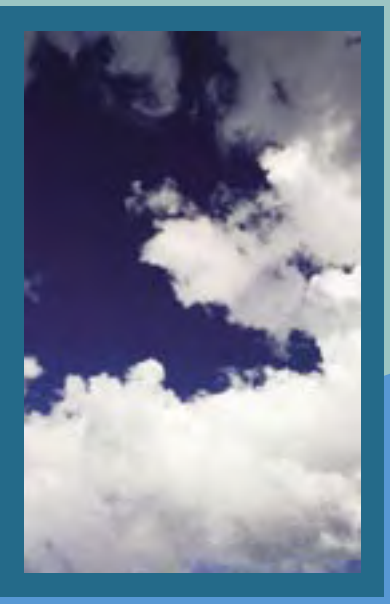
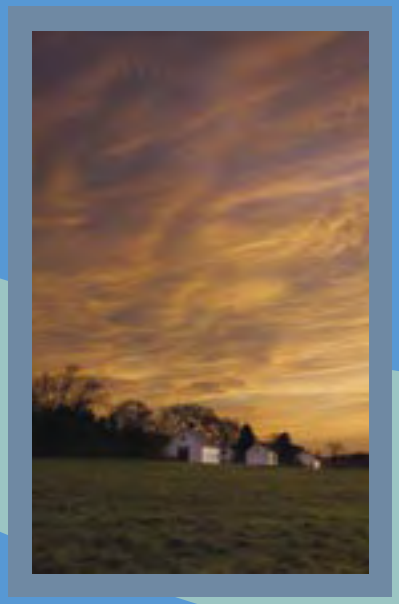
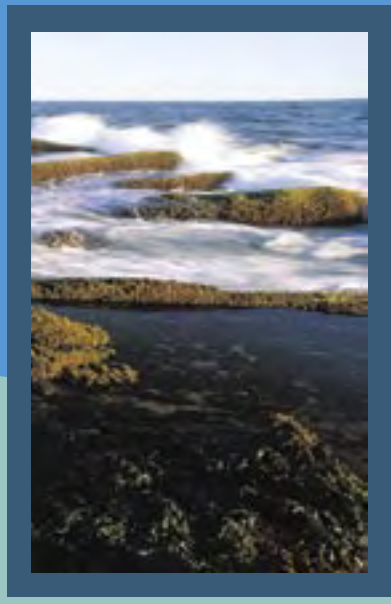
COMMONWEALTH OF MASSACHUSETTS

The State of Our Environment 2006

Executive Office of Environmental Affairs



COMMONWEALTH OF MASSACHUSETTS

The State of Our Environment 2006

Executive Office of Environmental Affairs

Governor Mitt Romney

Lt. Governor Kerry Healey

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"Humankind has not woven the web of life. We are but one thread within it. Whatever we do to the web, we do to ourselves. All things are bound together. All things connect."
–Chief Seattle, 1855

Foreword

Massachusetts is known for its natural beauty: sandy beaches and rugged shorelines, sparkling lakes and winding rivers, fertile forests and productive farmlands, the quiet solitude of its western hills.

The Commonwealth is also known as a birthplace of maritime commerce and the industrial revolution in America. Its land and seascapes are dotted with reminders of this legacy: historic fish piers, old mill towns, and simpler times.

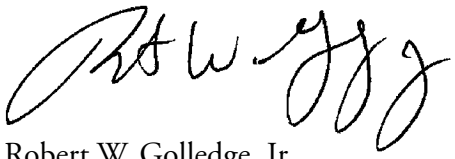
Reflecting this divergence, environmental conditions in Massachusetts are considerably better than they once were and are continuing to improve. This report documents both the progress we have made and the challenges we face.

- **Air:** Summertime smog and emissions of toxic mercury are both down across Massachusetts, the state is meeting federal standards for five of six criteria air pollutants, and its first-in-the-nation effort to reduce greenhouse gas emissions from power plants is beginning to bear fruit. With the cars, trucks, and buses we drive now generating more air pollution than any other source, future air quality gains depend in large measure on vehicle buying patterns, driving habits, and improving public transit systems.
- **Waste:** As a proportion of the material they use, residents are throwing away less and recycling more than ever in Massachusetts, and businesses are dramatically reducing their toxic releases to the environment. Building on this momentum, the Commonwealth is encouraging municipal pay-as-you-throw programs, banning additional easy-to-recycle materials from disposal, and increasing government purchases of recycled, non-toxic, and energy-efficient products.
- **Water:** Massachusetts has abundant pure drinking water, lakes and rivers teeming with fish and wildlife, and wetlands that absorb pollution and floodwaters to protect people and property. Because these resources are finite and dwindling, the state is working to help municipalities conserve existing water supplies and explore options for developing new ones, revitalize fisheries and aquatic ecosystems, preserve and restore wetlands, and promote sustainable development.
- **Land:** Comparatively small and densely populated, Massachusetts nonetheless has more forest as a proportion of its land mass, more productive farms in terms of direct sales at market, and a more robust parks and recreation system than most other states. To build on the value of these assets, the Commonwealth is working to preserve working forests and farms, clean up and reclaim urban brownfields, acquire additional open space, and protect the biodiversity of its ecosystems.
- **Coast and Ocean:** Along 1,500 miles of coastline and among 2,100 square miles of state-managed ocean waters, Massachusetts has unparalleled environmental and economic resources. Beaches, fisheries, and maritime heritage attract commerce, development, and tourism. The state needs to balance these activities with efforts to stem the tide of marine fisheries depletion, reverse historic salt marsh losses, and plan for combating coastal storms and erosion.

Wherever possible, this report provides meaningful facts and figures against which to measure progress and set goals. It is both a snapshot of current environmental conditions in Massachusetts and a blueprint for improving them in the future.

State law designates the Executive Office of Environmental Affairs and its agencies as chief stewards of clean air and water, abundant natural resources, sustainable surroundings, and the quality of life these all ensure. In reality, however, preserving and protecting the natural environment is everyone's job.

All of us, and our actions, and their consequences are bound together and connected—part of the web of life. Continuing to improve our stewardship of these precious resources is our greatest challenge and responsibility.



Robert W. Golledge, Jr.
Secretary
Executive Office of Environmental Affairs

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"To know even one life has breathed easier because you have lived – that is to have succeeded."
–Ralph Waldo Emerson

Air

Each of us takes as many as 20,000 breaths over the course of a typical day, inhaling roughly 5,000 gallons of air. This requires our lungs to work hard. No wonder even subtle changes in air quality can have such profound effects on our health and sense of wellbeing.

The quality of the air we breathe is determined by a combination of weather conditions and pollution emissions dispersed from a variety of sources – chiefly motor vehicles, factories, power plants, and consumer products such as paints. These pollutants can be toxic, create haze that limits visibility, or can combine to form ground-level ozone, the primary ingredient in smog.

In Massachusetts, air quality is good most of the time, and has been improving as industry, business, and consumers work together to reduce pollution. However, each summer, air pollution drives thousands of people – particularly children and the elderly – indoors and into hospital emergency rooms.

Air pollution poses significant risks to our environment, health, and economy. It contributes to both short- and long-term human health effects, including respiratory and cardiac disease, neurological damage, and a range of cancers. It degrades ecosystems, harming plants and animals. And it changes our climate in ways that will have far reaching implications.

Air Quality Trends in Massachusetts

Over the last three decades, the federal government and individual states have enacted a variety of laws and regulations aimed at reducing air pollution from on- and off-road vehicles, large stationary sources such as factories and power plants, and smaller, more dispersed "area" sources like dry cleaners and gas stations. Massachusetts has long been at the forefront of these efforts, developing and implementing programs as innovative as they are stringent, and adopting aggressive regulations from other states when appropriate.

But innovation alone does not ensure results. The ultimate measure of success is the quality of the air we breathe, and an analysis of air quality data over time shows that Massachusetts has made clear progress. For example, our state currently meets national air quality standards for five of six federal "criteria" pollutants.

Even with these successes, however, Massachusetts can and must do better.

Criteria Pollutant	Ambient Levels (2005)	Meeting Standards Since
Carbon Monoxide (CO)	Down 70% Since 1985	2002
Lead (Pb)	Down 87% Since 1987	1985
Nitrogen Dioxide (NO_2)	Down 62% Since 1985	1985
Particulate Matter (PM):		
Coarse Particles (PM_{10})	Down 22% Since 1989	1989
Fine Particles ($PM_{2.5}$)	Down 7% Since 1999	2004
Sulphur Dioxide (SO_2)	Down 64% Since 1986	1985

Particulate Matter

While the Commonwealth currently meets 1997 national ambient PM standards, there is growing concern about the health risks associated with breathing fine particles ($PM_{2.5}$). The U.S. Environmental Protection Agency (EPA) recently lowered the daily fine particle standard from 65 micrograms per cubic meter ($\mu g/m^3$) to 35 $\mu g/m^3$ while leaving the annual $PM_{2.5}$ standard of 15 $\mu g/m^3$ unchanged in spite of calls from its Clean Air Scientific Advisory Committee and states, including Massachusetts, to set a more stringent annual standard. The Commonwealth is collecting data to determine whether its air will meet the new daily standard and continues working to reduce PM pollution across the state.

Reducing Diesel Emissions through Truck Stop Electrification

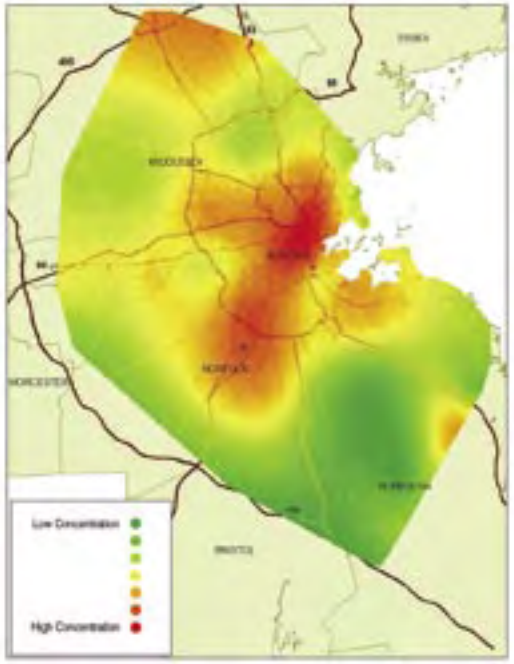
Trucking is vital to our economy. Most goods, services, and deliveries make their way to consumers in trucks.

When stopping to break for the night, truck drivers sometimes run their engines, releasing harmful emissions and wasting fuel, to power heating or air conditioning – as well as computers, cell phones and other amenities – when they are parked in rest areas or at truck stops. Some truck stops have installed Truck Stop Electrification systems that allow trucks to "plug-in" when stopping for the night. This alternative power source allows drivers to turn off their engines, thus reducing fuel consumption, vehicle wear and tear, and harmful emissions.

In Fall 2006, the Executive Office of Transportation, in collaboration with EOEA, issued a request for proposals for private firms to develop a Truck Stop Electrification program for Massachusetts. This initiative, which leverages federal environmental and transportation funding, is an example of how an integrated air, transportation, and energy policy can deliver private and public benefits.

Recent research indicates that PM concentrations are not uniform from one area to the next. Some locations, primarily in urban settings, show high levels of particulate pollution. There also are "hot spots" of unacceptably high PM concentrations caused by locally intense emission sources. Through the work of researchers at the Harvard University School of Public Health, it is now possible to identify these hot spots to an accuracy level of one city block and use this information to help guide future pollution control initiatives.

