MARTHA'S VINEYARD COASTAL PONDS FACT SHEET

HIGHLIGHTS OF THE MASSACHUSSETTS ESTUARIES PROJECT REPORTS

Nitrogen Loading in Coastal Ponds

Massachusetts Estuaries Project

Estuaries are special bodies of water occurring when the sea extends inland and meets the mouth of a river or stream. The estuaries of southeastern Massachusetts - the harbors and bays of Cape Cod, the Islands, and Buzzards Bay - are ecosystems that provide home and habitat for shellfish and sea grasses and breeding grounds for important commercial offshore marine fisheries.

Rapid population growth over several decades has created an abundance of nutrients that have leached into the estuaries through ground and surface waters. Nutrients, such as phosphorus and nitrogen, act as a fertilizer to aquatic plants. The result: changes in water quality and the buildup of invasive weed and algal growth causing fish kills, closed beaches, destroyed productive shellfish areas and creating aesthetically displeasing waters that adversely affect the valuable tourist industry and coastal property values.

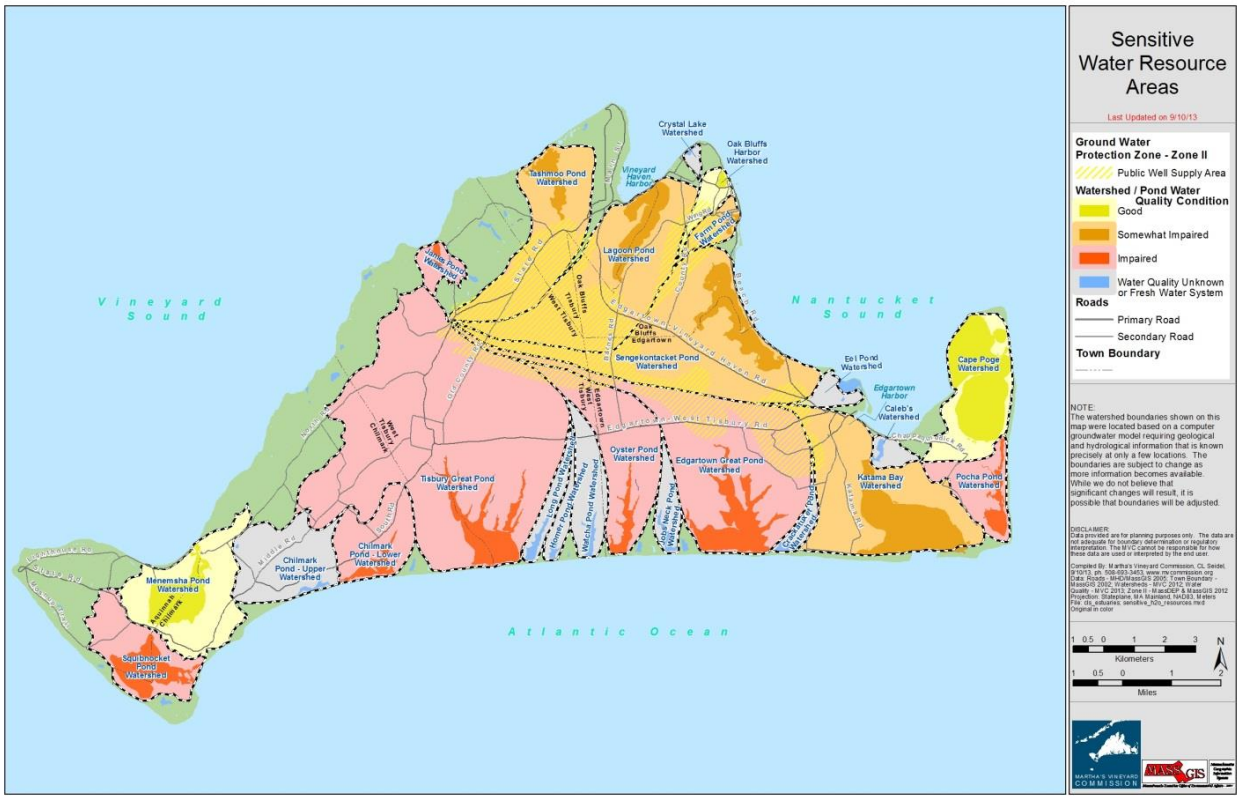
The Massachusetts Estuaries Project is an effort to begin to fix this problem by determining all of the factors specific to each estuary that are causing the problem. This involves determining the geographic area contributing nutrients to a specific estuary, determining what the nutrient sources are, what the nutrient load is, and how great a nutrient load the estuary can tolerate without dramatically changing its character and usages. In most cases, to return the estuaries to the water quality condition that support sensitive shellfish habitats and lush eelgrass beds, it will be necessary to remove a significant percentage of the nutrient loadings coming from an estuary's watershed. Nutrient removal may come primarily in the form wastewater treatment and secondarily through stormwater management programs including limiting use of lawn fertilizers. In some scenarios, changing the water flow within

an estuary to increase flushing may compliment nutrient reduction and removal efforts.

