

HUMAN USES & PLANNING



Home to nearly 1.7 million people and representing more than a quarter of all Massachusetts residents, the 50 communities of the Massachusetts Bays Program region have tremendous value to the Commonwealth. While fishing and tourism are a substantial source of revenue for local communities, the Bay State as a whole relies on the industrial contributions made by coastal areas, including the generation and transport of energy resources, wastewater treatment, and cargo shipping. Recreational opportunities along the coast, particularly in the many protected areas of the region, are enjoyed by both residents and visitors alike. Considerable planning goes into ensuring that values are balanced between human use and environmental well-being.



HUMAN POPULATION

Q14

How is human population distributed among the MBP communities and how does it compare state-wide?

Contributor: Christian Krahfurst, Massachusetts Bays Program

Why this is important

Understanding human population dynamics and change is critical for effective environmental management. High concentrations of people in coastal regions have produced many social and economic benefits including improved transportation links, creation of jobs, revenue from industry and tourism, and food production. However, the cumulative effects of intense coastal development often have negative impacts on coastal environments primarily through increased development and consumption of coastal resources, alteration of natural ecosystem processes, and production and disposal of wastes. Thus, human population dynamics and environmental change are intrinsically linked. Humans are a major source of environmental degradation, especially when the population exceeds the threshold limits of the ecosystem. Known impacts associated with high population density include loss of biodiversity, air and water pollution, and losses of forests, open space, and arable land. Therefore, human population dynamics are extremely important when it comes to the health and future of our environment.

Coastal areas are particularly stressed since most of our global population resides within 200 km of the coast (worldwide, this represents approximately 3 billion people — about half of the world's population).

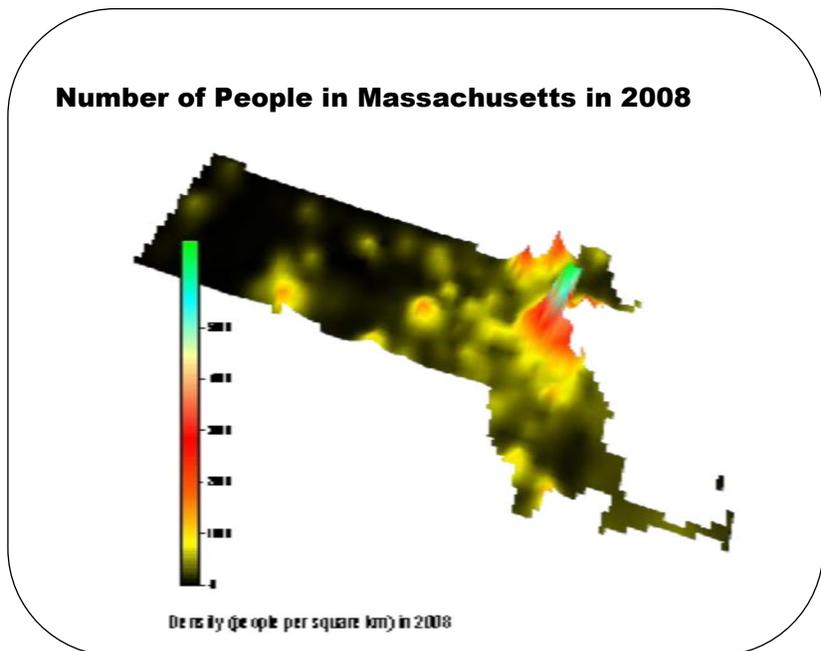


Figure 14.1. Population distribution in Massachusetts (# people km²)

State of the Bays

Nearly one third (27 %) of Massachusetts citizens live in the coastal communities of the Massachusetts Bays region (Figure 14.1). This value has been relatively consistent since 2000 (only a 0.3% increase overall by 2008). Thus, human population within the five Massachusetts Bays Program (MBP) regions has not changed dramatically since 2000 (Figure 14.2). Revere and Chelsea were the communities with the greatest amount of change, exhibiting a 24% and 18% increases, respectively, but these double-digit increases are uncharacteristic of the MBP planning area. Communities on Cape Cod generally saw small decreases in population densities since 2000 with Dennis and Yarmouth losing the greatest amounts (around 4%).