Hot Spots of Particulate Pollution in Greater Boston, June 26, 2002



Map based on: Gryparis A, Coull BA, Schwarz J, Suh HH. Semiparametric latent variable regression models for spatio-temporal modeling of mobile source particles in the greater Boston area. Journal of the Royal Statistical Society, Series C, 2007, in press.

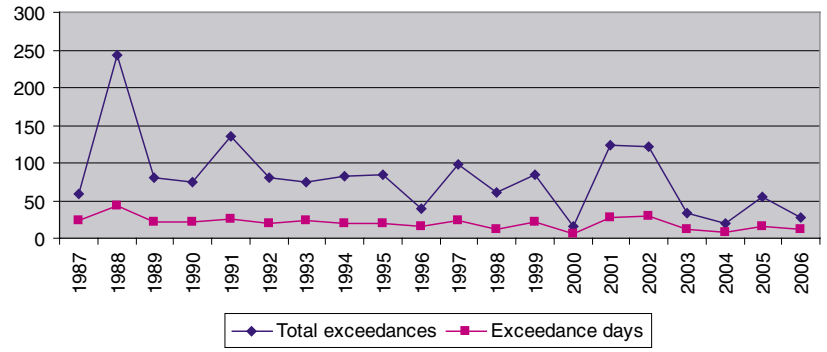
Nitrogen Oxides and Ozone

Nitrogen oxides (NO_x) and another class of pollutants known as volatile organic compounds (VOCs) are the key ingredients in the formation of ground-level ozone, the primary component of "smog." Ground-level ozone poses significant health risks, particularly for children, the elderly, people with respiratory diseases including asthma, chronic bronchitis, and emphysema; and those who work or exercise outdoors.

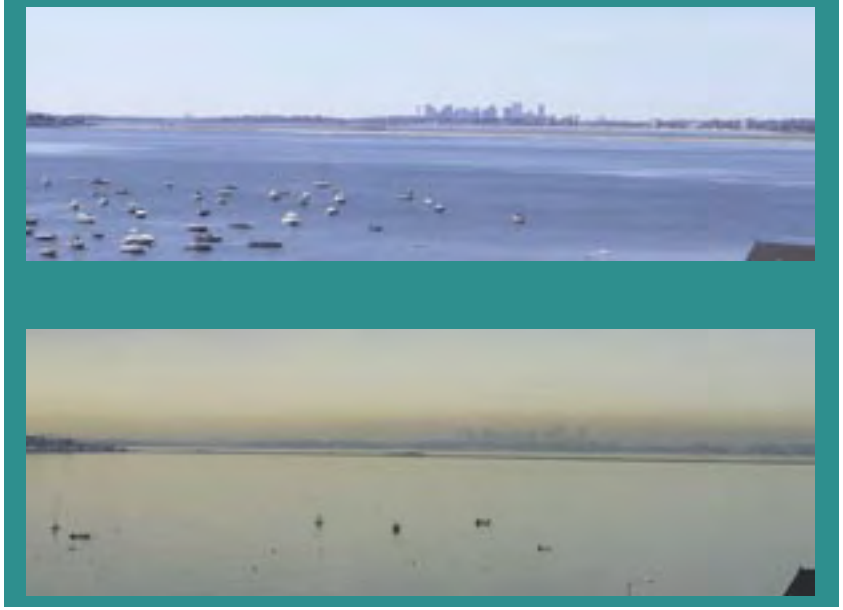
Since 1990, power plants and factories have reduced their NO_x emissions by nearly two-thirds and their VOC emissions by three-quarters. Vehicle exhaust emissions of VOCs are also declining. But NO_x emissions from cars, trucks and buses are on a steady to increasing trajectory.

In fact, recent estimates indicate that the vehicles we drive are now responsible for 70 percent of all Massachusetts NO_x emissions. This is largely because we are driving more miles per person than ever before, and consumers have developed a preference for larger, less fuel-efficient vehicles such as SUVs.

8-hour Ozone Exceedances in Massachusetts, 1987-2006



Effect of Smog on Visibility - Boston Skyline

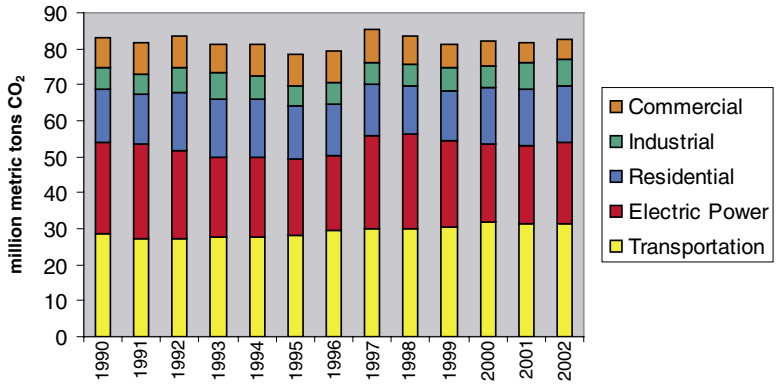


One result of this trend is that, on a statewide basis, Massachusetts does not yet meet the federal ozone standard all of the time. However, progress is being made. For example, the number of days on which the Commonwealth exceeds the ozone standard has dropped in recent years.

Carbon Dioxide

Carbon dioxide (CO_2) emissions within the Commonwealth have remained relatively stagnant since 1990 with the electric power and transportation sectors accounting for over 50 percent of the total emissions. Massachusetts took the lead on CO_2 by promulgating first-in-the-nation rules that limit CO_2 emissions from six existing power plants and adopting California CO_2 standards for vehicles.

Profile of Carbon Dioxide (CO_2) Emissions Sources in Massachusetts, 1990-2002



Building on Experience and Looking Ahead

While Massachusetts has a long history of aggressive and innovative environmental regulation that has made the air cleaner and helped us all breathe easier, the state needs to strive for continued improvement today and into the future. Through ongoing data collection and analysis, the Commonwealth is gaining a better understanding of specific emission sources, how pollutants travel once they become airborne, the health and environmental impacts of air pollution, and the impacts of state policies on

air quality. These will be the guideposts as the state charts its course for the future.

Massachusetts has begun to address greenhouse gases, which pose significant risks to our environment, health, and way of life. Numerous international, national and regional studies have all reached the same conclusion: that climate change could have far-reaching impacts on ecosystems and human society, and that it is already being felt in myriad ways, both subtle and dramatic. The Commonwealth has taken a variety of steps to address climate change, but scientists indicate that many additional actions are needed.

As research more clearly defines links between specific air pollutants and impacts on health and the environment, Massachusetts can better identify problematic emission sources and potential approaches to address them. For example, recent studies point to the importance of reducing diesel engine emissions in areas that are densely populated or where sensitive groups like children and the elderly can be found. Acting on this scientific research, the Executive Office of Environmental Affairs (EOEA) and Department of Environmental Protection (MassDEP) are currently developing a statewide Comprehensive Diesel Strategy.

As important as it is to understand how various economic sectors contribute to our air quality problems, it is also critical to understand where the largest sources of emissions are located and how pollution is influenced by prevailing winds, since air pollution is often a regional issue.

Massachusetts is "downwind" of coal-fired power plants in the Midwest. Likewise, air pollution that originates here can affect people and environmental conditions beyond the Commonwealth's borders. That is why regional coordination and cooperation are vital. Massachusetts will continue working as a member of the Ozone Transport Commission to craft policies that are appropriate in size and scope, and work effectively for all.

Finally, Massachusetts environmental agencies recognize that building on the many air quality improvements already achieved will require new approaches, including the integration of environmental, energy, transportation, and housing policies. Initiatives that promote smart growth, energy efficiency, transit-oriented development, and a broader set of transportation choices are well underway and will all promote cleaner, healthier air.

Reducing Greenhouse Gas Emissions: Leading by Example

The Commonwealth is leading by example when it comes to reducing emissions of climate changing greenhouse gases (GHG). As part of its 2012 goal to reduce state government GHG emissions by 25%, the State Sustainability Program works with state agencies and public colleges and universities on efforts to reduce state government's impact on the climate. These efforts have been aided by recent state bulletins that require agencies to reduce energy consumption, build green, and utilize biofuels in the state fleet and building heating applications.

A model of state action can be seen at Mt. Wachusett Community College in Gardner, which has so far reduced its own GHG emissions by more than 22% between 2002 and 2005. Through the installation of a biomass heating system, energy efficiency projects, and strong leadership, the college has eliminated over 700 tons per year of carbon emissions, which equates to 148 fewer cars on the road. In addition, Mt. Wachusett has recently added a biomass combined heat and power generator, and is working to install a wind turbine and greatly expand their solar power system as they continue to look for significant future emissions reductions.

Another example of the state leading by example: wind turbine on the campus of the Massachusetts Maritime Academy in Bourne.

"To waste, to destroy our natural resources… will result in undermining in the days of our children the very prosperity which we ought by right to hand down to them amplified and developed."
–Theodore Roosevelt

Waste

Each of us generates trash every day. Waste handling and disposal can be expensive and pose a number of risks to our health and environment. Industrial use of toxic chemicals and the resulting hazardous wastes can likewise threaten public health and natural resources. Fortunately, Massachusetts is a leader in developing innovative programs to reduce the volume and toxicity of its waste stream.

Solid Waste Reduction and Recycling

The more we throw away, the less we can depend on clean air and water, ample open space, and a healthy lifestyle. When we generate trash, it needs to be transported to a disposal facility for burning or burial. While Massachusetts has reduced the environmental and health effects associated with combustion facilities and landfills through tighter emissions controls and more stringent leachate containment system requirements, these disposal methods still result in emissions of mercury, dioxin, and methane, and sometimes lead to groundwater or surface water contamination.

Getting rid of waste is also costly: between $60 and $80 per ton for disposal, not including transportation, container rental costs, and other fees associated with waste management. In fact, Massachusetts pays more for disposal than most other states. In response, the state aggressively pursues waste reduction and recycling initiatives, which are not only better for our health and environment, but also generally cost less than disposal. Diverting waste from incinerators and landfills means fewer emissions and less contaminated runoff.

The Department of Environmental Protection (MassDEP) estimates that by recycling 48 percent of their solid waste in 2004, Massachusetts residents reduced greenhouse gas emissions by 2.1 million tons, the equivalent of planting 17 million trees. Further, by throwing away less and recycling more, we reduce the consumption of natural resources and increase materials reuse in manufacturing, which saves both energy and water.

