level rise is also a major concern given projected rates over the next 50-100 years. These issues are presented in the draft Massachusetts Coastal Erosion Commission report, which was released in January 2015 and open for public review and through April 7, 2015. See www.mass.gov/eea/waste-mgnt-recycling/coasts-and-oceans/erosion-commission-report.html for more information.

4. *Are there emerging issues of concern, but which lack sufficient information to evaluate the level of the potential threat? If so, please list. Include additional lines if needed.*

Emerging Issue	Information Needed
n/a	

[49] See list of coastal hazards at the beginning of this assessment template.

In-Depth Management Characterization:

Purpose: To determine the effectiveness of management efforts to address identified problems related to the coastal hazards enhancement objective.

1. *For each coastal hazard management category below, indicate if the approach is employed by the state or territory and if there has been a significant change since the last assessment.*

Management Category	Employed by State/Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Change Since the Last Assessment (Y or N)
Statutes, Regulations, and Policies:			
Shorefront setbacks/no build areas	Y	Y	N
Rolling easements	Y	N	N
Repair/rebuilding restrictions	Y	Y	N
Hard shoreline protection structure restrictions	Y	Y	N
Promotion of alternative shoreline stabilization methodologies (i.e., living shorelines/green infrastructure)	Y	Y	Y
Repair/replacement of shore protection structure restrictions	Y	Y	Y
Inlet management	N	N	N
Protection of important natural resources for hazard mitigation benefits (e.g., dunes, wetlands, barrier islands, coral reefs) (other than setbacks/no build areas)	Y	Y	N
Repetitive flood loss policies (e.g., relocation, buyouts)	N	N	N
Freeboard requirements	Y	Y	N
Real estate sales disclosure requirements	N	N	N
Restrictions on publicly funded infrastructure	Y	Y	N
Infrastructure protection (e.g., considering hazards in siting and design)	Y	Y	N
Other (please specify)			
Management Planning Programs or Initiatives:			
Hazard mitigation plans	Y	Y	N
Sea level rise/Great Lake level change or climate change adaptation plans	Y	Y	Y
Statewide requirement for local post-disaster recovery planning	N	Y	N
Sediment management plans	Y	Y	N
Beach nourishment plans	Y	Y	N
Special Area Management Plans (that address hazards issues)	Y	Y	N

Management Category	Employed by State/Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Change Since the Last Assessment (Y or N)
Managed retreat plans	Y	Y	N
Other (please specify)			
Research, Mapping, and Education Programs or Initiatives:			
General hazards mapping or modeling	Y	Y	N
Sea level rise mapping or modeling	Y	Y	Y
Hazards monitoring (e.g., erosion rate, shoreline change, high-water marks)	Y	Y	Y
Hazards education and outreach	Y	Y	Y
Other (please specify)			

2. *Identify and describe the conclusions of any studies that have been done that illustrate the effectiveness of the state's management efforts in addressing coastal hazards since the last assessment. If none, is there any information that you are lacking to assess the effectiveness of the state's management efforts?*

The Massachusetts Coastal Erosion Commission recognized CZM's efforts to continue the StormSmart Coasts program. CZM released a sea level rise guidance document and a series of new fact sheets on erosion management, and launched two new coastal resilience grant programs for communities. Sea level rise layers, marine sediment data, coastal structure inventories, and updated shoreline change rates have been made available. CZM is also assisting with additional revisions to the Massachusetts Basic Building Code and regulatory standards for the Land Subject to Coastal Storm Flowage resource area.

Identification of Priorities:

1. *Considering changes in coastal hazard risk and coastal hazard management since the last assessment and stakeholder input, identify and briefly describe the top one to three management priorities where there is the greatest opportunity for the CMP to improve its ability to more effectively address the most significant hazard risks. (Approximately 1-3 sentences per management priority.)*

Management Priority 1: **Promote the use of green infrastructure for coastal resilience**
Description: Pressure to further fortify the coastline is building due to coastal storm damages over the last few years. Natural approaches can provide coastal storm damage protection and enhance natural resources. Opportunities to expand the application of green infrastructure exist with CZM's StormSmart Properties fact sheets, and coastal resilience and green infrastructure grant programs.

Management Priority 2: **Increase freeboard of development in high-hazard areas**
Description: Elevating buildings above predicted flood elevations can greatly reduce damages during coastal storm events. The Massachusetts Basic Building Code is being updated and there

is an opportunity to adopt freeboard requirements for buildings in coastal A-Zones. Communities are also interested in freeboard incentives.

Management Priority 3: **Forecast erosion trends to support managed retreat**
Description: Estimates of future shoreline movement require historical observations of shoreline positions and can utilize wave data, sediment budgets, and alongshore features. Process-based shoreline change forecasting can be applied to establish setbacks and rolling easements.

2. *Identify and briefly explain priority needs and information gaps the CMP has for addressing the management priorities identified above. The needs and gaps identified here should not be limited to those items that will be addressed through a Section 309 strategy but should include any items that will be part of a strategy.*

Priority Needs	Need? (Y or N)	Brief Explanation of Need/Gap
Research	Y	Design standards for mixed sediment nourishment and sills; effectiveness and impacts of green infrastructure applications; flood zone mapping methodologies
Mapping/GIS/modeling	Y	Coastal A-Zone mapping; sediment transport analyses and budgets; application of the Kalman filter to the MA coast
Data and information management	Y	Wave data; lidar
Training/Capacity building	Y	Green infrastructure options and case studies
Decision-support tools	Y	Continued support of Digital Coast
Communication and outreach	Y	Fact sheets on green infrastructure effectiveness
Other (Specify)	Y	Innovative adaptation strategies

Enhancement Area Strategy Development:

1. Will the CMP develop one or more strategies for this enhancement area?

Yes

2. Briefly explain why a strategy will or will not be developed for this enhancement area.

Coastal hazards risk reduction continues to be a primary concern of the Commonwealth and CZM. Coastal communities need effective options for managing vulnerability and costs of erosion, flooding, coastal storms, and sea level rise.

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C. Special Area Management Planning

In-Depth Resource Characterization:
Purpose: To determine key problems and opportunities regarding the preparation and implementation of special area management plans for important coastal areas.

1. *What are the one to three most significant geographic areas facing existing or emerging challenges that would benefit from a new or revised special area management plan (SAMP) or better implementation of an existing SAMP? For example, are there areas where existing management approaches are not working and could be improved by better coordination across multiple levels of government? What challenges are these areas facing? Challenges can be a need for enhanced natural resource protection; use conflicts; coordinating regulatory processes or review; additional data or information needs; education and outreach regarding SAMP policies; or other (please specify). When selecting significant challenges, also consider how climate change may exacerbate each challenge.*

	Geographic Scope (within an existing SAMP area (specify SAMP) or within new geographic area (describe new area))	**Challenges**
Geographic Area 1	Ocean Planning Area	Protection of natural resources and existing human uses while achieving policy goals through allowing emerging human uses (e.g., renewable energy)
Geographic Area 2	Designated Port Areas	Balancing the preservation of existing/historic infrastructure and land for water-dependent industrial use with local land use planning, changing economies/industries

2. *Briefly explain why these are currently the most significant challenges that may require developing a new SAMP, or revising or improving implementation of an existing SAMP. Cite stakeholder input and/or existing reports or studies to support this assessment.*

The 2015 Ocean Management Plan ("plan") includes a comprehensive assessment of the progress in completing the requirements and commitments established by the Oceans Act (2008) and the initial ocean plan. The plan contains siting and performance standards for specific human uses allowed in ocean waters (cables, pipelines, sand extraction for beach nourishment, and renewable energy development) and includes updated "special, sensitive, or unique life and habitats" for protection.. The plan also includes a prioritized list of science and data acquisition tasks necessary to advance ocean management in Massachusetts in the future. The development and content of the 2015 Ocean Management Plan is described more fully in the Ocean Resources section of this assessment.

CZM regulations (at 301 CMR 25.00) stipulate that CZM shall from time to time carry out reviews that apply set procedures and standards to determine whether particular areas of land or water shall be included or remain in an existing Designated Port Area (DPA). It has been apparent since the regulations were first established that several DPAs would benefit from a certain degree of "pruning" or other minor adjustment, and for this purpose an initial series of four reviews was carried out between 1994 and 2003 (two in Boston and one each in Gloucester and Plymouth). Subsequently, in 2013 and 2014, CZM conducted comprehensive boundary reviews of the Gloucester Inner Harbor and Beverly Harbor DPAs. CZM needs to resume its boundary review activities in one or more of the remaining DPAs including the Chelsea Creek, East Boston, and Weymouth Fore River DPA.