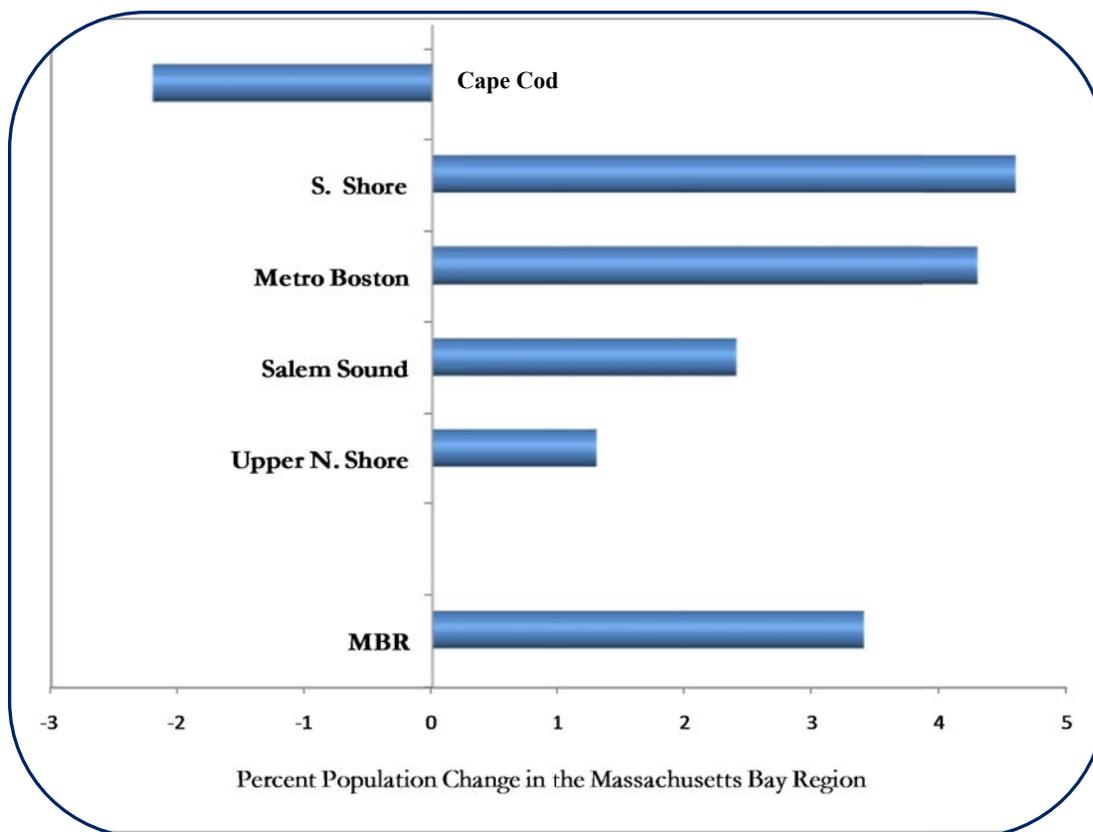


Figure 14.2. Percent change in human population (2000-2008) for the Massachusetts Bays region (MBR), including the subregions: upper North Shore, Salem Sound, Metro Boston, South Shore and Cape Cod. Based on US Census data.



IMPERVIOUS SURFACE

Q15

How much of the Massachusetts Bays region is covered by impervious surface?

Contributors: Dan Sampson, Massachusetts Office of Coastal Zone Management, Josh Daskin and Christian Krabforst, Massachusetts Bays Program

Why this is important

Land covered by asphalt, concrete, buildings or heavily-compacted earth is classified as impervious surface. These areas do not allow water to seep into the ground. Instead, impervious surfaces increase stormwater runoff into surrounding surface waters. Some of the sediment, pathogens, nutrients, and toxic contaminants associated with stormwater are delivered to local water bodies, adversely impacting water quality and other coastal resources. Increased runoff also means decreased recharge to underground aquifers, which provide important sources of drinking water to many MBP communities. A review of nationwide studies found that stream water quality begins to decline when 10% of the watershed is covered by impervious surface and that severe degradation occurs at 25%. (Visit the Center for Watershed Protection's website: <http://www.cwp.org> for supporting documents). The locations and hydrologic associations of impervious surface, open land, and waterways, as well as use of best management practices for removing contaminants and mimicking natural flows, all interact to determine the actual impact on receiving waters. Despite these complexities, percent cover of impervious area is often used as a starting point for estimating the impact of local land use on wetlands and waterways.



Figure 15.1. Catch basin collecting rainwater following a storm.

State of the Bays

According to the MassGIS Impervious surface data layer, 17% of the MBP region was covered in impervious surface in 2005. Impervious surface cover within individual municipalities ranged from 4.5% to nearly 80%. Of the five MBP regions, only the Upper North Shore had less than 10% of its area covered by impervious surfaces as of 2005 (Figure 15.2). Out of the 50 communities that make up the MBP region, only nine communities (Essex, Newbury, Ipswich, Rowley, Wellfleet, Truro, Provincetown, Norwell, and Duxbury) had less than 10% of their area covered with impervious surfaces (Figure 15.3). Because the methodology used by MassGIS had changed significantly since MBP reported on this indicator in the 2004 State of the Bays Report, direct comparison to the 2005 data is not possible. A recent uptick in land acquisition and conservation in the MBP planning area (See Question 16, Protected Lands) and a relatively stable population (See Question 14, Human Population) are positive signs that impervious surface cover has not increased significantly over the past five years. However, Mass Audubon’s “*Losing Ground*” report (2009) on patterns of development (See *box note* below) suggests that southeastern Massachusetts continues to be part of the “sprawl frontier” where development pressure, primarily residential development, remains high.