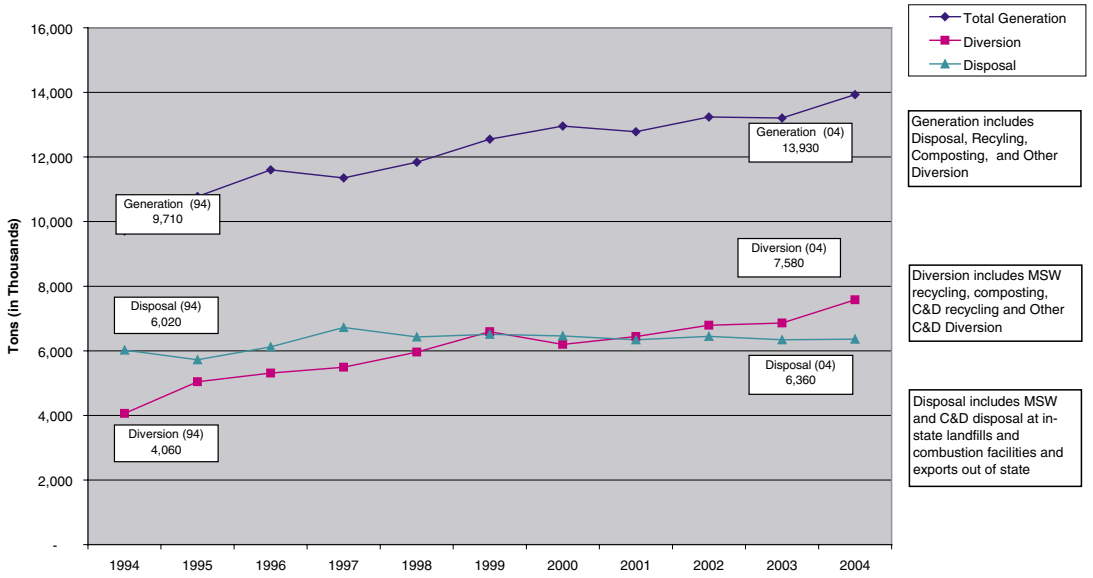
Recycling, reuse, and remanufacturing also bolster the economy, directly supporting 19,000 jobs in Massachusetts with a payroll of nearly $600 million and annual revenues of $3.6 billion. Total direct and indirect economic activity from recycling, reuse, and remanufacturing is estimated to generate more than $142 million annually in state revenues for the Commonwealth.

Measures of Recycling Progress

The first task in setting long-range waste reduction and recycling targets is to measure existing conditions and recent progress. MassDEP's recent *Solid Waste Master Plan: 2006 Revision*, published in June 2006, set two goals for the state to reach by 2010: reduce total solid waste volume by 70 percent, and as part of this overall reduction, recycle at least 56 percent of solid waste.

Program	2002	2003	2004	2010 Goal
Waste Reduction	57%	58%	60%	70%
Overall Recycling	47%	47%	48%	56%
Municipal Solid Waste Recycling	31%	34%	35%	NA
Construction & Demolition Recycling	75%	71%	71%	NA

Solid Waste Generation, Recycling and Disposal Trends, 1994-2004



Although the Commonwealth is on track to achieve its 2010 goals, recycling rates have remained somewhat static over the last several years, prompting the Executive Office of Environmental Affairs (EOEA) and MassDEP to revisit the strategies and approaches outlined in the original Solid Waste Master Plan

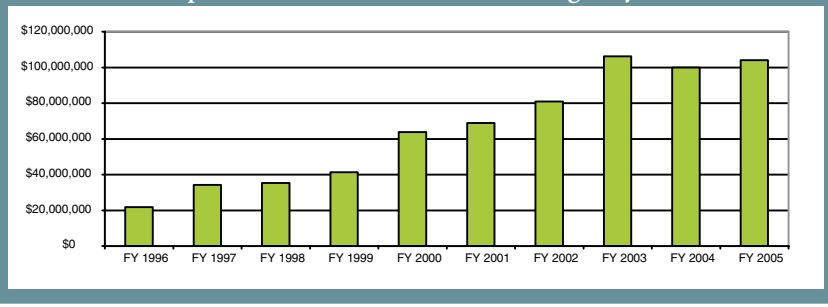
To help build on the state's waste reduction and recycling progress, EOEA and MassDEP have established and overseen several key initiatives, including efforts with municipalities to expand Pay-As-You-Throw (PAYT) waste disposal. Since 2000, the number of Massachusetts towns and cities with PAYT programs has increased from 94 to 120. These programs now serve 30 percent of the state's population. The tonnage of material recycled in communities with PAYT programs has typically increased by 25 percent, with a corresponding drop in disposal. The proportion of Massachusetts residents with access to curbside recycling programs has also increased, from 10 percent in 1990 to 80 percent in 2004.

Massachusetts Environmental Purchasing Program (EPP)

The State Purchasing Office has established a national model for recycled and environmentally preferable product (EPP) purchases. Since the mid 1990s, state and municipal purchases of recycled products have grown from $5 million to more than $70 million, while other EPP purchases – non-toxic and energy efficient products, for example – have grown to some $100 million annually. State volume purchasing creates markets for more environmentally friendly products, reduces environmental and health impacts, and often spurs growth and success at smaller and local companies.

Many state agencies and college campuses have recently undertaken successful efforts to dispose of less and recycle more. Over the last several years, for example, the Department of Correction has cut down on trash and increased recycling in the prison system, saving the Commonwealth hundreds of thousands of dollars.

State and Municipal Purchases of Products Containing Recycled Materials



Recycling initiatives are growing at the industry level, too. Working closely with the supermarket industry, for example, MassDEP has developed recycling programs to divert organic materials from more than 160 supermarkets to composting and animal feed operations. These stores are now recycling between 60 percent and 70 percent of the organic material they previously threw away, and are spending between $3,000 and $20,000 less per store per year on waste disposal.

MassDEP also recently instituted a ban on the disposal of certain construction and demolition (C&D) materials, including wood, asphalt, brick, concrete, and metals. As a result of this and other disposal bans, Massachusetts today is recycling 71 percent of its construction and demolition waste.

At the same time, the Commonwealth has made its waste ban enforcement practices more comprehensive and equitable by extending them to waste haulers and generators that dispose of banned materials. Municipalities are leveraging this state enforcement initiative to establish mandatory recycling programs at the local level.

In addition to continuing successful programs already underway, Massachusetts is moving forward with targeted efforts in three economic sectors to advance its waste reduction and recycling goals:

- **Commercial businesses:** MassDEP is working to increase waste paper and cardboard recycling rates and to expand the number of facilities available for organic waste processing. In collaboration with the EOEA State Sustainability Program, the agency has also identified prime opportunities at state facilities and hospitals to expand recycling.
- **Residential areas:** The state will support local outreach and incentive programs designed to increase paper and cardboard recycling, and to ensure that at least half of all Massachusetts residents have access to PAYT programs by 2010.
- **Construction and demolition:** MassDEP will award grants and loans, and issue beneficial reuse determinations, to facilitate connections with markets for reusable C&D materials such as wood, gypsum wallboard, and asphalt shingles.

Hazardous Waste Cleanup and Brownfields Redevelopment

As the birthplace of the American industrial revolution, Massachusetts has been at the forefront of manufacturing innovation, which has fueled the state's economy and improved its quality of life. However, in many cities and towns, old mill buildings and factory sites lie unused because of hazardous waste contamination. These sites, known as brownfields, pose a potential health risk to those living near them – both people and wildlife – and may threaten water supplies.

Many of these sites also represent the most appropriate places for new development because they are situated in urban cores, where critical infrastructure and skilled workers are readily available. But the costs and complexities of cleaning up these sites can push development away from commercial and industrial areas into "greenfields," resulting in the loss of countryside and possibly creating other problems related to sprawl. So, Massachusetts has made a concerted effort to expedite and encourage the cleanup and reclamation of brownfields through a number of initiatives.

Construction of the Basketball Hall of Fame in Springfield occurred on a brownfield as part of a larger urban revitalization project.

Hazardous Waste Sites Coming In and Closing Out, 1994-2006

Trends

From 1994 to 2004, some 20,000 hazardous waste sites were investigated and cleaned up in Massachusetts. Nearly 90 percent of these sites were cleaned to a standard that will allow for any future activity or development. At the remaining sites, a variety of cost-effective technology solutions, such as encapsulation, have been used in combination with land use restrictions to ensure that these properties are also returned to productive use.

Although about 1,800 new sites are reported to MassDEP every year, in 2004, for the first time, the number of sites being cleaned or closed surpassed the number of new sites identified. As this trend continues, Massachusetts is steadily safeguarding the environment while turning old blights on the landscape into new economic opportunities.

Successful Initiatives

Massachusetts laid the cornerstone for unprecedented success in remediating and reclaiming contaminated properties in 1992, when the state adopted the nation's first privatized waste site cleanup program. Today, private Licensed Site Professionals oversee and sign off on cleanup projects. While MassDEP retains enforcement authority at sites and audits completed work to ensure that the private sector is meeting rigorous environmental and public health standards, the agency's removal from direct review and oversight of most site cleanups means they are being completed sooner and state resources are being directed to the most problematic sites.

The 1998 Brownfields Redevelopment Act created a number of incentives to promote brownfields remediation and reuse in Massachusetts. Among these incentives are changes to state liability laws to protect innocent owners, lenders, and developers from being held responsible for problems that they did not create and may be attempting to resolve. The law also provided $30 million in funding for grants and loans to brownfields developers, tax credits for cleanup activities, and technical assistance for cities, towns and community groups seeking to promote the reclamation and reuse of neighborhood properties. In 2006, an additional $30 million was authorized for the grants and loans program.

A continuing obstacle to brownfields cleanup is the issue of the unwilling owner. Some property owners, fearful of becoming responsible for cleanup costs, refuse access to their properties for the purpose of investigation and possible remediation. As a result, potentially valuable properties wind up

Owned by the Department of Conservation and Recreation, the recently completed Neponset II Park in Dorchester is built on 3 former industrial sites.

fenced off and underutilized. MassDEP continues taking enforcement steps in an effort to persuade these responsible landowners to clean up their properties. But the state also needs to explore other solutions, including a variety of incentives and liability law changes.

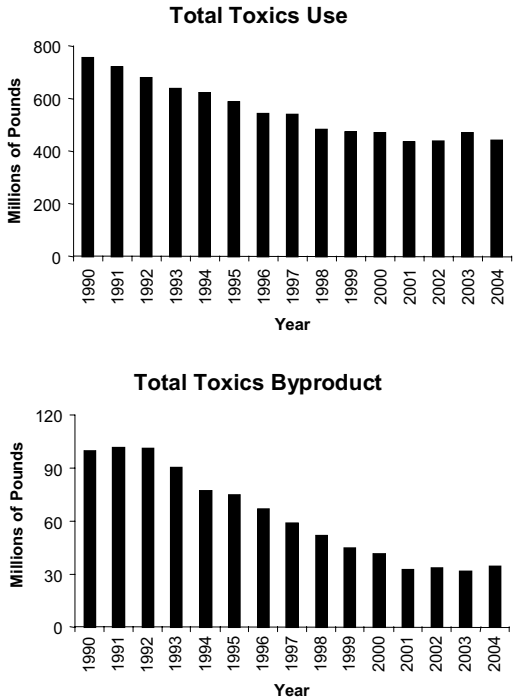
Toxics Use Reduction and the Zero Mercury Strategy

Toxics in the environment pose many serious risks to both human and ecological health. Toxic releases come from a number of sources, including power plants, factories, and accidental discharges. Many toxic chemicals do not break down after being released into the environment and accumulate in living creatures, posing serious long-term risks to ecosystems and to people. One chemical in particular, mercury, has been identified as a potent neurotoxin which builds up in animal and human tissue, and has been proven to cause persistent health problems, such as memory loss and neurological damage, especially in infants and young children.

Trends

In 2000, companies required by the Toxics Use Reduction Act (TURA) to report their use of toxic chemicals achieved a statutory goal of reducing toxic byproducts or waste by 50 percent relative to the 1990 levels. Since then, companies have continued to reduce their use of toxics, and their generation of hazardous wastes and harmful emissions.