The MEP project is providing water quality, nutrient loading, and hydrodynamic information for 89 estuaries in southeastern Massachusetts. This information is combined through the use of a linked watershed/estuary model that predicts the water quality changes that will result from land use management decisions. The report for each of the estuaries evaluates several water quality conditions and how that relates to the health of the estuary and the land use changes necessary to bring about that improvement.

Each report is reviewed by a suite of agencies, engineers, scientists, and citizen groups to make sure the MEP modeling approach is appropriate and useful for evaluating alternative scenarios and informing nutrient management plans and is consistent with nationwide practices Total Maximum Daily Loads (TMDL), i.e. the maximum load until damage.

This project is a collaborative effort by two state agencies, the Executive Office of Environmental Affairs (through the Department of Environmental Protection) and the University of Massachusetts's School of Marine Science and Technology, as well as regional planning agencies including the Martha's Vineyard Commission, the United States Geological Survey, the Division of Marine Fisheries, and the affected municipalities.



Pond Circulation and Nitrogen Impacts on Water Quality

Water testing of Martha's Vineyard ponds clearly indicates that during summer months, nitrogen is the nutrient that controls the growth of microscopic and larger plants – collectively called biomass. These ponds are categorized as nitrogen-limited water bodies. When nitrogen is added to a pond of this type, it is quickly converted into more biomass. Living plants produce oxygen while the sun is shining but at night they take it in and release carbon dioxide. When coupled with the demand for oxygen from decaying plant material, overnight oxygen can be completely removed from the deeper water, which stresses fish and shellfish in the pond. While the fish can swim away, the shellfish die out. As more organic matter is produced over the years, the bottom is no longer suitable habitat for shellfish. Inlets and tidal exchange are clearly a significant way to reduce nitrogen and the resulting crop of microscopic plant material that grows in the water column as a result. The EPA's Massachusetts State Quality Standards has set a minimum acceptable limit of dissolved oxygen concentration at 6 parts per million (ppm) at which aquatic animals are stressed.

It is necessary to have algae at a moderate level for a healthy pond. However, too much organic matter with algae exceeding desirable levels can harm not only the health of the ponds but also the health of the benthic habitat. The marine environment has organisms with different requirements for water quality. Many of these such as oysters and soft-shell clams are not particularly tolerant of poor conditions.

Eelgrass provides important habitat for fish and shellfish. When excess plant material grows in the eelgrass beds, on their leaves or suspended in the water column, it intercepts light that is necessary for eelgrass growth. Eelgrass responds by thinning out and eventually disappearing. Generally, eelgrass bed population will be found at or less than the depth of 2 meters (6.6 feet). The deeper depths and excess algae (nitrogen) result in limited or lack of light penetration, which negatively affects the eelgrass bed population.