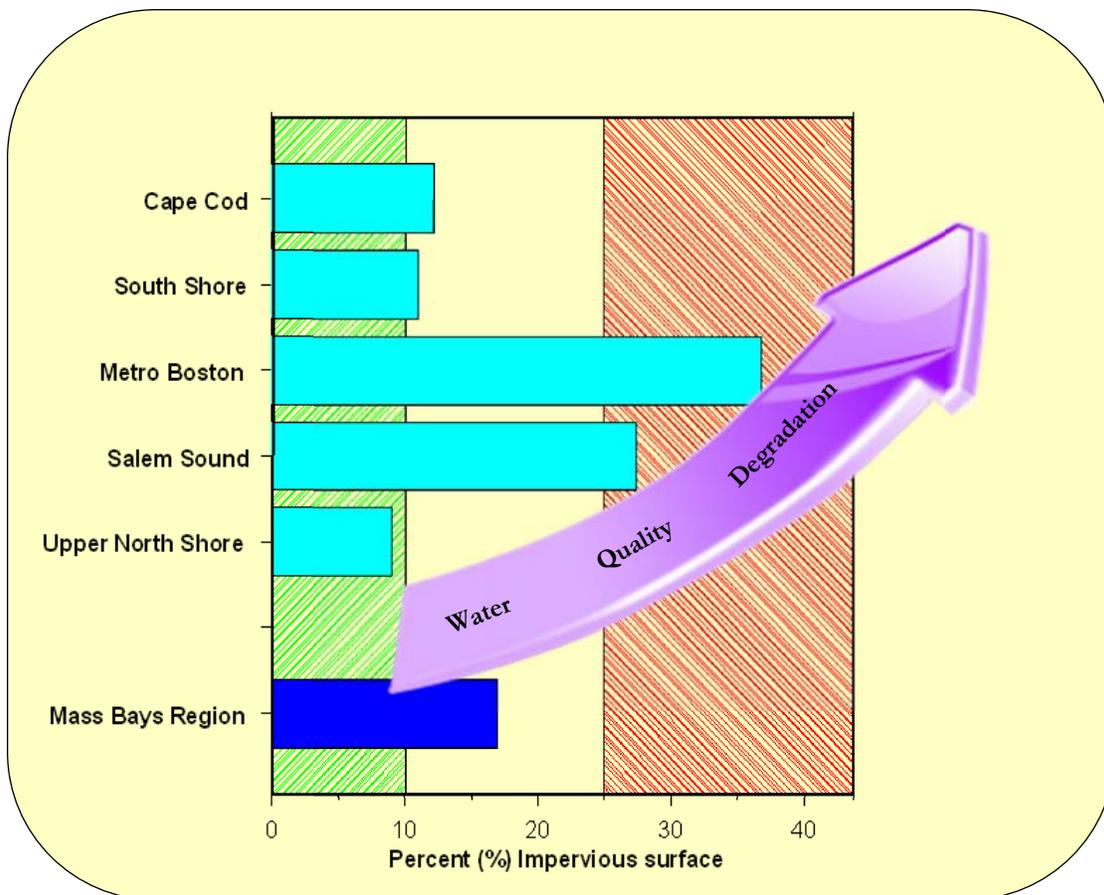


Figure 15.2. Percent Impervious surfaces in the five regions of the Massachusetts Bays Program region. Shading represents water quality thresholds identified by the Center for Watershed Protection. Based on 2005 Data from MassGIS.