Reduction in Toxic Chemical Use and Waste, 1990-2004



Reducing Toxics Use and Saving Money

Decorated Products Inc., of Westfield, an 80-employee maker of high quality nameplates, labels, and signs, had a problem complying with wastewater discharge limits, and called the Office of Technical Assistance for Toxics Use Reduction (OTA). That state office, which helps companies comply with environmental rules by reducing their use of toxic materials, came up with an idea for eliminating wastewater discharges entirely. Instead of disposing its acidic metal-etching chemicals down the drain after one use, OTA suggested that Decorated Products add ozone to the spent chemicals. Testing proved that the process would work and the company adopted it. Decorated Products now regenerates its etching chemicals by adding ozone, has eliminated 6,000 gallons of wastewater discharges per year, and saves about $220,000 annually because it no longer needs to purchase 35,000 gallons of fresh etching chemicals. Said company president Jeff Glaze, "The etching line employed six people. If it weren't for OTA, there is a good chance those jobs wouldn't have been there."

In 1998, Massachusetts trash incinerators were responsible for 70 percent of all mercury emissions in the state – approximately 8,600 pounds per year. In the late 1990s, the Commonwealth implemented the strictest limits in the nation for mercury emissions from incinerators and launched a major campaign to recycle rather than dispose of mercury-containing products, such as thermostats, thermometers, and fluorescent bulbs. Since 1999, the state's solid waste combustion facilities have reduced their mercury emissions by more than 95 percent to about 330 pounds annually.

Other initiatives that have reduced mercury releases into the environment include a focus on better mercury capture technologies at dental offices and a gradual shift to more benign dental filling substances, as well as regulations promulgated in 2004 that require the state's large coal-fired power plants to reduce their mercury emissions by 95 percent by 2012.

The Massachusetts environment has responded to these and other initiatives and significant reductions in mercury emissions have been realized. Overall, mercury emissions statewide have been reduced by about 70 percent since 1998, and by 87 percent in areas of the state that had the highest levels of mercury deposition. Five years of testing conducted by MassDEP on average mercury levels in fish across the Commonwealth indicate a 15 to 32 percent drop in mercury concentrations.

Successful Initiatives

The TURA program, administered by EOEA, was created to help manufacturers reduce their use of toxic chemicals and their generation of toxic wastes and harmful emissions. In Massachusetts, industrial users of toxic chemicals above certain threshold amounts are required to report annually on their chemical use, toxic waste generation, and amounts of chemicals ultimately treated or released into the environment. They also are required to plan for reductions in their use of toxic chemicals. These companies receive specialized help and support from the state's Office of Technical Assistance for Toxics Use Reduction (OTA) and the Toxics Use Reduction Institute on the Lowell campus of the University of Massachusetts.

Starting in 2001, the TURA program began to shift its focus to a select group of toxics that were identified as being the most hazardous. These included mercury, lead, and trichloroethylene (TCE, an industrial solvent). Today, industrial users of these chemicals receive more state attention and assistance. For example, OTA is working to help companies that have long relied on TCE as a cleaning solvent find alternative cleaners or new technologies to reduce the amount of TCE they use.

Next Steps

In 2006, Governor Romney signed into law two significant pieces of legislation that will drive continued toxics use reductions:

- The Mercury Management Act includes a series of "phase out" and "take back" provisions for products that contain the toxic heavy metal, and require manufacturers and distributors of mercury-containing products to meet specific notification requirements.
- The Toxics Use Reduction Reform Act made a series of changes to the way companies will participate in the TURA program from now on. The most significant change authorizes the state to establish a list of Higher Hazard Substances for which reporting requirements will be triggered at much lower use thresholds. Companies that use these chemicals may have to pay higher fees, but will also receive additional state technical assistance to reduce their reliance on them.

"For many of us, water simply flows from a faucet… We have lost a sense of respect for the wild river, for the complex workings of a wetland, for the intricate web of life that water supports."

–Sandra Postel, Last Oasis: Facing Water Scarcity

Water

Massachusetts might be described as a "water rich" state. From Boston to the Berkshires and Cape Cod to the Merrimack Valley, some 44 inches of average annual rainfall replenish 27 watersheds, more than 8,200 miles of rivers and streams, 3,050 lakes and ponds, and hundreds of reservoirs and wells that together supply more than one billion gallons of water to homes and businesses every day.

Yet the Commonwealth faces important water resource-related challenges; in particular, a growing tension between what people and the natural environment each need. Massachusetts must effectively manage its water resources to avert a clash between future economic growth and environmental necessity.

In releasing its first comprehensive Water Policy in 2004, Massachusetts sought to advance four basic principles to guide decision makers through the myriad of interwoven activities that will determine how well we address these competing demands:

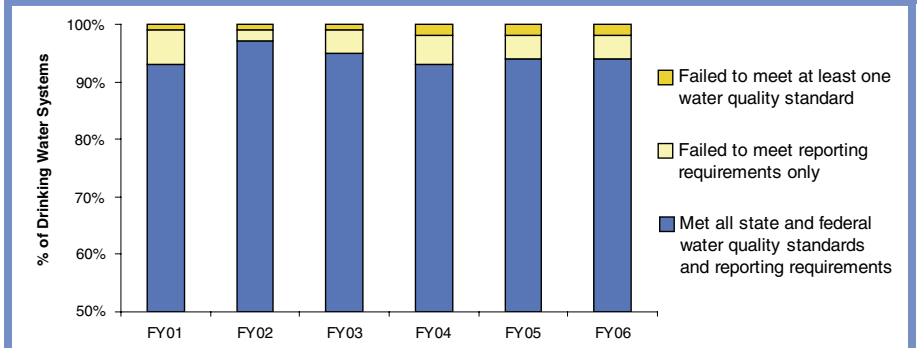
- Protect clean water and restore impaired resources;
- Keep water local, and seek to have municipalities live within their water budgets by addressing issues from a watershed perspective;
- Protect and restore fish and wildlife habitats; and
- Promote development strategies that are consistent with sustainable water resource management.

Ensuring the Quantity and Quality of Our Drinking Water

Drinking Water Quality

Massachusetts has one of the purest water supplies in the country. State and federal drinking water standards address more than 90 potential contaminants in public water supplies. During the fiscal year ending in June 2006, 94 percent of the 1,726 public water systems in the state met all federal and state health-based standards, including strict requirements for submitting regulatory compliance reports. Attesting to the quality of our water, 98 percent of reporting systems met or exceeded all drinking water standards.

Regulatory Compliance in Massachusetts Public Drinking Water Systems, 2001-2006



About 40 percent of the state's water comes from aquifers and wells, and roughly 60 percent from reservoirs and other surface supplies. Public water suppliers, private water companies, and water districts provide water to more than 90 percent of the state's population. Private wells supply the rest. Local boards of health are empowered to adopt regulations to protect residential wells, and have done so in 77 percent of the communities where private wells are in use.

In addition to monitoring our drinking water for regulated contaminants, the Department of Environmental Protection (MassDEP) also conducts research on currently unregulated contaminants to determine whether health-based standards are needed to protect people who live and work in Massachusetts from unacceptable risks.

Earlier this year, MassDEP took the proactive step of establishing a first-in-the-nation standard for perchlorate, a previously unregulated contaminant found in fireworks and other explosives that is highly mobile and persistent in groundwater and surface water. The Massachusetts perchlorate standard is intended to protect sensitive populations such as pregnant women, nursing mothers, and infants from thyroid function interference and other health risks posed by this chemical.

Drinking Water Quantity

While it is important for Massachusetts to continue vigilant monitoring of drinking water quality, the state and its municipalities need to do more to ensure a sufficient supply for continued growth of the population and economy.

Although per capita water use is lower in Massachusetts than in many other states, some of the Commonwealth's towns and cities lack sufficient water supplies to endure extended dry periods or support anticipated future growth. A recent study by the Metropolitan Area Planning Council noted that 37 communities in greater Boston may exceed their existing Water Management Act withdrawal limits by 2010. Another study indicates that at maximum "build-out," combined water consumption across Massachusetts will increase by 60 percent to approximately 1.6 billion gallons per day.

As communities think about how they will meet peak demand now and in the future without exceeding regulatory limits on their water use, they will need to focus on conservation and efficiency. The Massachusetts Water Resources Commission took a significant step in this direction when it updated the state's Water Conservation Standards. The revisions encourage communities to meet or demonstrate progress toward meeting residential water use of 65 gallons per person per day.

The Massachusetts Water Policy also calls for protection and restoration of lands that hold the keys to ensuring the quality and quantity of existing and future drinking water supplies. One recent example underscores the importance of doing so: an Executive Office of Environmental Affairs (EOEA) study of 130 communities along the rapidly growing I-495 belt, many of them largely dependent on local wells, found that nearly 20 percent of the land within 200 feet of current water supplies is unprotected and at risk of development. The story is similar in other watersheds across the state.

Watershed	Acres of Public Water Supply Protection Areas	Public Water Supply Protection Areas Land That Could be Developed
Buzzards Bay	27,816	31%
Charles	36,931	16%
Merrimack	19,661	20%
Narragansett/Mount Hope Bay	10,296	23%
Nashua	36,071	18%
Parker	8,131	20%
Shawsheen	9,264	8%
Sudbury/Assabet/Concord	29,971	11%
Taunton	60,775	23%
Ten Mile	6,235	21%
	TOTAL: 245,151	Average: 19%

Investment in watershed land protection has already proven to be cost-effective. Between 1987 and 1999, Massachusetts spent $92 million on conservation around the water supply for metropolitan Boston, much of which is surrounded by undeveloped land. In doing this, the state avoided

the need to build a $140 million treatment plant with an annual operations budget of $10 million. Yet for municipalities looking to protect water supplies in highly developed areas, the outlook can be sobering. For example, two studies of Cape Cod's future water needs found that 20 additional town wells will be needed by 2020, but only five percent of the land on the Cape is available or suitable for developing them.

EOEA is responding to this challenge in part through its Drinking Water Supply Protection Grant program, which provides municipalities, as well as water and fire districts, financial assistance to protect and actively maintain key parcels of land associated with water supplies. In the last few years, the state has awarded nearly $4 million to help protect 906 acres of critical water supply land while simultaneously expanding passive recreation opportunities across the Commonwealth.

Down the road, desalination – the conversion of salt water to fresh water that is suitable for drinking or irrigation – may be one method Massachusetts pursues to meet its increasing water supply demands. Two proposed desalination plants are currently under state review and the Water Resources Commission is looking at conceptual desalination policies.

Protecting Water-Dependent Ecological Resources

In the natural environment, water quality is critical for maintaining healthy ecosystems and protecting public health. Before the 1970s, industries and municipalities dumped untreated wastewater directly into most major rivers, badly polluting them. Under federal and state clean water legislation, 75 to 90 percent of these discharges stopped, wastewater treatment expanded, and more Massachusetts waters began to meet recreational use standards.

Unfortunately, non-point source water pollution remains a continuing threat. Unlike pollution from a specific discharge, this type of pollution comes from many widespread sources and is therefore harder to control. Non-point sources include failing septic system leachate and stormwater runoff that move through and over the ground, picking up pollutants along the way and depositing them into inland and coastal waters.

Many partners – government agencies, municipalities, schools, and citizens – play important roles in monitoring the health of lakes, rivers, streams, and the ocean. The Commonwealth has prioritized its water quality monitoring efforts to focus on water bodies that are most likely to become contaminated, including 67 percent of the lake area, 26 percent of the river miles, and nine percent of the marine waters in Massachusetts.

The state assesses these water resources based on their suitability for specific uses, such as primary (swimming) and secondary (boating and fishing) recreation, aquatic habitat, and consumption of fish without risk of exposure to toxics. Of the river miles tested, 29 percent are considered safe for fishing and swimming and provide a healthy habitat for aquatic life. Targeted water quality monitoring indicates that approximately 21,000 of the 150,000 acres of lakes in Massachusetts, or about 14 percent, fully support their designated uses, while approximately 80,000 acres are impaired, many as a result of mercury contamination from the air. The remaining acres have not yet been tested. In Massachusetts, 80 percent of all water body impairments result from pathogens, noxious aquatic plants, excess nutrients, turbidity, metals, or oxygen depletion.