3. *Are there emerging issues of concern, but which lack sufficient information to evaluate the level of the potential threat? If so, please list. Include additional lines if needed.*

Emerging Issue	Information Needed
N/A	

In-Depth Management Characterization:

Purpose: To determine the effectiveness of management efforts to address identified problems related to the special area management planning enhancement objective.

1. *For each additional SAMP management category below that was not already discussed as part of the Phase I assessment, indicate if the approach is employed by the state or territory and if significant state- or territory-level changes (positive or negative) have occurred since the last assessment.*

Management Category	Employed by State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
SAMP research, assessment, monitoring	Y	Y	Y
SAMP GIS mapping/database	Y	Y	N
SAMP technical assistance, education, and outreach	Y	Y	N
Other (please specify)			

2. *For management categories with significant changes since the last assessment briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information.*

Designated Port Area Planning and Boundary Reviews

a. Describe significant changes since the last assessment;

Since the last assessment CZM has conducted a comprehensive boundary review of the Gloucester Inner Harbor DPA and is currently in the process of reviewing the Beverly Harbor DPA.

b. Specify if they were 309 or other CZM-driven changes; and

The boundary review of the Gloucester Inner Harbor DPA was done at the request of the City of Gloucester. The Mayor of Gloucester requested that CZM conduct a comprehensive review of the entire boundary of the DPA to inform the Municipal Harbor Plan (MHP) renewal process. The boundary review of the Beverly Harbor DPA was similarly done at the request of the Mayor of the City of Beverly. The Mayor of Beverly requested the review of the entire boundary of the DPA to inform local planning efforts which include a potential rezoning of the Beverly waterfront.

c. Characterize the outcomes or likely future outcomes of the changes.

In Gloucester, the City's MHP renewal incorporates the changes to the DPA boundary as determined by CZM in its boundary review decision issued in April 2014. This boundary review decision removed 2 (out of 7) planning units from the DPA because CZM found that these planning units were not in substantial conformance with the use character suitability criteria of the DPA regulations, because they contain a dense mix of non-industrial buildings, including residential, commercial, and recreational uses. The use character of these areas is substantially residential, with small commercial businesses and mixed residential and commercial uses as well. The waterfront primarily serves recreational boating needs, and while there are mixed residential, commercial, recreational, and industrial uses, the industrial activities are dwarfed by the extent of residential, commercial, and recreational uses.

CZM issued the boundary review report in January, 2015 with recommendations to remove the entire DPA. CZM found that the lands and waters contain a mix of residential and recreational uses, all of which are not compatible with water-dependent industrial uses. CZM expects to issue a final determination in April 2015.

3. *Identify and describe the conclusions of any studies that have been done that illustrate the effectiveness of the state's or territory's special area management planning efforts since the last assessment. If none, is there any information that you are lacking to assess the effectiveness of the state's or territory's management efforts?*

Through NOAA's 312 evaluation process, CZM was commended by several DPA stakeholders on our efforts to maintain and enhance the DPA program. CZM has taken a comprehensive approach to strengthen the program including new regulatory flexibility to allow for a greater

mix of uses; conducting DPA boundary reviews to modernize the DPA boundaries; and ongoing technical and regulatory assistance to communities through the Municipal Harbor Planning and DPA Master Planning processes.

Identification of Priorities:

1. *Considering changes with coastal resource protection or coastal use conflicts within defined geographic areas, special area management planning activities since the last assessment, and stakeholder input, identify and briefly describe the top one to three management priorities where there is the greatest opportunity for the CMP to improve their ability to prepare and implement special area management plans to effectively manage important coastal areas. (Approximately 1-3 sentences per management priority.)*

Management Priority 1: ***Conduct review of existing DPA boundaries***
Description: Since the boundaries of these DPAs were originally established in 1978, and the subsequent underlying regulatory framework was sequentially developed, there has not been a comprehensive boundary review, using the designation standards found at 301 CMR 25.04, to determine if the current boundaries of the Chelsea Creek, East Boston, and Weymouth Fore River DPAs should remain as currently established or whether they should be modified.

2. *Identify and briefly explain priority needs and information gaps the CMP has to help it address the management priorities identified above. The needs and gaps identified here do not need to be limited to those items that will be addressed through a Section 309 strategy but should include any items that will be part of a strategy.*

Priority Needs	Need? (Y or N)	Brief Explanation of Need/Gap
Research	N	
Mapping/GIS	Y	Mapping of new DPA boundaries (if appropriate)
Data and information management	Y	Utilize existing and/or create new DPA inventories which catalog port users and site characteristics
Training/Capacity building	N	
Decision-support tools	Y	Review of existing municipal records, state and federal licenses/permits and qualitative interviews with land and business owners
Communication and outreach	Y	Public information sessions, meetings, and hearings to receive feedback on current port activities and proposed boundary changes
Other (Specify)		

Enhancement Area Strategy Development:

1. *Will the CMP develop one or more strategies for this enhancement area?*

Yes

2. *Briefly explain why a strategy will or will not be developed for this enhancement area.*

A strategy will be developed for this enhancement area because there is a need to review the current DPA boundaries to ensure that they accurately reflect the criteria outlined in CZM regulations (302 CMR 25.00) and reflect the existing land use patterns in DPA communities.

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D. Ocean Resources

In-Depth Resource Characterization:
Purpose: To determine key problems and opportunities to enhance the state CMP to better address cumulative and secondary impacts of coastal growth and development.
What are the three most significant existing or emerging stressors or threats to ocean and Great Lakes resources within the coastal zone? Indicate the geographic scope of the stressor, i.e., is it prevalent throughout the coastal zone or are specific areas most threatened? Stressors can be land-based development; offshore development (including pipelines, cables); offshore energy production; polluted runoff; invasive species; fishing (commercial and/or recreational); aquaculture; recreation; marine transportation; dredging; sand or mineral extraction; ocean acidification; or other (please specify). When selecting significant stressors, also consider how climate change may exacerbate each stressor.

	Stressor/Threat	**Geographic Scope** (throughout coastal zone or specific areas most threatened)
Stressor 1	Offshore development (including cables, offshore energy facilities)	Commonwealth of Massachusetts waters
Stressor 2	Sand extraction	Commonwealth of Massachusetts waters
Stressor 3	Ocean acidification and polluted runoff	Commonwealth of Massachusetts waters

Briefly explain why these are currently the most significant stressors or threats to ocean resources within the coastal zone. Cite stakeholder input and/or existing reports or studies to support this assessment.

On behalf of the Executive Office of Energy and Environmental Affairs (EEA), the Massachusetts Office of Coastal Zone Management (CZM) serves as the lead state agency for ocean planning—working with other state agencies and regional and federal partners to balance current and new uses of ocean waters while protecting ocean habitats and promoting sustainable economic development. Starting in January 2013, CZM began working on a comprehensive update to the 2009 MA Ocean Plan and on January 6, 2015, the 2015 Ocean Plan was promulgated. Through its experience in ocean planning and management—including its role on the Bureau of Ocean Energy Management's Intergovernmental Renewable Energy Task Force, Northeast Regional Planning Body, and the Northeast Regional Ocean Council—and in its functions in project review, CZM has recognized that several offshore development projects, including pipelines, cables, offshore energy facilities, and marine sand extraction for beach nourishment, have been proposed or are in planning stages. These potential stressors and threats have been affirmed by stakeholders during the ocean plan update process and by a group convened by CZM to provide input and feedback specific to the 2014-2015 §309 assessment and strategy process. Further, monitoring conducted by state agencies, local communities, and watershed-based associations affirm that polluted runoff continues to be a threat to coastal and ocean water quality. Through

published literature, ongoing research work, and presentations, scientists from the Northeast and beyond confirm that ocean acidification is happening on the Northeast U.S. Shelf at rates comparable to the global average, which itself is unprecedented in earth's history. Data indicate elevated CO_2 and acidification in many estuaries. Polluted runoff carries nutrients and organic carbon from anthropogenic sources and are important contributing processes to ocean acidification

Are there emerging issues of concern, but which lack sufficient information to evaluate the level of the potential threat? If so, please list. Include additional lines if needed.

Emerging Issue	Information Needed
Climate change and ocean acidification	More data on changes in pH and pCO_2 levels; More research on data on perceived impacts on ecosystems and resources and potential impacts such as population shifts, changes in abundance, increased incidence of invasive species, etc
Offshore aquaculture	There is currently no off-shore commercial finfish aquaculture in MA state waters. All aquaculture facilities in the marine environment are located in-shore or near-shore and are focused on shellfish species including oyster, soft shell clam, blue mussel, quahog, and bay scallop. With growing interest in off-shore aquaculture comes the need for more information and data to inform the planning for and siting and review of projects, including trends in industry; potential effects on marine resources, habitats and species; and interactions with existing ocean uses. The 2015 Ocean Plan identifies this need and calls for an advisory group to further examine the issue. Additionally the Northeast Regional Planning Body is also looking at aquaculture on a regional scale, and its work group will help to describe current conditions and identify data needs that could inform management decisions.