Martha's Vineyard's Coastal Ponds and Watersheds *Watershed Map on Opposite Page*					
Watershed Name	**Town(s)**	**Health**	**MEP Status***	**Present Septic Input**	**Desired Septic Input**
Cape Poge	*EDG*	*Good*	*2*		
Chilmark Pond - Lower	*CHL*	*Impaired*	*3*		
Edgartown Great Pond	*WT/EDG*	*Impaired*	*4*	*55%*	*16%*
Farm Pond	*OB*	*Somewhat Impaired*	*4*	*69%*	*27%*
James Pond	*WT*	*Impaired*	*N/A*		
Katama Bay	*EDG*	*Somewhat Impaired*	*3*		
Lagoon Pond	*WT/TIS/OB*	*Impaired*	*4*	*76%*	*35%*
Menemsha Pond	*AQ/CHL*	*Good*	*2*		
Oak Bluffs Harbor	*OB*	*Good*	*4*	*81%*	*-*
Oyster Pond	*WT/EDG*	*Impaired*	*3*		
Pocha Pond	*EDG*	*Impaired*	*1*		
Sengekontacket Pond	*WT/EDG/OB*	*Somewhat Impaired*	*4*	*80%*	*50%*
Squibnocket Pond	*AQ/CHL*	*Impaired*	*2*		
Tashmoo Pond	*WT/TIS/OB*	*Somewhat Impaired*	*3*		
Tisbury Great Pond	*WT/CHL*	*Impaired*	*4*	*41%*	*22%*
Caleb's	*EDG*	*Unknown/Freshwater*	*N/A*	*N/A*	*N/A*
Chilmark Pond - Upper	*CHL*	*Unknown/Freshwater*	*N/A*	*N/A*	*N/A*
Crackatuxet Pond	*EDG*	*Unknown/Freshwater*	*N/A*	*N/A*	*N/A*
Eel Pond	*EDG*	*Unknown/Freshwater*	*N/A*	*N/A*	*N/A*
Homer Pond	*WT*	*Unknown/Freshwater*	*N/A*	*N/A*	*N/A*
Jobs Neck Pond	*EDG*	*Unknown/Freshwater*	*N/A*	*N/A*	*N/A*
Long Pond	*WT*	*Unknown/Freshwater*	*N/A*	*N/A*	*N/A*
Watcha Pond	*WT/EDG*	*Unknown/Freshwater*	*N/A*	*N/A*	*N/A*

**N/A- Not Available/No Funds; 1- Funds Approved/Underway; 2-Under Study by the MEP; 3-Study Completed by the MEP; 4-Completed Report*

Modeling

A series of three linked computer models are used for each pond to evaluate its tolerance for nitrogen. One evaluates the land uses in the watershed and determines the nitrogen that is added to the pond from man's activities. Another considers the shape of the pond bottom, the volume of water it holds and the tidal flow to determine how water circulates to the ocean and is replaced by new groundwater. The third model, with data generated by the other two, predicts the likely water quality in the pond and is validated through water quality testing. The models are calibrated with three years of water quality data and collection of tidal circulation data during an opening to the ocean.

Watershed Delineation and Nitrogen Loading

The watershed area was determined by updating old groundwater contour information with new data.

Proper management of water quality and habitat health requires determination of the amount of nitrogen transported by groundwater from the watershed to the pond. This is done through the quantification of nitrogen sources. In addition, the amount of nitrogen from direct atmospheric deposition, as well as that from nitrogen regeneration from pond sediment must be determined to gain a full picture. Ultimately, pond managers will be able to identify the need for nitrogen reduction within sub-watershed areas or the watershed as a whole to improve water quality.

A model based upon watershed specific land uses and pre-determined nitrogen loading rates is used to quantify the amount of nitrogen in the watershed. Regional loading factors for southeastern Massachusetts and local specific watershed data, such as average water use, are used for this assessment. Nitrogen loading from atmospheric deposition utilizes regional data sources. Nitrogen regeneration from sediment is determined through in-depth field analysis of the sediment.

The nitrogen concentration in a pond – the critical factor for a coastal pond's ecological health – depends mainly on how much nitrogen enters the pond system from various sources, as reduced by tidal flushing.

The *Manageable Load* comes from sources we can change at the local level, such as wastewater and fertilizer, while the *Total Load* includes acid rain on water body surfaces and "natural"(permeable) surfaces requiring state or national response. It shows present-day and estimated future load at buildout.

Goal and Nitrogen Limits

The MEP sets a restoration target and threshold nitrogen concentration for each pond based on pre-degradation habitat quality and what can be reasonably achievable. The threshold nitrogen level for an embayment represents the average water column concentration of nitrogen that will support the habitat quality being sought.

The MEP concluded that habitat restoration in these nutrient enriched systems should focus on improving eelgrass habitat, when it had historically been a part of the system, as well as on full restoration of infaunal habitat quality system-wide. This change should approximate historical conditions in the great pond. There will be a critical nitrogen threshold (explained more in the summaries of specific watersheds) that needs to be achieved in order to have a healthy system supporting shellfish and eelgrass.

Notes and Other Sources:

- Massachusetts Department of Environmental Protection – Southeast Regional Office: http://www.mass.gov/eea/agencies/massdep/about/contacts/southeast-region.html
- The DEP Report *Embayment Restoration and Guidance for Implementation Strategies* outlines a wide range of strategies for reducing excessive nitrogen concentrations in coastal ponds
- Martha's Vineyard Commission Coastal Ponds: www.mvcommission.org/coastalponds

Note: These highlights were prepared by MVC staff, which made every attempt to accurately summarize the MEP report. However, for full and accurate information please use the original reports, especially for decision making.

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