Water quantity is also a critical component of a healthy natural environment. In some areas, particularly during the summer months, rivers are drying up and leaving fish populations stranded. Impervious surfaces, such as parking lots, that effectively prevent rainwater from replenishing aquifers are combining with increasing water supply demand and out-of-basin wastewater transport to reduce streamflow and impair both water quality and aquatic habitat.

In its Water Policy, EOEA has identified the importance of managing water systems efficiently to maintain flow in our rivers and streams during dry seasons. Many related efforts are underway:

- MassDEP is updating its Stormwater Management Policy to provide more guidance to municipalities and developers on recharging stormwater closer to its point of origin, thereby keeping more water local.
- EOEA has developed a Smart Growth Toolkit and established a statewide Low Impact Development task group to help promote public and private development practices that are sensitive to water and other ecological needs.

- Scientists at the Department of Conservation and Recreation (DCR) are developing "index" streamflows using historic statistics from those Massachusetts rivers that have been least disturbed by human activity. These will help scientists determine the degree to which other rivers' flows are being affected by human use and better inform state water resource decision making.
- EOEA is currently studying monthly water budgets for every community in Massachusetts, taking into account seasonal variations in water use, irrigation, wastewater flow, and natural streamflow. When compiled, these data will help inform local decisionmakers about impacts on local streams.

Wetlands

An important measure of environmental health is abundant and unspoiled wetlands. Protecting the wetlands that remain in Massachusetts and restoring those the Commonwealth has unnecessarily lost are a major focus of state environmental agencies. Wetlands play a critical role in controlling damage from floods and storms, limiting contamination of water resources and supplies, and providing good habitat for fish, shellfish, and other wildlife.

While there are many contributors to wetlands loss, Massachusetts is particularly concerned about and is aggressively targeting the illegal destruction of these resources. State law dictates that anyone who plans to fill or work within 100 feet of wetlands must first obtain a permit from the local conservation commission. Applicants are required to avoid, minimize, and mitigate wetlands damage.

Based on a statewide aerial assessment, MassDEP has identified more than 850 acres of wetlands that have been filled since 1990, primarily due to residential and commercial development. While much of this activity was reviewed and approved on the local level, some wetland destruction takes place illegally. Based on a study of 92 communities across the state, MassDEP estimates that 58 percent of all wetlands loss is the result of illegal, unpermitted alteration and filling.

Addressing Low-Flow Conditions in the Ipswich River Watershed

The Ipswich River watershed currently supplies drinking water to 23 communities with 330,000 residents. In five of the last 10 years, the Ipswich has experienced low-flow and no-flow periods during which some segments of the upper river have gone dry. These episodes have resulted in fish kills and other ecological damage.

In general, this water supply problem is the result of significant and continuous land use changes in the Ipswich River watershed. Within these communities, an annual average of nearly 1,000 acres has been developed since 1971. This development pressure, combined with wasteful water usage and "out-of-basin" transfers, contribute directly to low-flow conditions.

DCR, with funding from the U.S. Environmental Protection Agency (EPA), is piloting innovative approaches to reduce severe low-flow problems in the Ipswich River watershed. These include low impact development techniques that recharge stormwater to the groundwater, and water conservation techniques that provide incentives for homeowners and businesses to reduce their water use during drier months.

Reclaiming and Restoring a Wetland in Amesbury

2001-Former wetland (outlined in red) illegally filled by development

2005-Post wetland restoration

Restoring degraded wetlands is an important next step. As of September 2006, Massachusetts was moving ahead with 48 projects encompassing the restoration of 550 acres of wetlands, with planning underway for another 40 priority projects that would bring an additional 300 acres of wetlands back to life.

EOEA is also establishing the state's first Wetlands Mitigation Bank in the Taunton River Watershed. This pilot project was mandated by legislation passed in 2004 to mitigate the wetlands impacts of transportation, public works, and other large projects that require wetlands variances, permits, and Orders of Conditions. The mitigation bank will improve wetlands function in the Taunton River Watershed; marshal and provide extensive financial resources, planning assistance, and scientific expertise to create high quality wetlands and wildlife habitat; and enhance the success of compensatory mitigation to offset project impacts.

Freshwater Fisheries

Another important measure of environmental health is the quality of freshwater fisheries. In an effort to define the condition of fish populations in Massachusetts rivers and streams, and establish restoration goals, biologists at the Department of Fish and Game (DFG) are conducting population assessments of fisheries across the state. In many cases, they are observing species mixes they would not expect to encounter under "normal" conditions. Low flows and other impairments give rise to population growth among fish species that are more commonly associated with lake and pond habitats ("macrohabitat generalists") at the expense of those fish that depend on more free-flowing waters ("fluvial dependent" and "fluvial specialist" species).

Over the centuries, human activity has changed, diminished, and at times even eliminated valuable riverine habitats. More than 3,000 dams fragment the Commonwealth's rivers and streams – an average of one dam for every three miles of river.

MWRA Update

No discussion of water in the Commonwealth is complete without mentioning the state's largest water supply and wastewater collection network, managed by the Massachusetts Water Resources Authority (MWRA). The Authority provides wholesale water and sewer services to 2.5 million people and more than 5,500 large industrial users in 61 metropolitan Boston communities.

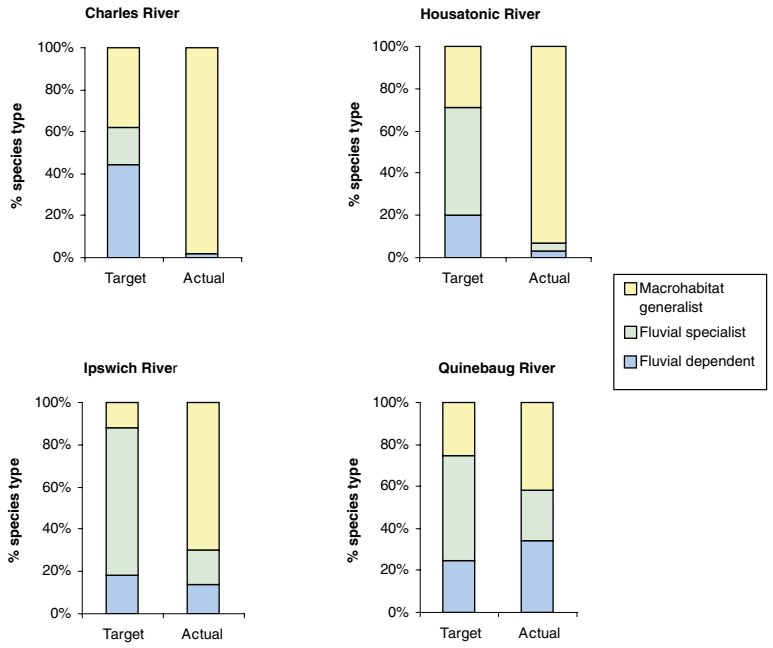
Relying primarily on the reservoirs of the Quabbin and Wachusett watersheds, MWRA customers have one of the most abundant and high quality water supplies in the world. The completion of a new, state-of-the art ozone water treatment plant in July 2005 culminated a ten-year, $1.7 billion MWRA program to modernize the Greater Boston water supply, ensuring safe and reliable delivery of drinking water for decades to come.

The MWRA sewage treatment system has undergone a nearly complete transformation under the federally mandated 11-year, $3.8 billion project to clean up Boston Harbor. Nearly two decades of environmental monitoring data document dramatic improvements in the quality of the harbor's water, sediment, and living natural communities.

According to the Boston Harbor Association, water quality at harbor beaches has vastly improved over the last decade, as long-time bacteria problems associated with wastewater discharges have been reduced. In 2005, most Boston Harbor beaches met swimming standards more than 90 percent of the time. When the MWRA combined sewer overflow (CSO) control program is completed in 2015, Boston should enjoy some of the cleanest urban beaches in the world.

Revere Beach
Photo credit: Fred Popper

Using Fish Species Mix as an Indicator of River Health



DFG is recommending dam removals and flow increases to help return fish to their natural habitats. In recent years, five dams have been removed in partnership with the DFG Riverways Program. Removing older dams that no longer serve a purpose helps restore river habitat, improve water quality, and relieve their owners of maintenance costs and liability concerns.

"The oldest task in human history: to live on a piece of land without spoiling it."
–Aldo Leopold, A Sand County Almanac

Land

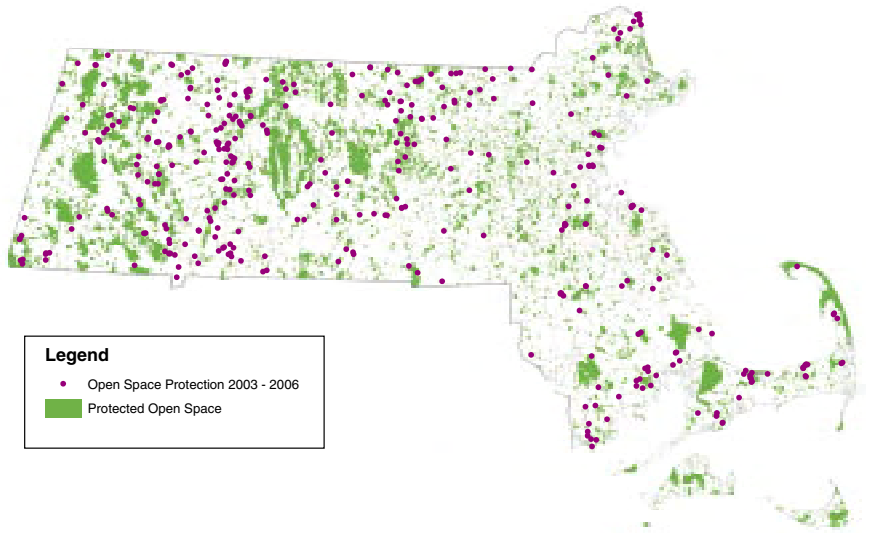
One-fifth of the Commonwealth's land area has been permanently protected for conservation or outdoor recreation purposes. These lands not only provide aesthetic, environmental, and recreational benefits to the state, but also add value to local economies. They increase neighboring property values; provide natural buffers that control floods, absorb stormwater and other runoff, and safeguard drinking water supplies; and support forestry, agriculture, recreation, and tourism. In fact, an analysis by the Executive Office of Environmental Affairs (EOEA) estimated that 50,000 acres of conservation land provides about $134 million annually to the Massachusetts economy via the forestry, farming, and tourism industries and provides a one-time savings of $22 million in avoided public infrastructure costs.

Half of the more than one million acres of conservation and recreation lands in Massachusetts are state-owned, while the rest are under municipal, non-profit, or federal control. An important component of the state's conservation efforts is the network of land trusts that join public and private interests to protect thousands of acres every year. The Massachusetts Audubon Society (30,000 acres), The Nature Conservancy (22,000 acres), and The Trustees of Reservations (24,000 acres) are three groups among dozens that together are conserving more than 180,000 acres of valuable open space across the Commonwealth.

In recent years, state land conservation efforts have emphasized acquiring or protecting high quality resources in quickly developing areas near existing state forests and parks. As a result, the number of people living within one mile of each acre of land protected by EOEA over the past four years has more than doubled compared to previous years. Over the same period, the state has increased by 46 percent the "connectedness" of its acquisitions (as measured by length of common boundary per acre protected) to build on past investments and strengthen safeguards for still viable habitat, parcels of farm and forest, and drinking water supplies.

