



Buzzards Bay
National Estuary Program

Jordan C. Collyer, Chairman
Board of Selectmen,
Mattapoissett Town Hall
P.O. Box 435
Mattapoissett, MA 02739

October 8, 2009

Re: Review of Eel Pond Water Quality Data

Dear Mr. Collyer:

As per the Board's request, I have reviewed water quality data for Eel Pond and concluded that water quality has not improved in recent years as tidal exchange has increased in the western channel. Moreover, water quality in Eel Pond remains among the worse of embayments tested in Buzzards Bay. Below I provide an explanation for these conclusions.

Background

On September 22, at the request of the Board of Selectmen, I attended a meeting where the Board discussed with the town's engineering firm (CLE Engineering), the status of permitting for the Eel Pond tidal restoration work. As you know, the project proposed by CLE would dramatically improve tidal flushing to Eel Pond to such an extent that it would achieve two goals:

- 1) the increased tidal exchange would increase salinity and saltwater inundation in the upper estuary to a sufficient degree that it would kill-off the invasive nuisance Common Reed (*Phragmites*) that is overtaking areas of natural salt marsh vegetation, and
- 2) the increased tidal exchange will improve water quality and help minimize the effects of excessive nitrogen inputs and resulting eutrophication.

At the meeting, many speakers noted that flow in the West Channel has dramatically increased in recent years, while at the same time flow in the East Channel has declined dramatically. The board posed the question whether tidal flushing may have increased in the Eel Pond estuary to such an extent that the need to conduct the tidal restoration may be unnecessary.

To answer this question, the Buzzards Bay NEP reviewed data collected by the Coalition for Buzzards Bay from Eel Pond (watershed and testing stations are shown in Figure1), including reported Bay Health (eutrophication) Index Scores, total nitrogen concentrations, salinity data, and other data collected in the Coalition for Buzzards Bay's water quality monitoring program.

There are many issues and nuances to answering your question, and there are some interesting trends between the two monitoring stations in Eel Pond, but overall Eel Pond water quality has not shown a clear or statistically significant¹ water quality trend during the past eight years as the western channel has expanded (see Figure 1). Any apparent trends in Figure 1 may not be statistically significant due to year-to-year variability of the data. More importantly, water quality in Eel Pond remains among the worse of the embayments tested around Buzzards Bay.

¹ Statistical test information: the correlation coefficient (r2) for the average annual point data in Figure 1 (ignoring the variability shown) was 0.48, which was not statistically significant ($\alpha=0.05$, $df=6$). The correlation coefficient on annual data (not 5-year rolling average) shows less of a correlation with time.