In-Depth Management Characterization:
Purpose: To determine the effectiveness of management efforts to address identified problems related to the ocean and Great Lakes resources enhancement objective.

1. *For each of the additional ocean and Great Lakes resources management categories below that were not already discussed as part of the Phase I assessment, indicate if the approach is employed by the state or territory and if significant state- or territory-level changes (positive or negative) have occurred since the last assessment.*

Management Category	Employed by State or Territory (Y or N)	CMP Provides Assistance to Locals that Employ (Y or N)	Significant Changes Since Last Assessment (Y or N)
Ocean and Great Lakes research, assessment, monitoring	Y	Y	Y
Ocean and Great Lakes GIS mapping/database	Y	N	Y
Ocean and Great Lakes technical assistance, education, and outreach	Y	N	N
Other (please specify)			

2. *For management categories with significant changes since the last assessment briefly provide the information below. If this information is provided under another enhancement area or section of the document, please provide a reference to the other section rather than duplicate the information.*
    a. *Describe significant changes since the last assessment;*
    b. *Specify if they were 309 or other CZM-driven changes; and*
    c. *Characterize the outcomes or likely future outcomes of the changes.*

<u>Ocean Research, Assessment, and Monitoring and GIS mapping/database</u>
Since 2010, extensive work has been completed to identify, categorize, and map benthic habitats in Massachusetts state and adjacent federal waters. Recognizing that the understanding of the ocean ecosystem and the human services it supports will evolve, the 2009 Ocean Plan identified eight science and data actions as top priorities for a five-year timeframe. As detailed in the *2014 Review of the Massachusetts Ocean Management Plan* and in the 2014 Draft Ocean Plan, significant progress has been made towards implementing these priority actions, including considerable work to assess and characterize the ocean seafloor and benthic habitats, two intensive surveys of recreational boating activity, and significant updates to MORIS—the Massachusetts Ocean Resource Information System online mapping tool—in terms of both functionality and data contents.

Work on marine habitat assessment and mapping includes work on seafloor characterization using acoustic, photographic, and core/grab sample data. This work has improved understanding and locations of unique marine habitats, including kelp beds, mussel beds/reefs, and reef-forming gastropod species (*Crepidula* sp.), along with associated sediments using over ten thousand high resolution images of the seafloor. These data were also used to validate the accuracy of refinements to the hard/complex sensitive special and unique (SSU) and biogenic reef areas in the Massachusetts Ocean Plan update. These changes were identified in the 309 Ocean Uses Strategy for the Ocean Management Plan update and also supports the Cumulative and Secondary Impacts strategy to refine the "special, sensitive, or unique" (SSU) areas, identify new data sources, and ultimately produce more accurate and detailed habitat maps and SSU

delineations for the Massachusetts Ocean Plan. The refinements to the hard/complex sea floor SSU have been incorporated into the 2015 Massachusetts Ocean Plan update.

In the update of the 2009 Ocean Plan, CZM worked with scientists and technical experts to acquire and analyze new distribution and abundance data for critical marine species, including North Atlantic Right Whale, Humpback Whale, Fin Whale, sea ducks, eelgrass, and important fish species.

CZM and the MA Division of Marine Fisheries (*MarineFisheries*) are also working on the application of marine habitat classification frameworks for the ocean planning area. CZM is applying NOAA's Coastal and Marine Ecological Classification Standard to areas of Massachusetts that have sufficient data, and the Commonwealth's seafloor classification scheme includes surficial sediment, the geoforms underlying this sediment, a description of the temporal stability of the sediment, a limited number of depth classes, a description of the physical characteristics of the water column (e.g., mean temperature, current velocity, and salinity) in a given location, and descriptions of the dominant macrofauna, macroalgae, and/or infaunal community. CZM and *MarineFisheries* were participants in a regional marine habitat project to review a range of approaches to marine habitat classification and developing recommendations for regional habitat mapping and classification efforts to advance management of ocean habitats.

In February 2011, CZM released the updated and enhanced version of the Massachusetts Ocean Resources Information System (MORIS) online mapping tool, which can be used to search and display spatial data pertaining to the Massachusetts coastal zone. Users can interactively access various data layers (e.g., tide gauge stations, marine protected areas, access points, eelgrass beds, etc.) over a backdrop of aerial photographs, political boundaries, natural resources, human uses, bathymetry, or other data including Google basemaps, and can create and share maps and download data.

Since 2010 several major efforts have been undertaken to gather spatial and economic data on recreational boating activity. A partnership of many organizations led by SeaPlan (formerly the Massachusetts Ocean Partnership) and including CZM and the Massachusetts Marine Trades Association (MMTA), conducted two surveys in 2010 and 2012 to gather data on boating trips, including expenditures, recreational activities, and routes. Results gave an indication of recreational boating patterns in Massachusetts and provided an approximate estimate of the economic contribution of this activity to the Massachusetts economy. Both datasets as well as data compiled through a rapid assessment exercise conducted by the Massachusetts Marine Trades Association in 2013 served to revise the map of recreational boating in the 2015 ocean plan and develop a better representation of spatial patterns by this water-dependent activity.

As described in Section II, much of this work was advanced under 309 projects.

3. *Identify and describe the conclusions of any studies that have been done that illustrate the effectiveness of the state's or territory's management efforts in planning for the use of*

ocean and Great Lakes resources since the last assessment. If none, is there any information that you are lacking to assess the effectiveness of the state's or territory's management efforts?

The first step in the revision and update of the Massachusetts Ocean Plan involved a comprehensive assessment of progress and performance to achieve the requirements and commitments established by the Oceans Act and the ocean plan. The results of this assessment were released in Review of the Massachusetts Ocean Management Plan (January 2014) which provides a summary of the background and context for ocean planning in Massachusetts since 2009 and reports on the ocean plan development process, including the policies and management framework, plan administration and implementation, and work on science and data priorities identified in the Science Framework. The document also synthesizes the views and opinions of the state's Ocean Advisory Commission and Ocean Science Advisory Council on the ocean planning and implementation process, and summarizes stakeholder and public input received during a public review process in June 2013. The primary summary findings of the review are summarized in the Review of the Massachusetts Ocean Management Plan document and address the planning process, development of a plan policy and management framework, plan administration and implementation, stakeholder engagement, and enhancement and incorporation of science to inform trends and conditions and identify gaps. Primary findings are summarized below:

The 2009 Ocean Plan includes a preliminary list of environmental, socioeconomic and management indicators selected by experts based on a set of criteria in a first step towards development of strategy to assessment the plan's effectiveness. Extensive revision of the process in consultation with SeaPlan has resulted in development of a comprehensive framework that better fits the structure of the ocean planning process and meets the needs of managers and informs decision-making. The framework will guide the collection of qualitative and quantitative data and information on the effectiveness of management and implementation efforts of the ocean plan. The new framework is outlined in the 2015 Massachusetts Ocean Plan.

The advances in Ocean research, assessment, and mapping described above directly informed the update of the 2015 Ocean Plan, including formal maps identifying protected resources and use areas, trends for the ocean conditions described in the Baseline Assessment, and the development of new science and data priorities.

Identification of Priorities:

1. *Considering changes in threats to ocean and Great Lakes resources and management since the last assessment and stakeholder input, identify and briefly describe the top one to three management priorities where there is the greatest opportunity for the CMP to improve its ability to effectively plan for the use of ocean and Great Lakes resources. (Approximately 1-3 sentences per management priority.)*

Management Priority 1: **Planning for offshore development**

Description: Several offshore development projects, including cables, offshore energy facilities, and marine-based sand extraction for beach nourishment, have been proposed, are in planning stages, and/or are reasonably foreseeable in state and adjacent federal waters. Advancing pro-active planning, analysis, and siting measures under the state's Ocean Plan will result in better outcomes for ocean resource protection, support for important existing water-dependent uses, and the implementation of new, sustainable activities in ocean waters. With the planning of offshore wind energy development by the Bureau of Ocean Energy Management on the outer continental shelf south of Massachusetts, Massachusetts is actively working on the planning and analysis of potential routes for transmission cables from the wind energy facilities to land. Data compiled during the ocean plan process will provide the necessary information to ensure minimal impact on ocean ecosystems and habitats that may otherwise occur from this infrastructure. Additional characterization of these areas is required to facilitate this effort.
In Massachusetts, many communities are currently facing critical erosion and flooding threats to public infrastructure and services, recreational opportunities, and natural habitat and ecological function. These threats are resulting is increased interest in utilizing ocean sand resources for beach and dune nourishment and restoration. While there are considerable offshore sand resources in certain offshore areas the extraction for beach nourishment must be balanced with the protection of marine ecosystems—especially impacts on habitat for commercial and another important fish species—and water-dependent uses. Careful and in-depth characterization of sources, potential impacts, needs and cost-benefit analysis are required for effective planning for use of these resources.