In the three years since the creation of the Department of Conservation and Recreation (DCR), Massachusetts has increased by 46 percent allocations to fix crumbling infrastructure at its existing parks and recreation facilities. Still, much more remains to be done to preserve open space that is threatened by development but currently unprotected, and to provide ample outdoor recreational resources for the people of Massachusetts.

Additions to the Commonwealth's Protected Open Space, 2003-2006



Fostering Outdoor Recreation

As the seventh smallest geographically and third most densely populated of the states, Massachusetts is fortunate to have one of the largest state park systems in the country. Thanks to the work of Frederick Law Olmsted and Charles Elliott, the state's cities and towns are also graced by some of the nation's oldest and most beautiful local and regional parks.

Parks and open spaces are an important part of the foundation of our high quality of life. They also contribute significantly and directly to our economy. Of the $21 billion per year that tourism pumps into the Massachusetts economy, nearly half is directly attributable to outdoor recreational activities. For example, fishing and hunting contribute $630 million annually to the state's economy. Wildlife viewing adds another $600 million per year. And, according to the National Association of Home Builders, nearby parks and recreational opportunities can increase the value of building sites by 15 to 20 percent.

An estimated 35 million residents and visitors experience the quality of Massachusetts state forests, parks, reservations, and recreational open spaces every year. DCR offers a diverse array of recreational opportunities:

- 87 beaches;
- 29 campgrounds;
- 37 swimming, wading, and spray pools;
- 2,000 miles of walking and hiking trails;
- 145 miles of paved bike paths and rail trails;
- 62 playgrounds;
- 55 ball fields; and
- Educational programs and special services for people with disabilities.

There was a landmark change in how Massachusetts administers its state parks system in 2003, when the Metropolitan District Commission and the Department of Environmental Management were merged to form DCR. Today, the unified agency fosters efficient management of state forests, parks, and recreation sites through shared systems and service standards.

Innovations in a variety of operating tasks have helped the agency deliver safer, cleaner, and more accessible experiences to meet customer demand and expectations.

Capital investments in state parks and recreation areas follow Governor Romney's "Fix-It-First" agenda. Recognizing the critical importance of long-term capital investment, DCR in 2006 proposed a five-year capital plan for fiscal years 2007 through 2011. Under this plan, $120 million would be expended annually in accordance with public safety, health, and use criteria. Given the $1.6 billion in capital needs at DCR properties that the agency identified in 2006, including approximately $500 million for large roadway and bridge projects, this kind of sustained investment is critical.

The state is also helping cities and towns establish new parks and rehabilitate old ones. Through its Urban Self Help Grant Program, EOEA provided municipalities $11 million in funding for these projects between fiscal years 1999 and 2002. During the last four fiscal years, total grant making has

Fostering Partnerships to Restore State Parks

In August 2003, EOEA created the Office of Public Private Partnerships to support grassroots groups that are working to help restore state parks. Over the first two rounds of this program, state investments of $1.9 million have been matched by $2.4 million in private and other non-state investments from more than 41 partners. In the third round an additional $900,000 of state funds will leverage $1.5 million in private funds. This money has gone directly to 79 capital projects at 63 facilities managed by DCR. The most significant project of these has been the restoration and dedication of the Teddy Ebersol's Red Sox Fields at Lederman Park, along the Boston Esplanade, where work was recently completed to correct drainage problems and restore six ballfields.

Restoration of the Historic Tudor Barn at Middlesex Fells Reservation, Stoneham

Before

After

almost doubled to nearly $21 million. Crucial partners in these projects have been the more than 100 cities and towns that have adopted the Community Preservation Act. In the first four years after the law's passage, $55 million set aside by these municipalities for new land conservation and parks has been matched by $53 million in state funding to ensure completion of work.

The outdoor recreation opportunities available through state and municipal parks greatly contribute to the quality of life in Massachusetts. It is critical that the Commonwealth work to restore its park system through targeted capital investment and partnerships that will eventually alleviate millions of dollars in deferred maintenance. Cornerstones of this effort will include Urban Self-Help Grants to establish new municipal parks, gardens, and open spaces in blighted or under-served neighborhoods, particularly in the state's 51 cities, and building the number and capacity of urban land trusts. Land acquisition and parks maintenance should not be viewed as mutually exclusive budget demands. Instead, they should be seen as synergistic: well-maintained parks are part of a strategy for providing additional, adequate open space for residents to enjoy.

Preserving Biodiversity

Massachusetts is comprised of 14 distinct "eco-regions," from Berkshire mountain tops to coastal pitch pine barrens. Together, these regions support a tremendous amount of biodiversity, including 175 animal and 269 plant species designated by the state as rare, threatened, or endangered. Through its nationally acclaimed *BioMap* and *Living Waters* publications, the Division of Fisheries and Wildlife highlights these species' "core" habitats, which are increasingly threatened by development and the impact of invasive species. About 50,000 acres of "core" habitat identified by BioMap have been protected so far, but more than 660,000 acres of terrestrial habitat for rare species remain vulnerable.

Habitat "fragmentation" is also a threat to many species, particularly those dependent on large, undisturbed forests. A recent U.S. Forest Service study found that 75 percent of the state's forests are within a quarter mile of developed land. Scattered and haphazardly planned development is quickly "fragmenting" the remaining large undisturbed forests. A recent Harvard University study of north central Massachusetts found that over a recent 15-year period, the average size of an uninterrupted forest block had decreased from 1,100 acres to 800 acres.

Further, Massachusetts forests are decidedly "middle aged" and do not provide the quality of habitat provided by forests at the two comparative extremes of age. Today, fewer than one percent of our forests are classified as very old and less than four percent as very young.

Several recent state initiatives will improve management of important natural habitats and provide enhanced protection of rare and endangered species. In 2006, for example, the Department of Environmental Protection (MassDEP) issued the *Massachusetts Wildlife Habitat Protection Guidance for Inland Wetlands* to help identify and then minimize potential threats to important wildlife habitats posed by development. In addition, reforms to the Commonwealth's endangered species regulations will improve both the quality and efficiency of state review of projects that potentially threaten endangered species habitats.

Marbled Salamander, a state-listed Threatened Species

Continued preservation of our state's biodiversity depends on efforts to safeguard core habitat areas across Massachusetts, including wetlands, uplands, and aquatic systems. EOEA's recent designation of 50,000 acres of large forest reserves is a key first step. Adding another 50,000 acres of small reserves that protect special local resources will follow soon. Monitoring these reserves will help guide and improve forestry practices across the state. It is likewise important to expand the regeneration of young forests on state land and review forest cutting plans for private land to ensure that "regeneration cuts" leave adequate openings for young trees to take root and grow. The remaining 400,000 acres of state-owned forest will be managed through sustainable forestry practices.

Protecting Working Farms and Forests

Although 6,100 farms totaling more than 500,000 acres remain in Massachusetts, the state has lost 14 percent of its farmland to development over the last three decades. By the late 1990s, farms were vanishing at a rate of nearly 6,000 acres per year.

Massachusetts continues to lose farmland faster than any of its New England neighbors. Complicating matters, the development value of farmland is higher here than in any other state in the country, making the preservation of farmland a significant challenge. Still, Massachusetts agriculture is a $750 million per year industry, ranked first nationally in the value of direct sales per farm, making farmland protection important not only in terms of preserving open space, but from an economic perspective as well.

Through its Agricultural Preservation Restriction (APR) Program, the nation's first and most respected farm protection initiative, the Department of Agricultural Resources (DAR) obtains restrictions in perpetuity over all non-farm activities while farmers retain ownership of their lands. To date, the APR Program has succeeded in protecting 60,000 acres of prime Massachusetts farmland and is working toward a long-term goal of preserving an additional 240,000 acres. At the same time, the DAR Farm Viability Program is providing financial grants that support farming on an additional 25,000 acres in exchange for ten-year "no development" covenants.

Like farms, the state's working forestlands are threatened by development. Few people realize how vast but rapidly disappearing those wooded areas are. With forests covering 62 percent of its land area, Massachusetts is the eighth-most forested state in the country. According to a recent U.S. Forest Service report, "Few places on Earth have as many people living among so many trees."

The sale of native wood products contributes between $580 million and $845 million per year to the Massachusetts economy, and sustainable harvesting of forest products delivers an estimated $50 of local economic benefit for each dollar paid to forest landowners. Meanwhile, the "ecosystem services" provided by our forests – such as air and water filtration and carbon sequestration – have an estimated value of $2.9 billion per year.

Yet since 1985, Massachusetts has lost forestland at one of the fastest rates of any state in the country. Over this period, more than 100,000 acres of forest have been consumed by development, mostly east of Worcester. Development has also reduced the average forestland holding to less than 10 acres, making land conservation and sustainable forestry even more challenging. In recent years, harvesting of Massachusetts forests has occurred at only 50 percent of the sustainable rate. A key challenge is supporting local processing of wood products. One-third of the state's wood processing facilities have closed their doors in recent years; approximately half of all wood harvested in Massachusetts today is processed out of state. To ensure that working farms and forestlands across Massachusetts remain economically viable, the state will continue to push for incentives to support the landowners who work them. Options including tax incentives and technical assistance grants to support sustainable agriculture and forestry, as well as marketing assistance for "green certified" products, are being explored.

Over the last few years, Massachusetts environmental agencies have supplemented traditional land protection programs with business and natural resource planning and grants in exchange for landowners signing 10-to 20-year "no development" covenants. Supporting sustainable agriculture and forestry preserves results in open space protection and supports local economies. To continue making gains, the Commonwealth needs to fully implement its Sustainable Forest Management Initiative on state lands and establish the state's first National Forest using a "working forest easement" model.

Working Land Incentive Programs: Overview

Program	Number of Participating Landowners	Number of Acres in Program
Farm Viability	263	25,498
Forest Viability	10	626
Forest Stewardship	2,263	165,894
Forest Tax Law "Green Certification"	6,000	360,000

"It is a curious situation that the sea, from which life first arose, should now be threatened by the activities of one form of that life."
–Rachel Carson

Coast and Ocean

With 1,500 miles of coastline and 2,100-square miles of state-managed ocean waters, Massachusetts is home to sandy beaches, bustling ports, and rich fishing grounds. Since these are essential components of the Bay State's environment, economy, and quality of life, coastal and ocean resources require vigilant management and protection, especially given that waterfront areas are a focal point for continued development.

In addition, according to the National Oceanic and Atmospheric Administration (NOAA) and the Intergovernmental Panel on Climate Change, sea level around Boston has risen approximately 10 inches in the last century, a trend that is likely to accelerate over the next 100 years, posing significant implications for waterfront property owners, coastal habitats, and state efforts to manage coastal and ocean resources.

The challenge is complicated by a dynamic environment shaped by wind, waves, and tides where it can be difficult to assess environmental conditions and trends. In the ocean, where research is even more difficult, even less is known.

Recognizing these realities, the Executive Office of Environmental Affairs (EOEA) and its offices and agencies promote proactive coastal and ocean management, along with improved research and data collection, to provide a solid foundation for innovative local and state decision making that balances competing demands.

The Value of Our Coast and Ocean

Anyone who has strolled along the shore, taken a whale-watching trip, or cast in the surf for stripers knows that the coastline and ocean waters of Massachusetts contain priceless resources. To better understand their economic value, the Massachusetts Office of Coastal Zone Management (CZM) commissioned the Donahue Institute at the University of Massachusetts to conduct an evaluation of the state's marine economy, which includes commercial seafood, marine transportation, coastal tourism and recreation, marine sciences and technology, and marine-related construction and infrastructure sectors.