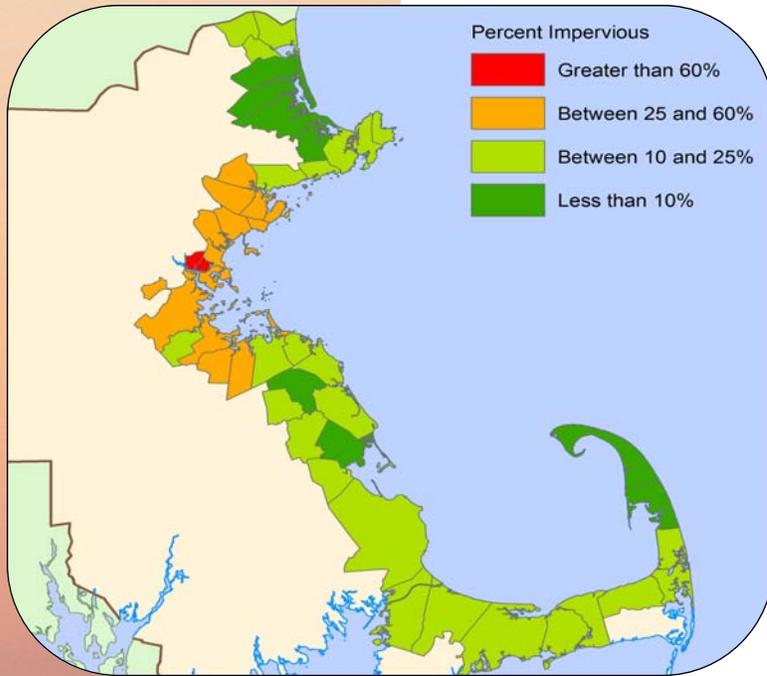


Figure 15.3. Percent impervious surface in the 50 towns of the Mass Bays region. Based on 2005 data from MassGIS.

Box Note: Beginning in 1991, Mass Audubon began producing a periodic analysis of land use in Massachusetts that summarizes environmentally relevant changes in land use. Their *Losing Ground* series is updated every five years and provides a web-based tool that allows users to view these changes at the town, watershed, ecoregion, county, and regional planning agency levels. To learn more about development patterns in your town, visit: <http://www.massaudubon.org/>



PROTECTED LANDS

Q16

How much of the Massachusetts Bays region is protected from development?

Contributors: Dan Sampson, Massachusetts Office of Coastal Zone Management, Josh Daskin and Christian Krabforst, Massachusetts Bays Program

Why this is important

Protection of forests, farms, wetlands, parks, beaches and historic sites serves many purposes. Among other benefits, protected lands typically have minimal impervious cover (See Question 15, Impervious Surface), help conserve biodiversity and the ecosystem services we derive from it, provide recreational and community space, and help safeguard water quality. A variety of tools are used to protect these lands including acquisition and designation of state and local parks, forests and preserves, purchase of conservation easements, and adoption of zoning regulations that limit the types and location of allowable development. In light of the continuing pressure from developed land in the Massachusetts Bays Program (MBP) region, land protection activities continue to be an important indicator of ecosystem health.

State of the Bays

As of October 2009, over 26% of land in the MBP region was permanently protected from development (See *box note*, next page) up from the 25% reported for 2003. This aggregated land use category is represented by approximately 194,200 acres of protected lands and includes conservation and recreation lands; town forests and parkways; agricultural, aquifer, and watershed protection lands; as well as cemeteries and forest legacy areas.

As shown in Figure 16.1, the percent of land protected varies from town to town. As might be expected, the towns with the highest percentages of protected land are found in the more rural areas of the MBP region: on Cape Cod and in the upper North

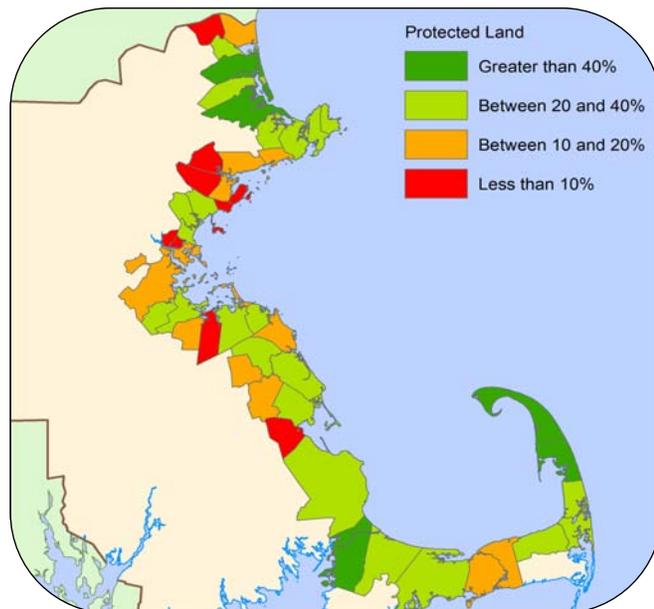


Figure 16.1. Percent of permanently protected area in the 50 communities of the Massachusetts Bays Program. Based on 2003 data from MassGIS.

Shore sub regions. The lowest levels of permanently protected land (communities with 10% or less) were found in Chelsea, Amesbury, and Kingston. Of the five MBP regions, the Upper North Shore and Cape Cod exceeded the MBP average with protected areas of 29.6% and 35.6%, respectively (Figure 16.2). MBP communities with protected land areas that exceeded 40% were Milton, Ipswich, Newbury, Bourne, Wellfleet, Truro, and Provincetown.