Management Priority 2: **Improving science and knowledgebase**
Description: The management of ocean resources and uses, including the siting of energy facilities, must be based on and informed by the best available science, and this is a central principle of the ocean planning in Massachusetts and for the Northeast. In the 2015 Ocean Plan's Science Framework (Volume 2), there are a number of critical science and data needs, including: advancing the characterization and classification of marine habitats, monitoring climate change across Massachusetts ocean waters, identifying ecologically important areas, working on effort-corrected data for sea turtle and marine birds; and developing higher resolution maps and characterization of recreational and commercial fishing.

2. *Identify and briefly explain priority needs and information gaps the CMP has to help it address the management priorities identified above. The needs and gaps identified here do not need to be limited to those items that will be addressed through a Section 309 strategy but should include any items that will be part of a strategy.*

Priority Needs	Need? (Y or N)	Brief Explanation of Need/Gap
Research	Y	Develop greater understanding of climate change effects—including ocean acidification—on ocean resources and development of appropriate management/policy response.
Mapping/GIS	Y	Continue to improve quality and spatial accuracy of current maps on marine habitats, species, resources, and ocean uses.

Data and information management	N	
Training/Capacity building	N	
Decision-support tools	Y	Development and implementation of compatibility assessments; better understanding of potential interactions with ocean development projects and ocean resources and uses; siting and optimization analyses.
Communication and outreach	Y	Continuing to work with key stakeholders and to build on and improve the communication, outreach and participation of new ones.
Other (Specify)		

Enhancement Area Strategy Development:

1. *Will the CMP develop one or more strategies for this enhancement area?*

Yes

2. *Briefly explain why a strategy will or will not be developed for this enhancement area.*

Protecting ocean resources and sustainable water-dependent uses are critical to the Commonwealth and this Nation and continue to support productive maritime industries, coastal communities and marine life. New approaches to manage ocean resources have been developed and are being implemented through the Ocean Plan, but continuing and emerging threats and conflicts remain. Reliable data is needed to support science-based policies and comprehensive management strategies that balance human use and protection of the ocean environment. Offshore energy facility siting is covered under this Ocean Resources enhancement area.

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V. Strategies

A. Wetlands - Developing climate change adaptation techniques for salt marshes

I. Issue Area(s)

The proposed strategy or implementation activities will support the following high-priority enhancement areas:

Wetlands
Coastal Hazards

II. Strategy Description

A. *The proposed strategy will lead to, or implement, the following types of program changes:*

☐ *A change to coastal zone boundaries;*
X *New or revised authorities, including statutes, regulations, enforceable policies, administrative decisions, executive orders, and memoranda of agreement/understanding;*
X *New or revised local coastal programs and implementing ordinances;*
X *New or revised coastal land acquisition, management, and restoration programs;*
☐ *New or revised special area management plans (SAMP) or plans for areas of particular concern (APC) including enforceable policies and other necessary implementation mechanisms or criteria and procedures for designating and managing APCs; and,*
X *New or revised guidelines, procedures, and policy documents which are formally adopted by a state or territory and provide specific interpretations of enforceable CZM program policies to applicants, local government, and other agencies that will result in meaningful improvements in coastal resource management.*

B. ***Strategy Goal:***

This strategy will research and develop recommendations for the application of climate change adaptation measures in coastal wetlands and inform policies to protect and preserve the ecosystem services of salt marshes in the Massachusetts coastal zone, especially flood protection and erosion control.

C. *Describe the proposed strategy and how the strategy will lead to and/or implement the program changes selected above. If the strategy will only involve implementation activities, briefly describe the program change that has already been adopted, and how the proposed activities will further that program change. (Note that implementation strategies are not to exceed two years.)*

Future changes in climate, particularly sea level rise, are projected to have profound impacts on salt marsh resources. As sea levels rise beyond the capacity for salt marshes to accumulate sediment and gain elevation, they will begin to drown –leading to cascading impacts to the system and a loss of important ecological and protective ecosystem services. If left alone, this deterioration will continue until ultimately the habitat converts from marsh platform to tidal mud flat. While marshes bordering suitable lands may be able to migrate upland in response to sea level rise, in many coastal areas the presence of development such as roads, homes, hardened shorelines, and other structures create a barrier preventing the ability of marshes to adapt to rising sea levels in this way.

It is clear that to meet the challenge of sea level rise, management techniques are needed to increase the ability of salt marshes to adapt to a changing climate and maintain their unique and distinct habitat value, protective functions against coastal hazards, and carbon storage capacity. Several adaptation measures have been developed or are in development for salt marshes but the efficacy and application of these have not been explored in depth for Massachusetts, nor is there a standard set of expectations for performance of these techniques. There is a real need to develop recommendations and policy for the application of climate change adaptation techniques for salt marshes, including the development of performance benchmarks to ensure that implemented strategies are scientifically sound, provide the intended results within acceptable impact limits, and are viable for the short and long term.

In 2013 CZM was awarded a project of special merit grant to implement a 309 strategy to characterize the impact of sea level rise on salt marshes. This project, nearly complete, will develop site specific, statewide predictions of wetland impacts—including areas where there is high vulnerability to loss, areas where change in type could be expected, impediments to marsh migration, and areas where wetlands can migrate and sustain. This wetland strategy will build on this work by researching and developing recommendations for climate change adaptation in salt marshes to inform policy and ultimately protect wetland function from climate change related impacts.

This project will review existing adaptation measures for salt marshes, identify and track case studies of projects in coordination with the CZM's green infrastructure grant program, and communicate and collaborate with managers and other stakeholders to develop recommendations on effective salt marsh adaptation measures and their application, including regulatory and policy considerations. Using the information compiled during an in-depth analysis and review of adaptation measures, case studies and stakeholder input, a series of factsheets will be developed to enable informed and effective decision making for the use and regulation of these techniques in salt marshes. Potential topics include (but are not limited to):

- Strategies to increase elevation such as sediment deposition, including dredge spoil repurposing;
- Shoreline stabilization techniques including soft solutions and living shorelines (green infrastructure);
- Methods to reduce interior ponding of the marsh surface; and

- Management techniques to aid landward salt marsh migration such as removal of invasive plants, tree cover management, transitional plantings, and strategic land acquisition.

For each type of adaptation technique, potential impacts, ease of use, viability, and siting considerations will be described to inform decision making on the selection and use of these tools for salt marsh climate change adaptation. In addition, performance benchmarks for both the short and long term will be established for each method to serve as the basis for monitoring to track both long term and short term impacts and results.

This strategy will continue the work of CZM to manage wetland resources in the face of climate change by informing policies to protect and restore wetland functions. The information generated by this project will improve implementation of CZM Habitat Policy 1 to: *"Protect coastal, estuarine, and marine habitats—including salt marshes… to preserve critical wildlife habitat and other important functions and services including nutrient and sediment attenuation, wave and storm damage protection, and landform movement and processes"* and Coastal Hazards Policy 1 to: "*Preserve, protect, restore, and enhance the beneficial functions of storm damage prevention and flood control provided by natural coastal landforms, such as … salt marshes*…" and their underlying legal authorities including the Wetlands Protection Act and its regulations. The information produced from this project will be formally adopted as procedural guidance by CZM and used by CZM and other state agencies and local Conservation Commissions to assist their regulatory decision making.

III. Needs and Gaps Addressed

Identify what priority needs and gaps the strategy addresses and explain why the proposed program change or implementation activities are the most appropriate means to address the priority needs and gaps. This discussion should reference the key findings of the assessment and explain how the strategy addresses those findings.

This project will directly address the need to provide improved and informed decision making tools to allow coastal managers to implement and/or regulate the most appropriate techniques to preserve wetland ecosystem services in the face of climate change.

IV. Benefits to Coastal Management

Discuss the anticipated effect of the strategy, including the scope and value of the strategy, in advancing improvements in the CMP and coastal management, in general.

The increasing recognition of the threats of a rising sea to critical coastal habitats has led to widespread concern among government agencies, local officials, and citizens regarding a relatively urgent need to explore, identify, and begin implementation of options for adaptation. From CZM's work on sea level rise impacts on wetlands, we are able to identify salt marsh areas at risk. The next step is how to effectively manage salt marshes to ensure that they can sustain the impacts of sea level rise. This project will directly benefit coastal zone management by giving managers the tools they need to select the most appropriate techniques to use for salt

marsh adaption and to track the viability of these efforts through time. This will in turn, support enhanced interpretation of CZM policies and networked authorities as well as related planning and management efforts. Regulatory decision makers during review of permits or requests for authorization can use this information to ensure consistency with the Massachusetts Wetlands Protection Act, particularly the streamlined permitting process applicable for restoration projects. Similarly, the information generated through this project will also support other important management efforts such as identification of priority restoration areas or sites for land acquisition or easement actions.