The June 2006 Donahue Institute study found that the Massachusetts marine economy directly employs more than 150,000 people, with a total payroll of more than $4.3 billion. Nearly 80 percent of the jobs it creates are in coastal tourism and recreation. Factoring in secondary employment – work created by the marine economy – total annual output is conservatively estimated at $14.8 billion, or nearly five percent of the Massachusetts Gross State Product.

Impacts and Trends

The cumulative impacts of development can lead to the loss and degradation of important habitats, such as salt marsh, coastal dunes, eelgrass beds, and mud flats – all of them vital to coastal and ocean species. Stormwater is a major threat. Water quality declines as stormwater carries contaminants from septic systems, roads, lawns, and other sources into rivers and streams, and eventually to the sea.

As coastal development increases, serious environmental and economic impacts can result. For example, river herring, cod, winter flounder and other species dependent on coastal environments are experiencing record

declines in population, due partly to the cumulative impacts of development on critical habitats. In fact, the number of spawning adult river herring in many Massachusetts runs dropped by roughly one-half from 2004 to 2005, following several consecutive years of slower but steady declines. These losses have led to the first moratorium in state history on the sale and harvest of all river herring.

Water Quality: Watching Blue Mussels

The Gulf of Maine Council on the Marine Environment is a U.S.-Canadian partnership focused on the sustainability of resources in the Gulf, which extends from Nova Scotia to Cape Cod Bay. Since 1993, the Council's Gulfwatch program has been monitoring contaminants in blue mussels. These shellfish are filter feeders that siphon large volumes of water to capture tiny plants and animals. In the process, they also concentrate contaminants from the water column in their tissues. Because mussels stay in one place, their tissues provide a good indicator of the chemicals present in the water they inhabit.

Gulfwatch results show that some contaminants – such as mercury, lead, and pesticides – are more concentrated in mussels collected near urban centers and the mouths of large rivers. Contaminants are most concentrated in Massachusetts, which is furthest "downstream" of the most industrialized watershed in the region.

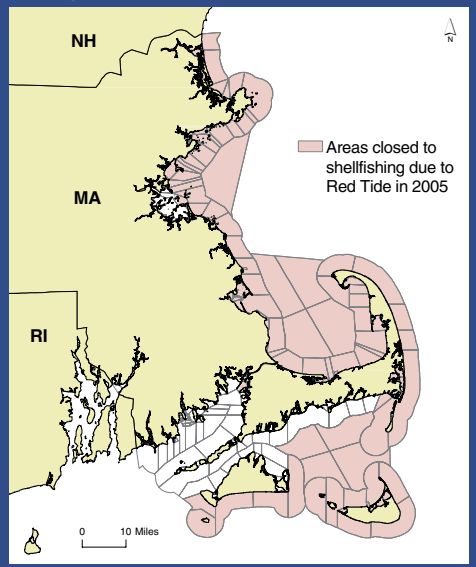
As more data and sites are analyzed, a clearer picture is emerging and it shows some statistically significant changes in contaminant levels. For example, mercury levels are decreasing in Ipswich, possibly because of aggressive state measures to limit mercury in the environment, while DDT and PCBs have increased in Duxbury, most likely from past pollution becoming re-suspended from contaminated sediments below. Gulfwatch is now synthesizing its 12 years of sampling data in order to develop an improved foundation for examining future trends.

Addressing the Impact of Red Tide

Millions of microscopic plants or phytoplankton thrive in nearly every drop of coastal seawater. In the presence of sunlight and sufficient nutrients to grow, these plants multiply, creating algae "blooms." While most of the thousands of species of algae are harmless, *Alexandrium fundyense*, which naturally occurs in all New England waters, is one of a few dozen that create potent toxins. Blooms of toxin-creating algae are commonly called red tide. Rigorous testing and monitoring by state and federal agencies ensures that any shellfish that reach retail markets and restaurants are toxin-free and safe to eat.

Research has shown that *Alexandrium* cells travel southward in coastal currents derived from rivers and other water moving west in the Gulf of Maine. In most years, natural current and wind patterns keep the cells from flowing into nearshore waters of southern New England. In 2005, however, spring storms brought heavy rains and steady northeast winds, creating a record-breaking red tide bloom that migrated into Massachusetts waters and closed more than 75 percent of the state's waters to shellfishing. Coastal Massachusetts again experienced a widespread red tide bloom in 2006, extending from the New Hampshire border to Duxbury, forcing additional shellfish closures and prolonging the economic hardship faced by the fishing industry.

Preliminary economic impact analysis estimates that red tide closures cost the Commonwealth more than $10 million in shellfish landings, and even more in indirect costs to shellfishermen. In 2005, Governor Mitt Romney declared a state of emergency that enabled the state to seek federal disaster aid for the shellfish industry; the first time this step was ever taken in Massachusetts because of red tide. In response, the Small Business Administration (SBA) made low-interest economic injury disaster loans available to the small businesses affected by this event and conducted several workshops along the coast to assist shellfishermen.



In 2006, the U.S. Congress provided $2 million in funding through the National Oceanic and Atmospheric Administration to help Massachusetts address the impacts of the 2005 red tide event. With these funds, Massachusetts Division of Marine Fisheries (DMF) will conduct a two-phase program that addresses the immediate needs of shellfishermen and examines potential long-term threats to their industry.

Water Quality: Beach Closures

Five years ago, the Massachusetts Department of Public Health (DPH) began a program to inventory and communicate beach monitoring results to the public. In June of 2006, DPH released *Marine and Freshwater Beach Testing in Massachusetts: Annual Report 2005 Season*, including water quality data from 602 public and semi-public beaches in 60 coastal communities. Of these beaches, 71 percent met all of the DPH water quality standards for swimming throughout the 2005 season.

DPH reported that 4.6 percent of the samples taken in 2005 showed bacteria levels in excess of health-based regulatory standards, results similar to those in previous years. Nearly 61 percent of these samples were taken within 24 hours of rainfall, suggesting that stormwater runoff is a significant contributor to high coastal bacteria levels, and that further efforts to reduce this pollution are needed.

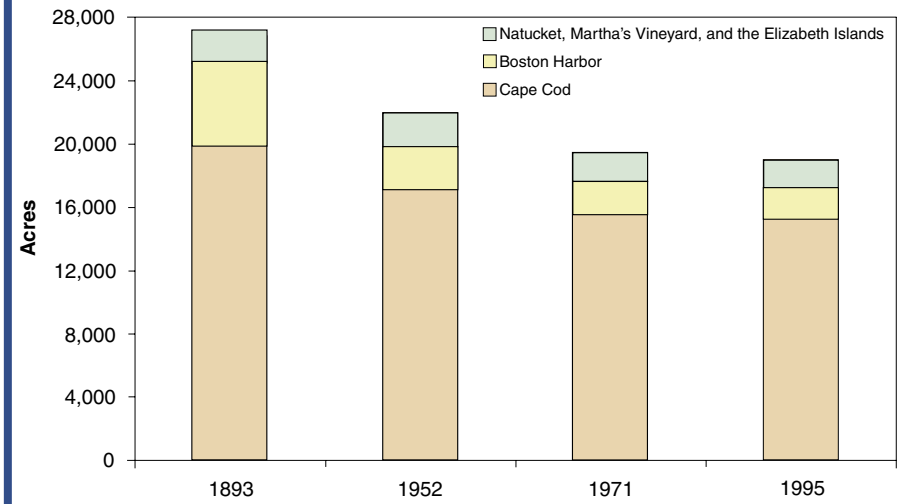
Beach Communities That Reported At Least One Incidence of Unacceptable Bacteria Levels in 2005

Source: MA Department of Public Health, 2006

Habitats: Coastal Wetlands

Coastal wetlands in Massachusetts have been diked, drained, and filled since Colonial times, but the extent and location of these losses has not been well examined. To better understand the trends for these critical resources, historical maps and contemporary aerial photographs were used to examine changes in coastal wetlands along the shores of Boston Harbor, Cape Cod, Nantucket, Martha's Vineyard, and the Elizabeth Islands.

Area of Estuarine Marsh Wetlands in the Commonwealth since 1893



A sharp decline in the loss of salt marshes and other coastal wetlands corresponded with passage of a first-in-the-nation law: the Massachusetts Wetlands Protection Act of 1972. Despite modern protections, however, the Commonwealth inherited a legacy of wetland loss that affects coastal management to this day. Proactive efforts, such as those of CZM's Wetlands Restoration Program are helping to correct some historic losses.

Of the 843 acres of wetlands altered in Massachusetts between 1990 and 2001, only four acres, or less than one-half of one percent, were found in coastal zone communities. A more recent analysis of wetlands loss, conducted from 2001 to 2005 and limited to towns and cities along the coast, showed that 1.9 acres, or two percent of the 120-acre total of all wetlands loss in these Massachusetts coastal communities, were coastal wetlands.

To further assess the health of Massachusetts marine habitats, the MassDEP Wetlands Conservancy Program has been systematically quantifying the distribution and abundance of seagrass beds since 1995. Eelgrass, or *Zostera marina*, is the most common seagrass present along the Massachusetts coastline.

Because many physical and water quality impacts from human activity affect the abundance and distribution of eelgrass, it is often considered a "sentinel" species for evaluating ecosystem health. Further, the size and location of eelgrass beds can be easily documented with aerial photographs, so it is an ideal habitat to track and monitor. Research indicates that the two principal factors affecting eelgrass growth are declining water quality and physical disturbance by people.

Eelgrass

A third statewide mapping of Massachusetts eelgrass beds is underway now. Based on the completed second mapping effort, MassDEP estimates that eelgrass beds declined by 11,000 acres or more than 23 percent between 1995 and 2001. The Massachusetts Estuary Project (MEP) is working to find solutions to improve water quality in the estuarine and marine environments.

MassDEP also published *Small Docks and Piers: A Guide to Permitting Small, Pile-supported Docks and Piers* in 2003 to provide construction standards for the protection of water quality, shellfish habitat, eelgrass, and salt marsh vegetation.

Fisheries

While the state's harvest of groundfish – cod, flounder, and haddock – remains a staple of the New England economy, many of these stocks face declining populations, which in turn are triggering more regulatory restrictions.

One of the most pressing challenges federal and state fisheries managers face is the depleted cod population in the Gulf of Maine. Although cod populations appear to be growing in Massachusetts waters, historic spawning areas along the coast of Maine are no longer producing as they once did. To protect the vital remnant population, the Massachusetts Division of Marine Fisheries (DMF), with approval from the Marine Fisheries Advisory Commission, imposed a two-year, December through January seasonal ban on recreational and commercial cod fishing in the most productive grounds in Massachusetts Bay, and designated the area as a Cod Conservation Zone.

Massachusetts' nearshore waters continue to sustain thriving recreational fisheries. In fact, the Commonwealth is one of only a handful of coastal states that can boast of having more than a million saltwater recreational anglers. Current estimates indicate that these outdoor enthusiasts spend more than $1 billion a year in the Bay State. During 2004 alone, saltwater anglers made more than 4.5 million fishing trips and caught more than 16 million fish. And, thanks to strategic management, the species they are after – striped bass, scup, haddock, fluke, bluefish, and black sea bass – have become significantly more abundant in recent years.

A precautionary management approach, combined with effective research and monitoring, can be applied to all state fisheries, affording sufficient protection today and ensuring smart, sustainable harvests from state waters in the future.