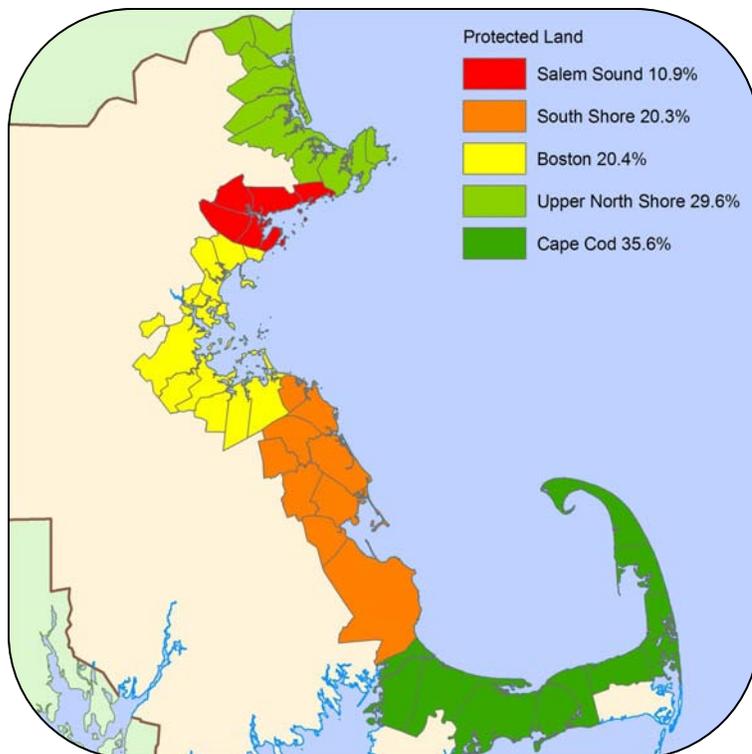


Figure 16.2. Percent of permanently protected lands in the five regions of the Massachusetts Bays Program. Based on 2005 data from MassGIS.

Box Note: Data from the MassGIS layer

“protected and recreational open space – December 2009” identifies parcels of “conservation lands and outdoor recreational facilities in Massachusetts.” Data were aggregated by city/town and summary statistics (e.g., number of acres protected, total number acres per city/town, and percent protected by city/town) were calculated and reported in Figures 16.1 and 16.2.



COASTAL DEVELOPMENT

Q17 What patterns of coastal development have taken place within the Massachusetts Bays region?

Contributors: Dan Sampson, Massachusetts Coastal Zone Management, and Christian Krabforst, Massachusetts Bays Program

Why this is important

Approximately one third of the Massachusetts population, 1.7 million people, lives within 50 communities bordering Massachusetts and Cape Cod Bays (See Question 14, Human Population). This distribution places tremendous pressure on the natural resources of the Bays' coastal waters and the number of residents continues to grow moderately. Continued monitoring of the changing uses of our coastal lands can provide useful information for coastal resource management and lend insight to how people may be impacting the Bays' natural resources. Many of the communities in the Massachusetts Bays region recognize the need to balance development and natural resources preservation. Tools for protecting these natural resources include adoption of the Community Preservation Act, creation of wetland bylaws, development of water resources protection overlay zoning districts, completion of open space plans, to name a few.

State of the Bays

Nearly 36% of the land in the Massachusetts Bay region is currently considered developed (See *box note*, next page). Developed lands include 14 land use categories, consisting mostly of residential, commercial, industrial and recreational uses. Comparison between 1999 and 2005 MassGIS land use layers is difficult since the methodologies in creating the layers were markedly different. For example, the 2005 "forest" land-use category includes stands of trees in large backyards, which were included as part of the residential polygons in the 1999 Mass GIS land use layers. (For comparison, approximately 73,000 acres in the Massachusetts Bays region were classified in the forested land use category in 2005 compared with about 59,000 acres in 1999). According to MassGIS 2005 data, the Upper North Shore

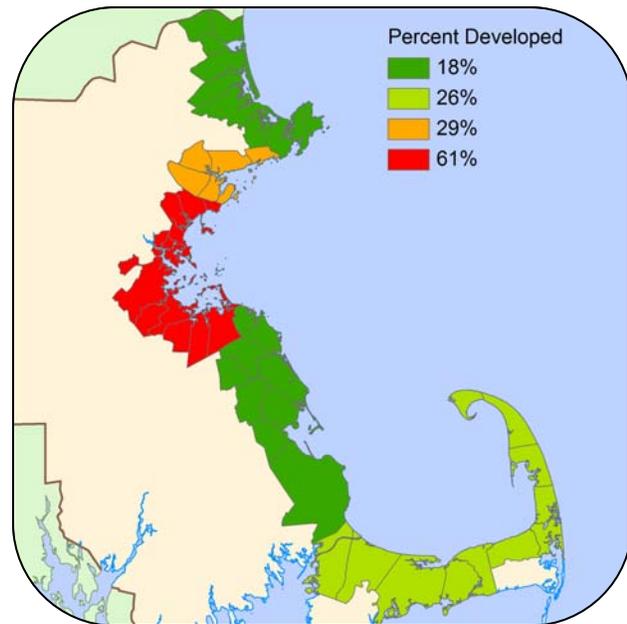


Figure 17.1. Percent developed lands summarized for the five Massachusetts Bays regions.