V. Likelihood of Success

The likelihood of success is high. CZM and its partners have high caliber wetlands personnel with extensive estuarine ecosystem and regulatory experience and a strong history of creating tools to enhance and inform coastal management decision making. This project provides critical information on adaptation measures for salt marshes that is needed to support better implementation of policies and authorities as well as planning and management. CZM will work with partners to develop specific approaches for implementation efforts.

VI. Strategy Work Plan

Using the template below, provide a general work plan that includes the major steps that will lead toward or achieve a program change or implement a previously achieved program change. If the state intends to fund implementation activities for the proposed program change, describe those in the plan as well. The plan should identify a schedule for completing the strategy and include major projected milestones (key products, deliverables, activities, and decisions) and budget estimates. If an activity will span two or more years, it can be combined into one entry (i.e., Years 2-3 rather than Year 2 and then Year 3). While the annual milestones are a useful guide to ensure the strategy remains on track, OCRM recognizes that they may change somewhat over the course of the five-year strategy unforeseen circumstances. The same holds true for the annual budget estimates. Further detailing and adjustment of annual activities, milestones, and budgets will be determined through the annual cooperative agreement negotiation process.

Strategy Goal: This strategy will research and develop recommendations for the application of climate adaptation measures in coastal wetlands and inform policies to protect and preserve the ecosystem services of salt marshes in the Massachusetts coastal zone, especially flood protection and erosion control.
Total Years: 5
Total Budget: $350,000

Year: 1
Description of activities: Research existing adaptation techniques, conduct literature review of climate change adaptation measures for salt marshes, examine adaptation projects underway in other states, summarize and synthesize the available information on climate change adaptation measures for salt marshes, identify data gaps and needs.

Major Milestone(s): Summary of findings to serve as basis for salt marsh climate change adaptation recommendations
Budget: $67,000

Year: 2
Description of activities: Present the summarized information to stakeholders, managers and experts; solicit comment and feedback on potential adaptation techniques to inform recommendations. Working with the green infrastructure grant program within CZM, identify 1-3 projects which focus on increasing the resiliency of salt marshes to follow through time to assess effectiveness of the techniques used. This information will be used to develop case studies to inform future salt marsh adaptation and management efforts.
Major Milestone(s): Stakeholder input, expert elicitation, case study selection
Budget: $67,000

Year: 3-4
Description of activities: Using feedback from stakeholders, experts, case studies, and literature review, select climate change adaptation measures. Develop factsheets on salt marsh climate change adaptation measures for web distribution. Develop performance benchmarks and implementation recommendations.
Major Milestone(s): Factsheet series on climate change adaption techniques available for salt marshes to inform the selection, siting, and regulation of these measures in the coastal zone.
Budget: $149,000 (total for the two years)

Year: 5
Description of activities: Conduct training and outreach about available climate adaptation measures and available tools, i.e. factsheets, for technique selection. Work with DEP, DFG, and other partners to incorporate recommendations on salt marsh adaptation practices into policy. Revise CZM program policies to include these recommendations.
Major Milestone(s): Incorporation of recommendations on climate change adaptation techniques for salt marshes into CZM program policies and other program policy as applicable.
Budget: $67,000

VII. Fiscal and Technical Needs

A. Fiscal Needs: *If 309 funding is not sufficient to carry out the proposed strategy, identify additional funding needs. Provide a brief description of what efforts the CMP has made, if any, to secure additional state funds from the legislature and/or from other sources to support this strategy.*

We anticipate that 309 resources will be sufficient to carry out the proposed strategy, with supplementation by additional support from other federal, state, or NGO sources as necessary.

B. Technical Needs: *If the state does not possess the technical knowledge, skills, or equipment to carry out all or part of the proposed strategy, identify these needs. Provide a brief*

description of what efforts the CMP has made, if any, to obtain the trained personnel or equipment needed (for example, through agreements with other state agencies).

CZM staff currently have sufficient technical knowledge and skills to carry out the majority of the proposed project in-house, technical and policy capacities may be supported by other states, federal agencies, and regional organizations.

VIII. Projects of Special Merit (Optional)

If desired, briefly state what projects of special merit the CMP may wish to pursue to augment this strategy. Any activities that are necessary to achieve the program change or that the state intends to support with baseline funding should be included in the strategy above. The information in this section will not be used to evaluate or rank projects of special merit and is simply meant to give CMPs the option to provide additional information if they choose. Project descriptions should be kept very brief (e.g., undertake benthic mapping to provide additional data for ocean management planning). Do not provide detailed project descriptions that would be needed for the funding competition.

Specific activities described above may be identified and advanced as a project of special merit to augment this strategy.

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B. Coastal Hazards - Demonstrating Effectiveness of Green Infrastructure to Provide Coastal Storm Damage Protection

I. Issue Area(s)

The proposed strategy or implementation activities will support the following high-priority enhancement areas (check all that apply):

Coastal Hazards

II. Strategy Description

A. *The proposed strategy will lead to, or implement, the following types of program changes (check all that apply):*

☐ *A change to coastal zone boundaries;*

☐ *New or revised authorities, including statutes, regulations, enforceable policies, administrative decisions, executive orders, and memoranda of agreement/understanding;*

☐ *New or revised local coastal programs and implementing ordinances;*

☐ *New or revised coastal land acquisition, management, and restoration programs;*

☐ *New or revised special area management plans (SAMP) or plans for areas of particular concern (APC) including enforceable policies and other necessary implementation mechanisms or criteria and procedures for designating and managing APCs; and,*

X *New or revised guidelines, procedures, and policy documents which are formally adopted by a state or territory and provide specific interpretations of enforceable CZM program policies to applicants, local government, and other agencies that will result in meaningful improvements in coastal resource management.*

B. Strategy Goal:

Monitor three green infrastructure projects to demonstrate effectiveness and develop case studies/guidelines to encourage local implementation.

C. *Describe the proposed strategy and how the strategy will lead to and/or implement the program changes selected above. If the strategy will only involve implementation activities, briefly describe the program change that has already been adopted, and how the proposed activities will further that program change. (Note that implementation strategies are not to exceed two years.)*

As described in the Coastal Hazards Assessment, one management priority is to promote the use of green infrastructure for coastal resilience as an alternative to shoreline stabilization structures. This enhancement strategy focuses on monitoring and demonstrating the effectiveness of green infrastructure projects to provide coastal storm damage protection along a variety of shoreline types. The strategy implements recommendations of the Massachusetts Climate Change Adaptation Advisory Committee (2012) as well as the Massachusetts Coastal Erosion Commission (2014). The development of case studies and guidelines will also improve

the state's management efforts and implementation of the Coastal Hazards Policy #1, and lead to a program change. Through this enforceable coastal hazards policy, CZM seeks to "*preserve, protect, restore, and enhance the beneficial functions of storm damage prevention and flood control provided by natural coastal landforms, such as dunes, beaches, barrier beaches, coastal banks, land subject to coastal storm flowage, salt marshes, and land under the ocean*." Currently, few local examples and best practices exist to support this policy.

III. Needs and Gaps Addressed

Identify what priority needs and gaps the strategy addresses and explain why the proposed program change or implementation activities are the most appropriate means to address the priority needs and gaps. This discussion should reference the key findings of the assessment and explain how the strategy addresses those findings.

The Coastal Hazards Assessment included a few research, training, and outreach needs that currently affect the Commonwealth's ability to promote proactive use of green infrastructure applications. Effectiveness and impacts of green infrastructure have not been well documented in Massachusetts or New England. Communities and other local partners would like to see where green infrastructure technologies have worked in Massachusetts and learn how to modify and improve designs according to different coastal environments. Fact sheets are critical to communicating preferred StormSmart approaches.

IV. Benefits to Coastal Management

Discuss the anticipated effect of the strategy, including the scope and value of the strategy, in advancing improvements in the CMP and coastal management, in general.