Ongoing Initiatives

EOEA offices and agencies are working on a number of key initiatives designed to improve understanding and ensure continued effective management of ocean and coastal resources.

Ocean Management

In 2003, Governor Romney asked EOEA to lead the pioneering Massachusetts Ocean Management Initiative. The secretariat created a Task Force to spearhead the initiative, and within one year that group had completed an extensive report and set of recommendations for administrative, statutory, and regulatory changes needed to ensure a proper balance between the use and protection of ocean resources. Among the many Task Force recommendations already being implemented, EOEA has drafted *An Act Relative to Oceans*, a bill that would authorize development of a statewide Ocean Management Plan.

Since 2003, CZM and the U.S. Geological Survey (USGS) have also been working together to produce high-resolution maps of seafloor topography and geology – information that is critical for ensuring that ocean and coastal projects do not disrupt vital habitat. So far, the seafloor has been mapped from the New Hampshire border through Boston Harbor. Completing the project by mapping from Boston to the Rhode Island line is a priority.

Coastal Hazards

To address erosion, coastal storms, and rising sea levels, Governor Romney and the Massachusetts Legislature asked CZM to appoint a Coastal Hazards Commission with a mandate to review existing coastal hazards practices and policies, identify information gaps, and draft recommendations. The Commission, which began its work in February 2006, will also produce a 20-year Coastal Infrastructure and Protection Plan, initially for the South Shore and ultimately for the entire Massachusetts coastline.

To support this effort and develop tools that communities can use to minimize the impacts of coastal hazards, CZM is pursuing several data development and technical assistance projects. For example, the office produced a *South Shore Coastal Hazards Characterization Atlas*, which covers ocean-facing shores from Hull to the Cape Cod Canal.

Thanks to the forward-thinking work of the Commission, Massachusetts is now well positioned to undertake the planning, regulatory, mapping, and education activities needed to address the significant and growing threats of coastal storms. With sea level rising and the pressure of development continuing in coastal communities, the Commonwealth will pay more later – in both lives and dollars – if it does not begin addressing these critical issues now.

Habitat Restoration

Massachusetts is a national leader in restoring coastal habitats. Numerous state programs are working closely with a wide range of public, private, and nonprofit partners to complete restoration projects that enhance recreational and commercial fisheries, improve the quality of critical fish and wildlife habitats, protect people and property from flooding, improve water quality, and increase coastal property values.

State programs include the CZM Wetlands Restoration Program; the Department of Fish and Game Riverways and Natural Heritage & Endangered Species Programs; the Department of Conservation and Recreation Lakes & Ponds Program; and the EOEA Natural Resource Damages Assessment & Restoration Program. In the last year, these programs have banded together to form the EOEA Habitat Restoration Network, which shares information and encourages holistic, integrated approaches to restoration planning and project design.

The accomplishments have been many: restoring eelgrass beds in Boston Harbor, tidal flow to hundreds of acres of salt marsh, and fish passage to many coastal fish runs and spawning areas; removing dams from rivers and streams; enhancing shellfish beds in several coastal communities; and completing coast-wide inventories of anadromous fish runs and other habitat restoration needs.

Oil Spill Act

The Massachusetts Oil Spill Act (Chapter 251 of the Acts of 2004) was implemented two years ago in response to a major oil spill in Buzzards Bay in 2003, and to address gaps in the existing federal regulatory scheme. The Act accords Buzzards Bay, Vineyard Sound, and Mount Hope Bay the status of "areas of special interest," thereby triggering a range of safeguards for their waters and wildlife.

Among its provisions, the Act requires financial assurance in the amount of $1 billion for vessels transporting 6,000 barrels or more of oil, hazardous material, or hazardous waste; the use of a local pilot and a tug escort to assist in the transit of these vessels through areas of special interest; alcohol and drug testing, enhanced watch, and other crew requirements; assessment of per-barrel-of-oil fees to be used for a range of oil spill prevention and response activities; and creation of a vessel traffic service (VTS) system.

In January 2005, the United States brought suit in U.S. District Court in Massachusetts, seeking to nullify certain provisions of the Act based on claims that they are preempted by federal law. In July 2006 the Court ruled in favor of the United States, enjoining the Commonwealth from enforcing the challenged provisions, including the tug escort requirement. Massachusetts, through the Office of the Attorney General, has appealed the ruling.

Despite the ongoing litigation, MassDEP has continued working cooperatively with the Coast Guard and the U.S. Army Corps of Engineers to establish the VTS system. Through its assessment of Oil Spill Response and Prevention Fees, MassDEP has also provided coastal communities with critical tools for responding to marine spills, including fully equipped emergency response trailers.

Conservation Programs Aim to Protect Threatened Right Whale Population

The western North Atlantic is home to more right whales than anywhere else in the Northern Hemisphere, but this population has dwindled to only about 300 individual whales. Recent models predict that under current conditions, these magnificent creatures will be extinct in less than 200 years.

For the last eight years, the Division of Marine Fisheries has conducted a vital program aimed at protecting right whales in Massachusetts waters through research, management, and public education efforts. During spring and winter, DMF and the Provincetown Center for Coastal Studies conduct the Right Whale Surveillance and Habitat Monitoring program in Cape Cod Bay, collecting information on seasonal trends in population demographics, habitat usage, and distribution and abundance patterns.

Another important project, being conducted jointly with the Atlantic Offshore Lobstermen's Association and rope manufacturers, focuses on the development of durable non-buoyant groundline (line that connects lobster traps) to reduce the risk of large whales becoming entangled in it. Starting on January 1, 2007, floating groundline will be prohibited in all Massachusetts state waters.

Photo taken pursuant to NOAA Fisheries Permit 633-1483 under the authority of the U.S. Endangered Species and Marine Mammal Protection Act

"Like the resource it seeks to protect, wildlife conservation must be dynamic, changing as conditions change, seeking always to become more effective."
–Rachel Carson

Afterword

Although environmental conditions in Massachusetts are better and steadily improving, our state occupies but one small portion of the planet, and assessing the state of the environment requires us to look beyond our borders and our shores.

Climate change and unsustainable consumption of natural resources are problems immense in scope and overwhelming in their implications. Although we are not powerless to affect these trends, we understand that they are not going to reverse themselves. The Earth we have known our entire lives could soon be a vastly different place unless all of us make tough but smart decisions, and cooperate as never before.

Every step that government, educational institutions, businesses, and consumers can take – from renewable energy and sustainable building practices to innovative regulation and "green" living – is a step worth taking. No matter how small these contributions might seem, each and every one makes a difference.

Fountain Pond State Park, Great Barrington

Resources

GENERAL CONTACT INFORMATION AND MISSION STATEMENTS FOR THE ENVIRONMENTAL AGENCIES

Executive Office of Environmental Affairs (EOEA)

100 Cambridge Street, Suite 900
Boston, MA 02114
Phone: (617) 626-1000
http://www.mass.gov/envir

Organizational Mission:
The Executive Office of Environmental Affairs is responsible for safeguarding the public health from environmental threats as well as preserving, protecting, and enhancing the natural resources of the Commonwealth. EOEA develops, directs, and coordinates state environmental policy and provides for the management of air, water, and land resources to assure the protection and balanced utilization of such resources and the overall environmental integrity of the Commonwealth.

Department of Agricultural Resources (DAR)

251 Causeway Street, Suite 500
Boston, MA 02114
Phone: (617) 626-1700
http://www.mass.gov/agr

Organizational Mission:
To help provide a safe, local supply of high quality foods, to work to strengthen the economic viability of Massachusetts' agriculture, to enhance the environmental sustainability of the agricultural industry, to preserve farmland resources throughout Massachusetts, and to help maintain agriculture as an important part of the overall economy of the Commonwealth.

Department of Conservation and Recreation (DCR)

251 Causeway Street, Suite 900
Boston, MA 02114
Phone: (617) 626-1250
http://www.mass.gov/dcr

Organizational Mission:
To protect, promote, and enhance our common wealth of natural, cultural, and recreational resources for the well being of all.

Department of Environmental Protection (MassDEP)

One Winter Street
Boston, MA 02108
Phone: (617) 292-5500
Fax: (617) 574-6880
http://www.mass.gov/dep

Organizational Mission:
The Department of Environmental Protection is the state agency responsible for ensuring clean air and water, the safe management of toxics and hazards, the recycling of solid and hazardous wastes, the timely cleanup of hazardous waste sites and spills, and the preservation of wetlands and coastal resources.

Department of Fish and Game (DFG)

251 Causeway Street, Suite 400
Boston, MA 02114
Phone: (617) 626-1500
http://www.mass.gov/dfwele

Organizational Mission:
The Department of Fish and Game is charged with stewardship responsibility over the Commonwealth's marine and freshwater fisheries, wildlife species, plants, and natural communities. The Department conserves and restores the state's rivers, streams, lakes, ponds, wild lands, and coastal waters through programs of research, restoration, and land protection. In addition, the Department issues licenses and registrations for hunting, trapping, and inland and marine fishing. The Department promotes recreational uses of the state's public lands and waters consistent with the agency's mission.

Resources (continued)

Air

Particulate Matter "hotspots":
http://www.hsph.harvard.edu/epacenter/

MA Climate Protection Plan:
http://www.mass.gov/Eocd/docs/pdfs/fullcolorclimateplan.pdf

General Information on Air:
http://www.mass.gov/dep/air/

California CO2 Standards:
http://www.mass.gov/dep/public/press/levfinal.htm
http://www.mass.gov/dep/air/laws/regulati.htm#lev

Waste

Solid Waste Master Plan:
http://www.mass.gov/dep/recycle/priorities/dswmpu01.htm

Office of Technical Assistance:
http://www.mass.gov/envir/ota/

TURA Reform Act:
http://www.mass.gov/legis/laws/seslaw06/sl060188.htm

Mercury Management Act:
http://www.mass.gov/dep/toxics/laws/hglawfax.pdf

Water

MA Water Policy:
http://www.mass.gov/envir/wptf/publications/mass_water_policy_2004.pdf

Perchlorate Information:
http://www.mass.gov/dep/water/drinking/percinfo.htm

2006 Water Conservation Standards:
http://www.mass.gov/envir/mwrc/pdf/Conservation_Standards.pdf
Drinking Water Supply Protection Grant Program:
http://www.mass.gov/envir/water/grants/FY07_drinking_water_grant.pdf
Riverways Program:
http://www.mass.gov/dfwele/river/index.htm

Land

Self Help Grant Program:
http://www.mass.gov/envir/dcs/selfhelp/

Public Private Partnerships:
http://www.mass.gov/envir/opp/default.htm

BioMap and Living Waters:
http://www.mass.gov/dfwele/dfw/nhesp/nhbiomap.htm
http://www.mass.gov/dfwele/dfw/nhesp/nhaqua.htm

Massachusetts Wildlife Habitat Protection Guidance for Inland Wetlands:
http://www.mass.gov/dep/water/laws/wldhab.pdf

Forest Reserves:
http://www.mass.gov/envir/forest/pdf/whatare_forestreserves.pdf

Farm Viability Program:
http://www.mass.gov/agr/programs/farmviability/

Coast and Ocean

Gulfwatch:
http://www.gulfofmaine.org/gulfwatch/

Beach Report:
http://www.mass.gov/Eeohhs2/docs/dph/environmental/exposure/beach_annual_report05.pdf

Wetland Restoration, Coastal Management, Ocean Management:
http://www.mass.gov/czm/czm.htm

Small Docks and Piers Guide:
http://www.mass.gov/dep/water/resources/smaldock.pdf

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