and South Shore regions were the least developed of the five regions of the Massachusetts Bays Program (Figure 17.1), while Salem Sound and Metro Boston were approximately 30% and greater than 60% developed, respectively. The percent of developed land in each of the 50 communities within the Massachusetts Bays planning area is also shown in Figure 17.2.

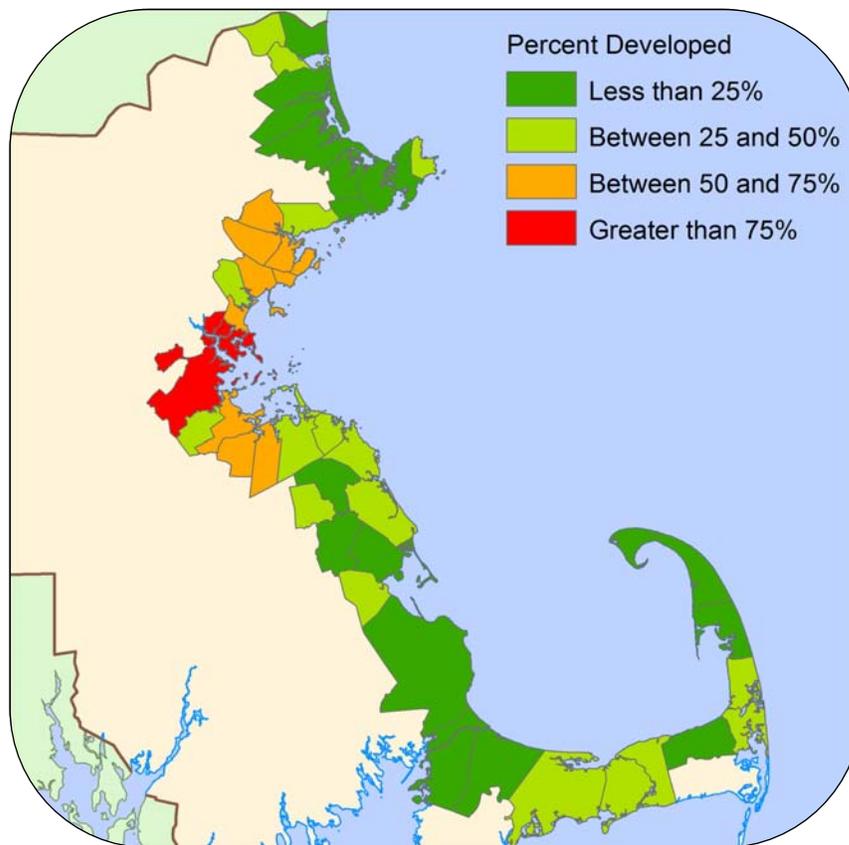


Figure 17.2. Percent developed lands within the 50 Massachusetts Bays Program Communities

Box Note: The Developed Lands category consisted of aggregating 2005 MassGIS land use categories, which includes mining, recreation, waste water management, residences, commercial and industrial, transportation, marinas, urban public/institutional purposes, and automotive salvage.



Status of liquid natural gas transport in Massachusetts

Contributor: Bob Boeri, Massachusetts Office of Coastal Zone Management

Offshore liquefied natural gas (LNG) terminals have come to the waters of Massachusetts. Forty percent of the state's electric power and home heating currently comes from natural gas. Traditionally, LNG was delivered via landside pipelines from the Gulf of Mexico and Canada, as well as shipments to a port in Everett. Increased demand for energy resources and a high coastal population make Massachusetts offshore waters an attractive location for LNG facilities.

The first offshore LNG facility to enter service in Massachusetts was the Northeast Gateway Deepwater Port, owned and operated by Excelerate Energy, LLC, which is located approximately 13 miles offshore of Gloucester at the termination of a 16-mile sub-sea lateral pipeline (Figure LNG.1). The construction and commissioning of the facility was completed in 2007. The second project, the Neptune Deepwater Port, is owned and operated by GDF Suez and is located approximately 10 miles off the coast of Gloucester at the end of a 13-mile sub-sea lateral pipeline. Construction of this pipeline and port, as well as commissioning of the facility, were completed in 2010. Currently only two other licensed offshore LNG facilities are operating in the United States—Louisiana's Gulf Gateway Deepwater Port in Louisiana, and Maryland's Dominion-Cove Point.