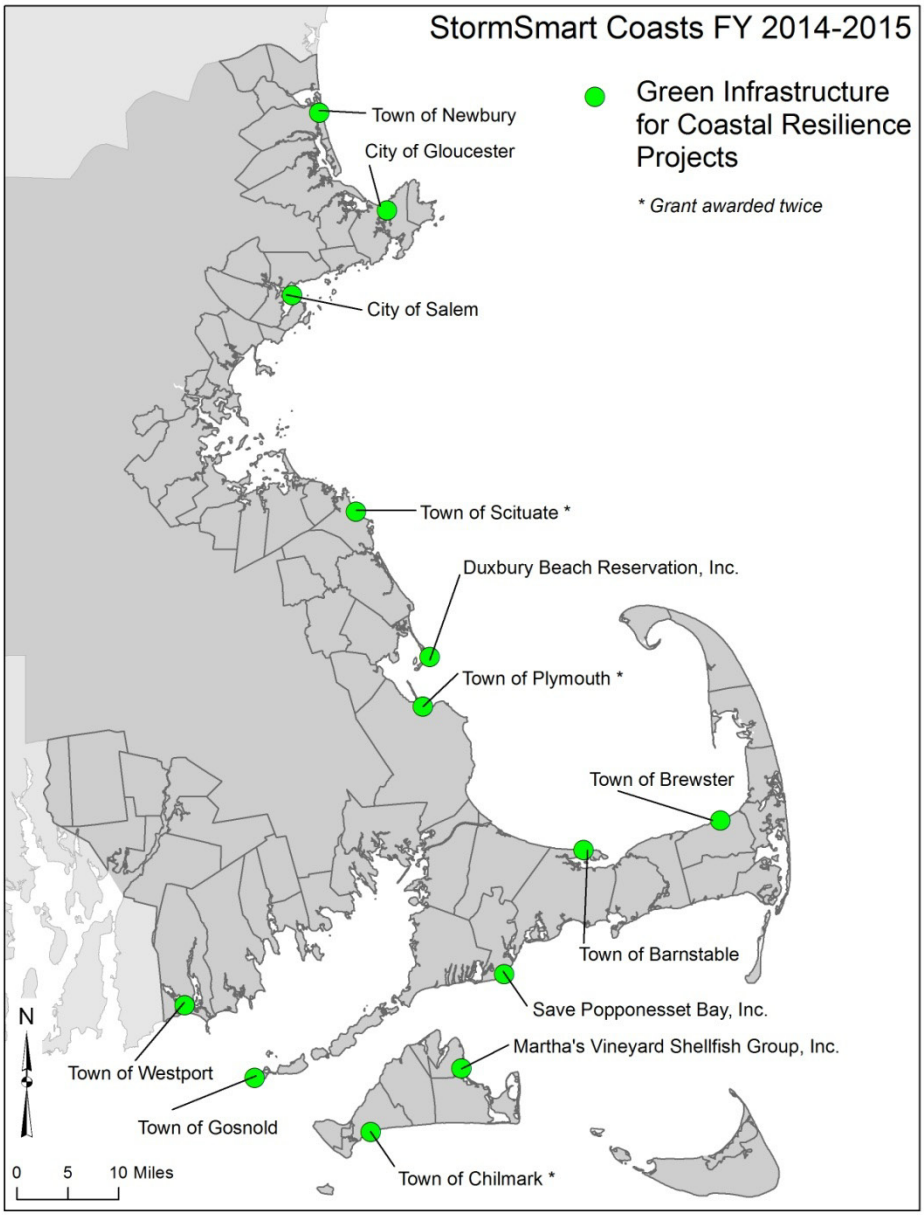
An expanded StormSmart Properties toolkit will bring much-needed information and guidance to state and local officials engaged in adaptation planning and regulatory decision making, and homeowners looking to protect their properties while enhancing natural beneficial functions of coastal landforms. By demonstrating green infrastructure can provide storm damage protection in Massachusetts, current pressure to further armor the shoreline can be alleviated to some degree.

V. Likelihood of Success

Discuss the likelihood of attaining the strategy goal and program change (if not part of the strategy goal) during the five-year assessment cycle or at a later date. Address the nature and degree of support for pursuing the strategy and the proposed program change and the specific actions the state or territory will undertake to maintain or build future support for achieving and implementing the program change, including education and outreach activities.

In January 2014, Governor Patrick announced a coordinated plan for climate preparedness to increase resiliency across the Commonwealth. Included in the plan was funding to reduce risk associated with coastal storms and sea level rise, invest in the repair or removal of critical coastal infrastructure (e.g., seawalls), and advance green infrastructure projects to protect

public assets, help restore ecological systems and benefit public safety in coastal communities. CZM's Coastal Community Resilience Grant Program and Green Infrastructure for Coastal Resilience Grant Program are important components of this climate preparedness plan for coastal cities and towns. In the first two rounds of funding through these grant programs (April 2014 and December 2014), over $5 million has been awarded to 27 different coastal cities, towns and non-profit organizations to complete 37 projects aimed at improving resilience to coastal storm and climate change impacts. Sixteen green infrastructure projects have been funded including building and enhancing dunes and beaches using new methodologies and materials, and employing ribbed mussels for shoreline protection. A third round of projects will be announced in July 2015.



The strategy goal aligns with CZM's StormSmart Coasts program, which has proven successful since its inception. Through StormSmart Coasts, CZM has advanced regulatory, planning,

mapping, and outreach tools to improve management of natural resources and public safety along coastal shorelines and floodplains.

VI. Strategy Work Plan

Using the template below, provide a general work plan that includes the major steps that will lead toward or achieve a program change or implement a previously achieved program change. If the state intends to fund implementation activities for the proposed program change, describe those in the plan as well. The plan should identify a schedule for completing the strategy and include major projected milestones (key products, deliverables, activities, and decisions) and budget estimates. If an activity will span two or more years, it can be combined into one entry (i.e., Years 2-3 rather than Year 2 and then Year 3). While the annual milestones are a useful guide to ensure the strategy remains on track, OCRM recognizes that they may change somewhat over the course of the five-year strategy unforeseen circumstances. The same holds true for the annual budget estimates. Further detailing and adjustment of annual activities, milestones, and budgets will be determined through the annual cooperative agreement negotiation process.

Strategy Goal: Monitor three CZM-funded green infrastructure projects to demonstrate effectiveness and develop case studies/guidelines to encourage local implementation. Depending on the types of green infrastructure technologies selected for monitoring, the following data may be collected: storm damages, shoreline change along and neighboring installations, other sediment/soil conditions, vegetation survival and growth, shellfish survival and growth, water levels, and salinity. Maintenance and improvements will also be evaluated.

Total Years: 4
Total Budget: $220,000

Year(s): 1-2
Description of activities: Select three CZM-funded green infrastructure projects, determine appropriate monitoring methodologies, establish field schedules, and collect data. Diversity of shoreline type, ecological parameters, green infrastructure technology, level of development, and geography will be considered when selecting representative projects.
Major Milestone(s): Seasonal monitoring data collected
Budget: $100,000

Year(s): 3-4
Description of activities: Analyze monitoring data, develop technical content for fact sheet(s) on the selected shore protection techniques, edit and publish the fact sheet(s) on the StormSmart Properties web page, and conduct local workshops.
Major Milestone(s): 1-3 StormSmart Properties fact sheets completed
Budget: $120,000

VII. Fiscal and Technical Needs

A. Fiscal Needs: *If 309 funding is not sufficient to carry out the proposed strategy, identify additional funding needs. Provide a brief description of what efforts the CMP has made, if any, to secure additional state funds from the legislature and/or from other sources to support this strategy.*

CZM anticipates supplementing 309 funding with support through the coastal resilience grant programs and academic partnerships.

B. Technical Needs: *If the state does not possess the technical knowledge, skills, or equipment to carry out all or part of the proposed strategy, identify these needs. Provide a brief description of what efforts the CMP has made, if any, to obtain the trained personnel or equipment needed (for example, through agreements with other state agencies).*

CZM will likely seek pro-bono technical assistance from bioengineering consultants who have provided their expertise on other StormSmart Properties fact sheets.

VIII. Projects of Special Merit (Optional)

If desired, briefly state what projects of special merit the CMP may wish to pursue to augment this strategy. Any activities that are necessary to achieve the program change or that the state intends to support with baseline funding should be included in the strategy above. The information in this section will not be used to evaluate or rank projects of special merit and is simply meant to give CMPs the option to provide additional information if they choose. Project descriptions should be kept very brief (e.g., undertake benthic mapping to provide additional data for ocean management planning). Do not provide detailed project descriptions that would be needed for the funding competition.

Specific activities described above may be identified and advanced as a project of special merit to augment this strategy.