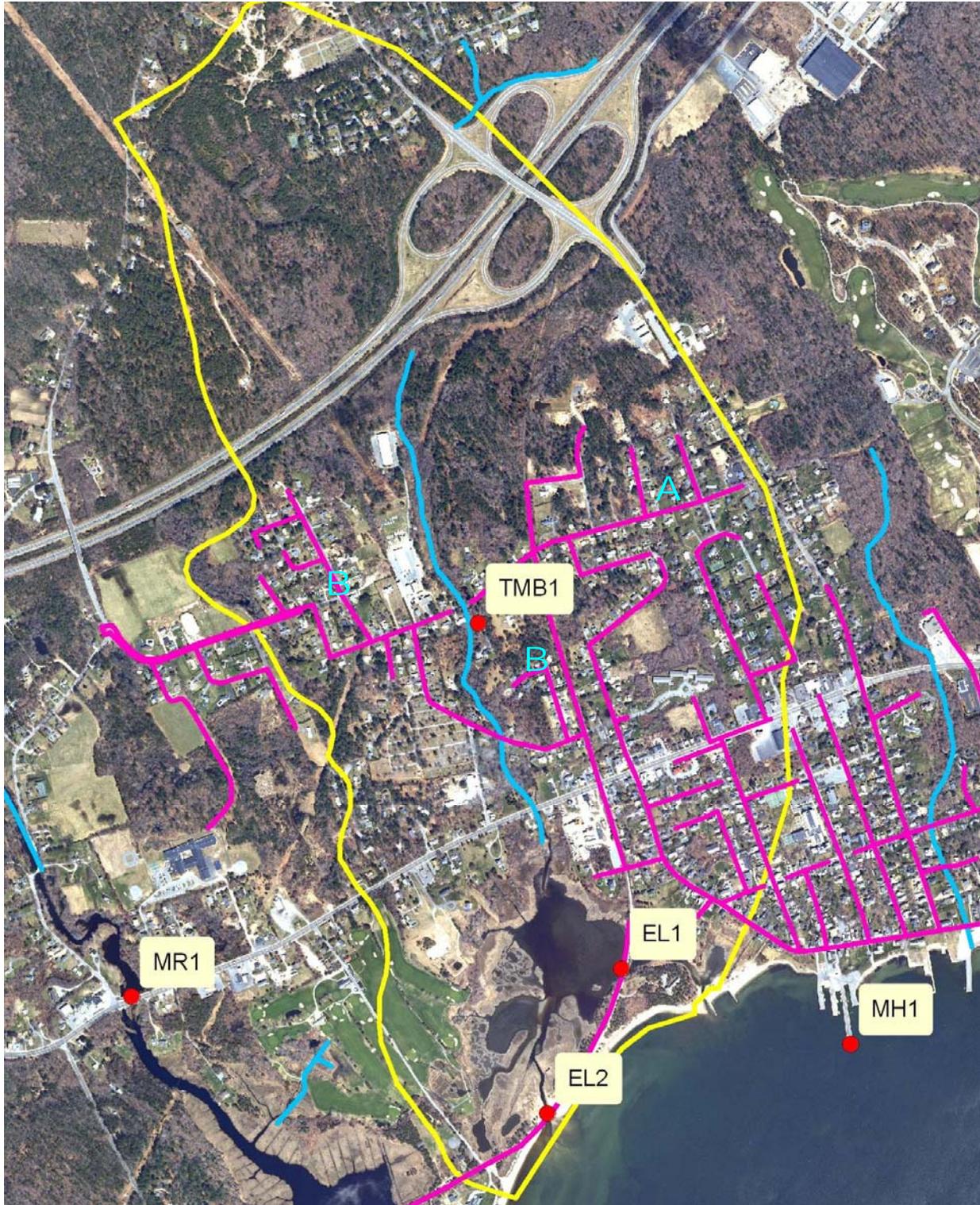


Figure 1. Eel Pond and its presumed watershed (yellow boundary), extent of sewer mains in the watershed (magenta lines), and the location of CBB water quality monitoring stations (Station EL1= East Channel, EL2= West Channel). The area labeled 'A' was sewered roughly in 1994; the areas marked 'B' were sewered mostly in 2003 and 2004 (N. Nicholson, pers. comm.).

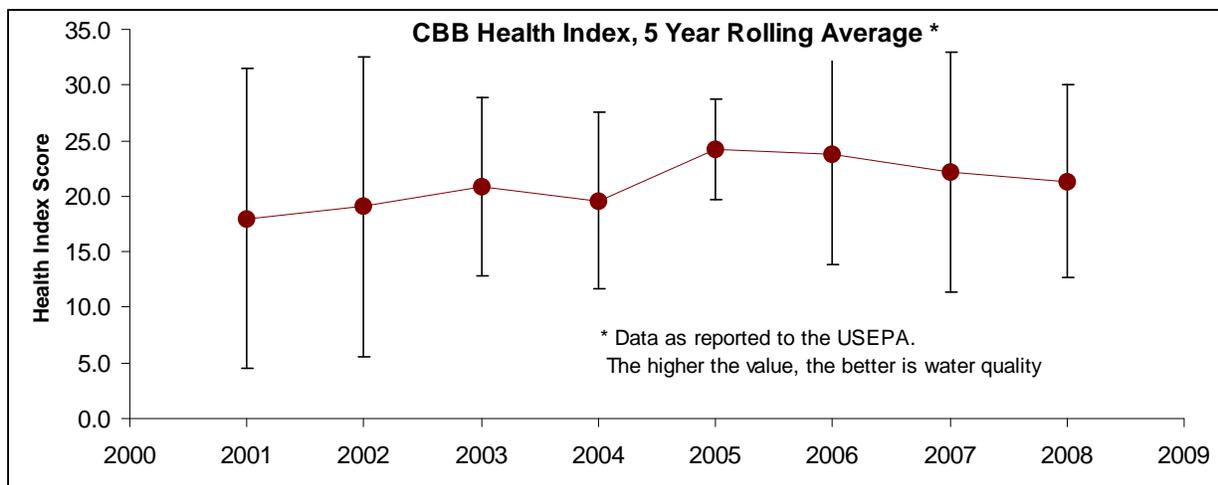


Figure 2. Five-year rolling average Bay Health Index scores (aka Eutrophication Index) for Eel Pond as reported by the Coalition for Buzzards Bay to the US EPA. Error bars show one sample standard deviation of the 5 year rolling average (only 4 years of data for 2001). The index is based on average conditions for five nitrogen pollution related measurements at the testing stations on the East and West Channels shown in Figure 1. The large variability of the data is the result of the sensitivity of this salt pond to summertime rainfall and other factors.

One possible explanation of the water quality data is that while flow through the West Channel has dramatically increased, flow in the East Channel has equally declined, so that net flow of the two channels combined has not appreciably changed over the years. It is also possible that net flow could have increased somewhat, but water quality was affected by new nitrogen sources in the watershed.

As noted by CLE, the degree of flushing of Eel Pond depends largely on the depth of the highest elevation at each channel. The CLE restoration designs included deepening the East Channel and installing a new culvert. In their designs, water levels at low tide were projected to decrease to such an extent that tidal flats may result in some parts of the estuary during most low tides. These conditions do not appear to exist now with the increased flow in the West Channel.

It is worth stressing that while the CLE designs are expected to improve tidal flushing over existing conditions, reduction of nitrogen inputs in the watershed may still be required to achieve good water quality in Eel Pond.

If you desire, I am prepared to provide you with more data and information about this water quality testing, station trends, lag times in seeing benefits from sewerage, and water quality trends relative to variations in rainfall and relative to other stations in Buzzards Bay. Please do not hesitate to contact me if I can be of further assistance on the matter, or you have any additional questions.

Sincerely,

Joseph E. Costa, Ph.D.
Executive Director