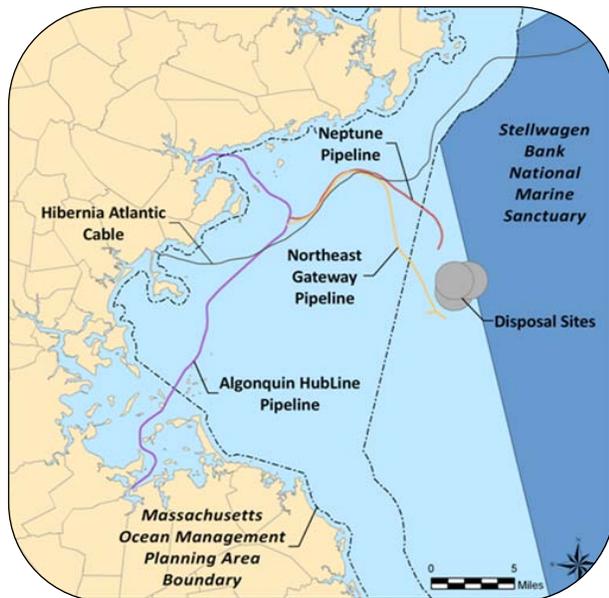
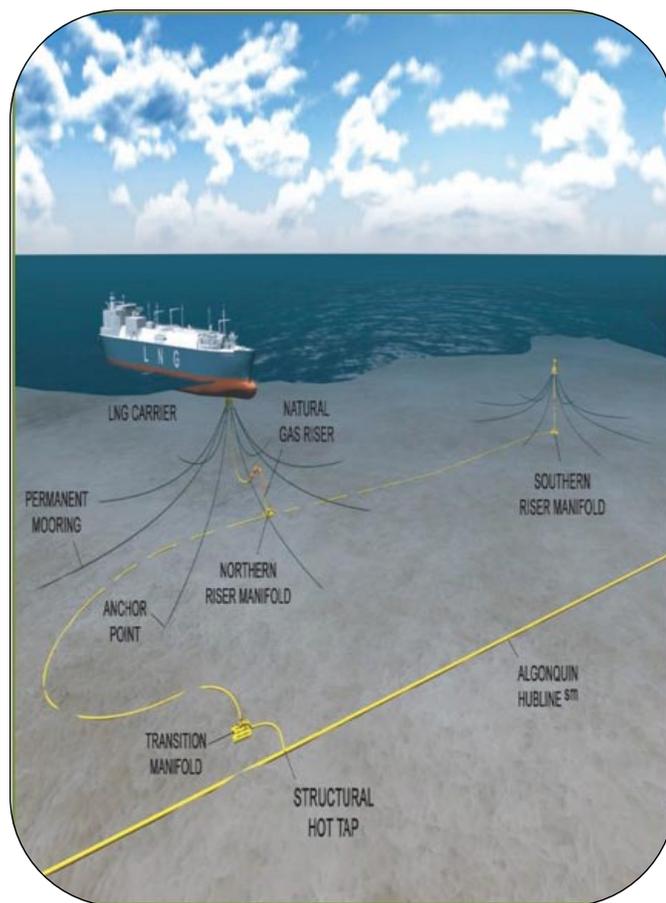


Figure LNG.1: Locations of presently permitted LNG pipelines. (Map courtesy of E. Chambliss, MA CZM).

Both facilities tie into the existing 24-inch HubLine natural gas pipeline, operated by Spectra Energy, which stretches undersea from Beverly to Weymouth, and is part of a distribution network originating in Canada. If operated at projected capacity, these facilities would deliver a daily total of 900 million cubic feet of natural gas, enough to heat an estimated three million homes.

The port facilities for both projects, located in federal waters, consist of dual submerged unloading buoys connected via a riser and transition manifold to the lateral pipeline (Figure LNG.2). Each buoy is anchored to the sea floor by eight suction piles connected to mooring lines. These buoys, which also act as a mooring for the LNG tankers, are submerged between 90 and 100 feet below the sea surface when not in use. Upon arrival, the specially designed tanker draws the unloading buoy into a receiving cone in the forward part of the vessel and connects it to onboard re-gasification equipment. The LNG on the ship is then vaporized and unloaded into the connecting pipeline for distribution—a process that takes four to eight days. The projects operate so that as one tanker is concluding the unloading operation, a second tanker would tie into the unoccupied buoy and begin unloading, thereby ensuring continuous gas flow.