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C. Special Area Management Plan – Designated Port Area Boundary Reviews

I. Issue Area(s)

The proposed strategy or implementation activities will support the following high-priority enhancement areas (check all that apply):

Special Area Management Planning

II. Strategy Description

A. *The proposed strategy will lead to, or implement, the following types of program changes (check all that apply):*

☐ *A change to coastal zone boundaries;*

☐ *New or revised authorities, including statutes, regulations, enforceable policies, administrative decisions, executive orders, and memoranda of agreement/understanding;*

☐ *New or revised local coastal programs and implementing ordinances;*

☐ *New or revised coastal land acquisition, management, and restoration programs;*

X *New or revised special area management plans (SAMP) or plans for areas of particular concern (APC) including enforceable policies and other necessary implementation mechanisms or criteria and procedures for designating and managing APCs; and,*

X *New or revised guidelines, procedures, and policy documents which are formally adopted by a state or territory and provide specific interpretations of enforceable CZM program policies to applicants, local government, and other agencies that will result in meaningful improvements in coastal resource management.*

B. Strategy Goal:

This strategy will review the current DPA boundaries to ensure that they accurately reflect the criteria outlined in CZM's Designated Port Area regulations (301 CMR 25.00) including criteria such as appropriate physical attributes, adequate land and water connections, and compatible land use development patterns.

C. *Describe the proposed strategy and how the strategy will lead to and/or implement the program changes selected above. If the strategy will only involve implementation activities, briefly describe the program change that has already been adopted, and how the proposed activities will further that program change. (Note that implementation strategies are not to exceed two years.)*

The strategy will lead to a program change by modifying the boundaries of the Chelsea Creek, East Boston, and Weymouth Fore River DPAs. In areas that are removed from the DPA, the regulatory framework (under MassDEP's Chapter 91 regulations and CZM's Municipal Harbor Plan regulations) allows for a greater diversity in uses and development allowances. The strategy will also implement recommendations of the DPA Working Group and many DPA

stakeholders that CZM conduct comprehensive reviews of all of the DPAs to ensure that the boundaries accurately reflect current community needs and are compatible with surrounding land use patterns.

III. Needs and Gaps Addressed

Identify what priority needs and gaps the strategy addresses and explain why the proposed program change or implementation activities are the most appropriate means to address the priority needs and gaps. This discussion should reference the key findings of the assessment and explain how the strategy addresses those findings.

Since the boundaries of the DPAs were originally established in 1978, and the subsequent underlying regulatory framework was developed, there have not been comprehensive reviews of many of the DPAs. This project will address this need by conducting comprehensive reviews, using the designation standards found at 301 CMR 25.00, to determine whether the boundaries should remain as currently established or whether they should be modified.

IV. Benefits to Coastal Management

Discuss the anticipated effect of the strategy, including the scope and value of the strategy, in advancing improvements in the CMP and coastal management, in general.

Reviewing and modernizing DPA boundaries provides municipalities a greater ability to manage and plan for uses in their DPAs. In areas that are removed from the DPA, it gives property owners greater flexibility to incorporate commercial and supporting uses that are consistent with the community's vision for the waterfront.

V. Likelihood of Success

Discuss the likelihood of attaining the strategy goal and program change (if not part of the strategy goal) during the five-year assessment cycle or at a later date. Address the nature and degree of support for pursuing the strategy and the proposed program change and the specific actions the state or territory will undertake to maintain or build future support for achieving and implementing the program change, including education and outreach activities.

The likelihood for success is high. CZM has recently conducted two comprehensive boundary reviews in the past two years in the City of Gloucester (completed) and the City of Beverly (projected to be completed in April 2015). CZM's methodology for conducting these boundary reviews, and our robust public process, is widely supported by DPA stakeholders. This project will continue to build on our recent successes, with CZM actively engaging the cities of Boston, Chelsea, and Quincy to modernize their DPA boundaries.

VI. Strategy Work Plan

Using the template below, provide a general work plan that includes the major steps that will lead toward or achieve a program change or implement a previously achieved program change. If the state intends to fund implementation activities for the proposed program change, describe those in the plan as well. The plan should identify a schedule for completing

the strategy and include major projected milestones (key products, deliverables, activities, and decisions) and budget estimates. If an activity will span two or more years, it can be combined into one entry (i.e., Years 2-3 rather than Year 2 and then Year 3). While the annual milestones are a useful guide to ensure the strategy remains on track, OCRM recognizes that they may change somewhat over the course of the five-year strategy unforeseen circumstances. The same holds true for the annual budget estimates. Further detailing and adjustment of annual activities, milestones, and budgets will be determined through the annual cooperative agreement negotiation process.

Strategy Goal: This strategy includes comprehensive boundary reviews, using the designation standards found at 301 CME 25.00, for the following DPAs: Chelsea Creek, East Boston, and Weymouth Fore River.
Total Years: 4
Total Budget: $150,000

Year(s): 1-2
Description of activities: Initiate boundary review for Chelsea Creek DPA. Conduct public information meeting to discuss boundary review process. Consult with the City of Chelsea and MassDEP, review applicable licenses, permits, and municipal records and perform outreach with waterfront property owners. Prepare boundary review report and hold public hearing to receive public input. Prepare final designation decision.
Major Milestone(s): Boundary review report and final designation decision
Budget: $75,000 (Year 1 - $50,000; Year 2 - $25,000)

Year(s): 2-3
Description of activities: Initiate boundary review for Weymouth Fore River DPA. Conduct public information meeting to discuss boundary review process. Consult with the City of Quincy and MassDEP, review applicable licenses, permits, and municipal records and perform outreach with waterfront property owners. Prepare boundary review report and hold public hearing to receive public input. Prepare final designation decision.
Major Milestone(s): Boundary review report and final designation decision
Budget: $75,000 (Year 1 - $50,000; Year 2 - $25,000)

Year(s): 3-4
Description of activities: Conduct boundary review for East Boston DPA. Conduct public information meeting to discuss boundary review process. Consult with the City of Boston and MassDEP, review applicable licenses, permits, and municipal records and perform outreach with waterfront property owners. Prepare boundary review report and hold public hearing to receive public input. Prepare final designation decision.
Major Milestone(s): Boundary review report and final designation decision
Budget: $75,000 (Year 1 - $50,000; Year 2 - $25,000)

VII. Fiscal and Technical Needs

A. Fiscal Needs: *If 309 funding is not sufficient to carry out the proposed strategy, identify additional funding needs. Provide a brief description of what efforts the CMP has made, if any, to secure additional state funds from the legislature and/or from other sources to support this strategy.*

We anticipate that 309 resources will be sufficient to carry out the proposed strategy, with supplementation by additional support from other local or state sources as necessary.

B. Technical Needs: *If the state does not possess the technical knowledge, skills, or equipment to carry out all or part of the proposed strategy, identify these needs. Provide a brief description of what efforts the CMP has made, if any, to obtain the trained personnel or equipment needed (for example, through agreements with other state agencies).*

CZM staff have sufficient technical knowledge and skills to carry out all of the proposed strategy.

VIII. Projects of Special Merit (Optional)

If desired, briefly state what projects of special merit the CMP may wish to pursue to augment this strategy. Any activities that are necessary to achieve the program change or that the state intends to support with baseline funding should be included in the strategy above. The information in this section will not be used to evaluate or rank projects of special merit and is simply meant to give CMPs the option to provide additional information if they choose. Project descriptions should be kept very brief (e.g., undertake benthic mapping to provide additional data for ocean management planning). Do not provide detailed project descriptions that would be needed for the funding competition.

Specific activities described above may be identified and advanced as a project of special merit to augment this strategy.

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D. Ocean Resources - Advancing Ocean Planning

I. Issue Area(s)

The proposed strategy or implementation activities will support the following high-priority enhancement areas (check all that apply):

Energy & Government Facility Siting
Ocean/Great Lakes Resources
Special Area Management Planning

II. Strategy Description

A. *The proposed strategy will lead to, or implement, the following types of program changes (check all that apply):*

☐ *A change to coastal zone boundaries;*

X *New or revised authorities, including statutes, regulations, enforceable policies, administrative decisions, executive orders, and memoranda of agreement/understanding;*

☐ *New or revised local coastal programs and implementing ordinances;*

☐ *New or revised coastal land acquisition, management, and restoration programs;*

☐ *New or revised special area management plans (SAMP) or plans for areas of particular concern (APC) including enforceable policies and other necessary implementation mechanisms or criteria and procedures for designating and managing APCs; and,*

X *New or revised guidelines, procedures, and policy documents which are formally adopted by a state or territory and provide specific interpretations of enforceable CZM program policies to applicants, local government, and other agencies that will result in meaningful improvements in coastal resource management.*

B. ***Strategy Goal:***

In Massachusetts state waters, as the primary geographic area, as well as adjacent federal waters under the Northeast Regional Ocean Planning Initiative, there are identified needs for science and information, planning and analysis, and stakeholder engagement. The strategy will directly result in future updates or revisions to the Massachusetts Ocean Plan, which is an underlying authority for the state's enforceable coastal policies. Additionally, work by the Northeast Regional planning Body in the development of regional ocean plan will directly inform and may necessitate changes to the state's Ocean Plan. The two priority elements are: (1) Advancing planning, analysis, and siting measures for offshore ocean development projects, including cables, offshore energy facilities, and marine-based sand extraction for beach nourishment; and (2) Addressing critical science and data needs to improve management of ocean resources and uses.