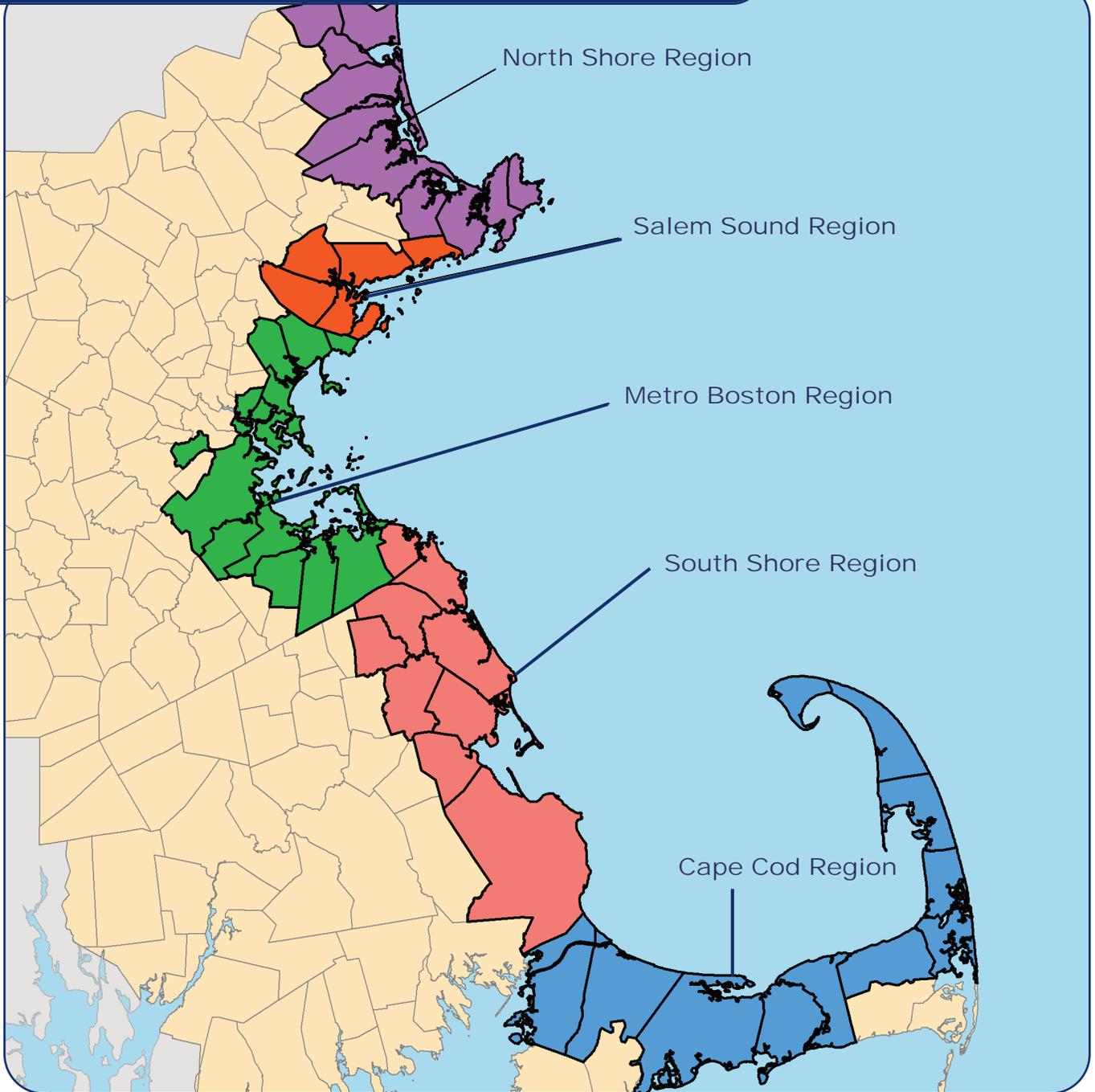
Environmental concerns were a primary focus during the state’s review of the projects prior to permitting. Potential impacts to marine mammals, benthic organisms, fisheries, water quality, and plankton were among the many issues evaluated. Because of the potential for a variety of adverse impacts, an exhaustive evaluation of pre-construction conditions was acquired during the permitting process. The final approvals of the projects included conditions that monitoring be conducted for up to three years after construction is completed. Annual monitoring reports are required to be evaluated by a team of state and federal agency scientists. In addition, the companies building these facilities were required to pay \$46 million to compensate for impacts that could not be avoided or minimized. These funds are being distributed for projects related to ocean habitat mapping and monitoring, right whale management, impacts to commercial fishing, public access, marine transportation infrastructure, and outreach.



Courtesy of Hoegh LNG AS

Figure LNG.2. Conceptual offshore LNG site plan.

MASSACHUSETTS BAYS PROGRAM AREA







WWW.MASSBAYS.ORG