C. *Describe the proposed strategy and how the strategy will lead to and/or implement the program changes selected above. If the strategy will only involve implementation*

activities, briefly describe the program change that has already been adopted, and how the proposed activities will further that program change. (Note that implementation strategies are not to exceed two years.)

As described in the Assessment, the Oceans Act requires the Ocean Plan to be reviewed at least once every five years. In the recent update of the Ocean Plan, there are specific elements that need to be addressed to advance the ongoing implementation and future revision of the plan. As these activities are addressed, CZM will work to amend the Ocean Plan and formally adopt the enforceable elements of the plan into the CZM program.

III. Needs and Gaps Addressed

Identify what priority needs and gaps the strategy addresses and explain why the proposed program change or implementation activities are the most appropriate means to address the priority needs and gaps. This discussion should reference the key findings of the assessment and explain how the strategy addresses those findings.

The strategy will directly address the two priority management needs identified in the Phase II Assessment: (1) Planning for offshore development; and (2) Improving science and knowledgebase.

IV. Benefits to Coastal Management

Discuss the anticipated effect of the strategy, including the scope and value of the strategy, in advancing improvements in the CMP and coastal management, in general.

The strategy will support work on identified needs, enable implementation of key next steps for the 2015 Ocean Plan, allow for incorporation into the state's Coastal Program, and support future formal revision and updating of the plan.

V. Likelihood of Success

Discuss the likelihood of attaining the strategy goal and program change (if not part of the strategy goal) during the five-year assessment cycle or at a later date. Address the nature and degree of support for pursuing the strategy and the proposed program change and the specific actions the state or territory will undertake to maintain or build future support for achieving and implementing the program change, including education and outreach activities.

On behalf of EEA, CZM led the development of the 2009 Ocean Plan and the first-ever update and amendment process leading to the recent release of the 2015 Ocean Plan. CZM has demonstrated the proficiency, leadership, and capacity to execute such endeavors. CZM has staff with science, technical, planning and policy expertise, has a long track-record of working with partners on cooperative projects, and has a demonstrated commitment to stakeholder engagement.

VI. Strategy Work Plan

Using the template below, provide a general work plan that includes the major steps that will lead toward or achieve a program change or implement a previously achieved program change. If the state intends to fund implementation activities for the proposed program change, describe those in the plan as well. The plan should identify a schedule for completing the strategy and include major projected milestones (key products, deliverables, activities, and decisions) and budget estimates. If an activity will span two or more years, it can be combined into one entry (i.e., Years 2-3 rather than Year 2 and then Year 3). While the annual milestones are a useful guide to ensure the strategy remains on track, OCRM recognizes that they may change somewhat over the course of the five-year strategy unforeseen circumstances. The same holds true for the annual budget estimates. Further detailing and adjustment of annual activities, milestones, and budgets will be determined through the annual cooperative agreement negotiation process.

Strategy Goal: Advancing priority elements for ocean planning
Total Years: 5
Total Budget: $500,000

Year(s): 1-4
Description of activities: Implementation of priority elements on two tracks.

Track #1: Advancing planning, analysis, and siting measures for offshore ocean development projects.

- Offshore sand planning and siting
  - Work to improve characterization of marine sand deposits.
  - Convening, management and support for state Offshore Sand Task Force.
  - Consultation with *MarineFisheries*, National Marine Fisheries Service (NMFS), and the fisheries work group.
  - Participation in the Northeast RPB regulatory working group and sand working group.
- Offshore wind energy and transmission planning and siting
  - Further investigation and analysis of preliminary areas identified in 2015 Ocean Plan for offshore wind transmission cable corridors, including geological and geotechnical surveys of the seafloor and subbottom and biological and cultural resource assessments.
  - Coordination and synchronization with BOEM, lease-holders, Intergovernmental Renewable Energy Task Force, and Northeast RPB.
  - Participation in the Northeast RPB regulatory working group.
- Offshore aquaculture planning and siting
  - Convening, management and support for offshore aquaculture working group.
  - Consultation with *MarineFisheries*, National Marine Fisheries Service (NMFS), and the fisheries work group.
  - Participation in the Northeast RPB regulatory and aquaculture working group.

Track #2: Addressing critical science and data needs to improve management of ocean resources and uses.

- Marine habitat characterization and mapping
  - Advance work to map biogenic habitats (formed by marine fauna and flora), including oyster beds and reefs, Crepidula (slipper shell) reefs, worm reefs, mussel beds and reefs, and kelp beds.
  - Support for seafloor mapping surveys in southern Cape Cod Bay, areas south and east of Nantucket, and areas south of Martha's Vineyard.
  - Updating distribution, abundance and other data on key marine species.
  - Obtain aerial survey data on sea turtle sightings, build a geodatabase, synthesize the data, and develop effort-corrected density maps.
  - Support efforts to acquire finer-scale spatial data on sea ducks (and other marine birds) to more accurately identify critical areas.
  - Work with Northeast RPB on marine life/habitat efforts including the development of distribution and abundance information of key species and their habitats and the exploration of decision support tools.
- Monitor climate change across Massachusetts ocean waters
  - Participate in regional efforts to monitor and report on long-term seawater temperature, pH, dissolved carbon dioxide, salinity, and sea level through regional programs and project-specific initiatives include: the Northeastern Regional Association of Coastal and Ocean Observing Systems (NERACOOS), the Northeast Coastal Acidification Network (NECAN), the Northeast Regional Ocean Council (NROC)/NERACOOS Sentinel Monitoring for Climate Change, and the Gulf of Maine Council's (GoMC) Ecosystem Indicator Partnership.
- Identifying ecologically important areas
  - Work with Northeast RPB on an interdisciplinary work group to explore options for adaptive ecosystem-based management approaches, including the identification of important ecological areas and the potential evaluation of decision-support tools.

Major Milestone(s): Reports, data sets, survey results, maps, etc.
Budget: $150,000/year

Year(s): 1, 4-5
Description of activities:
Year 1: Incorporate enforceable components of 2015 Ocean Plan into Massachusetts Coastal Program.
Year 4-5: Initiate and implement of Ocean Plan review and update amendment process; develop plan amendment material, public review process, Ocean Advisory Commission/Science Advisory Council process.
Major Milestone(s): Program change;
Budget: $75,000/year

VII. Fiscal and Technical Needs

A. Fiscal Needs: *If 309 funding is not sufficient to carry out the proposed strategy, identify additional funding needs. Provide a brief description of what efforts the CMP has made, if any, to secure additional state funds from the legislature and/or from other sources to support this strategy.*

309 resources are anticipated to be complemented by other state and federal resources as well as resource from regional partners.

B. Technical Needs: *If the state does not possess the technical knowledge, skills, or equipment to carry out all or part of the proposed strategy, identify these needs. Provide a brief description of what efforts the CMP has made, if any, to obtain the trained personnel or equipment needed (for example, through agreements with other state agencies).*

CZM's technical and policy capacities would be supported by other states, federal agencies, and regional organizations.

VIII. Projects of Special Merit (Optional)

If desired, briefly state what projects of special merit the CMP may wish to pursue to augment this strategy. Any activities that are necessary to achieve the program change or that the state intends to support with baseline funding should be included in the strategy above. The information in this section will not be used to evaluate or rank projects of special merit and is simply meant to give CMPs the option to provide additional information if they choose. Project descriptions should be kept very brief (e.g., undertake benthic mapping to provide additional data for ocean management planning). Do not provide detailed project descriptions that would be needed for the funding competition.

Specific activities described above may be identified and advanced as a project of special merit to augment this strategy.

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5-Year Budget Summary by Strategy

Enhancement Area	Proposed Project	Year 1	Year 2	Year 3	Year 4	Year 5	Total
Wetlands	Climate change adaptation Best Management Practices for salt marshes	$67,000	$67,000	$82,000	$67,000	$67,000	$350,000
Coastal Hazards	Demonstrating effectiveness of green infrastructure to provide coastal storm damage protection	$50,000	$50,000	$80,000	$40,000	--	$220,000
Special Area Management Planning	DPA Boundary Reviews	$50,000	$75,000	$75,000	$25,000	--	$225,000
Ocean Resources	Advancing Ocean Planning	$225,000	$150,000	$150,000	$225,000	$225,000	$975,000
Total funding		**$392,000**	**$342,000**	**$387,000**	**$357,000**	**$292,000**	**$1,770,000**

Note: For the purposes of this 309 Strategy budget summary, project years all begin in Year 1. The actual starting year will be dependent on 309 funding available (including Projects of Special Merit).