

September 4, 1998

David Pincumbe  
US EPA  
Boston, MA 02203

re: additional analyses requested on nitrogen loading in the Wareham River watershed

Dear Mr. Pincumbe:

After reviewing the August 11, 1998 Buzzards Bay Project's report on a nitrogen loading analysis of Wareham wastewater treatment facility, you have requested that I repeat certain calculations in my report using new loading assumptions from the wastewater treatment facility. Specifically you have requested two reassessments. First, that I repeat my loading calculations using a discharge volume of 1.8 MGD, since that is the expected discharge volume once the currently planned sewerage program is implemented. Second, that I conduct a sensitivity analysis of the benefits of the sewerage plan using different treatment facility N discharge concentrations. I have completed these tasks and the results are summarized in the enclosed brief report.

Sincerely,

Joseph E. Costa, Ph.D.  
Executive Director

cc: Ron Lyberger, MA DEP  
Tom Delair, MA DEP  
Jeff Gould, DEP-SERO  
Peg Brady, MCZM  
Rick Zeroka, MCZM  
Dave Janik, MCZM-South Coastal  
Joe Murphy, Town of Wareham

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Additional Nitrogen Loading Analyses Related to Potential Changes in  
the Discharge Volume and Nitrogen Concentrations of the  
Wareham Wastewater Treatment Facility.

By

Joseph E. Costa, Ph.D.

Buzzards Bay Project National Estuary Program

September 4, 1998

## Introduction

On August 11, 1998, the Buzzards Bay Project submitted a report at the request of the US EPA on the relative loading contributions of the Wareham sewage treatment facility and other watershed sources and how they compare to the recommended nitrogen loading limits for the Wareham River estuary as a whole as defined by the methodologies contained in the Buzzards Bay Comprehensive Conservation and Management Plan adopted by the state in 1991.

In response to that report, additional computations have been requested by state and federal regulatory agencies. First, loading calculations were asked to be revised using a discharge volume of 1.8 MGD, since that is the expected discharge volume once the currently planned sewerage program is implemented. Second, a sensitivity analysis be conducted to show the benefits of the sewerage plan using different treatment facility N discharge concentrations, also using the expected discharge increase to 1.8 MGD.

## Sensitivity analysis of sewerage plan benefits

In Table 3 of the August 11 report, at a treatment plant discharge of 18 ppm, the sewerage plan will result in a **net gain** of 27 kg/y for the sewerage of existing homes in and out of the Wareham River watershed, but a 227 kg/y benefit (net reduction) to the buildout nitrogen loading conditions. These changes were, however, very trivial compared to existing and future loading conditions and were not included in the overall loading assessment.

However, if the treatment plant discharges less than 18 ppm, the potential reductions of plant nitrogen loading can be far greater depending upon actual treatment plant discharges. Performing a sensitivity analysis using the format of Table 3 in the August report is unnecessary if future plant conditions are assumed to be 1.8 MGD (design capacity). This is because the new discharge volume of 1.8 MGD would account for flows from existing homes (both inside and outside the watershed) that are on septic systems that would be tied into the sewer system. This approach makes calculations simpler, and one need only consider the elimination of septic systems **inside** the watershed to calculate the net reduction of non-point source nitrogen pollution to the Wareham River Estuary as shown in Table 1 below.

**Table 1.** Wareham Nitrogen loading analysis: Reduction of NPS N pollution from sewerage inside the watershed (elimination of septic inputs). The results are independent of sewage treatment facility volumes and concentration.

	existing units	potential units	existing (kg/y)	potential new (kg/y)
Inside of Watershed				
Beaver Dam (act. partial)	37	3	190	15
Cromset Park	93	0	479	0
Linwood/Ladd Ave	36	0	185	0
Mayflower Ridge	41	5	211	26
Oakdale	142	86	731	443
Parkwood Beach	280	157	1441	808
Tempest Knob	73	1	376	5
TOTALS:	702	252	3612	1297
NPS N loss (kg/y):			3612	1297

## Revised Sewage Treatment Plant Loading Sensitivity Analysis

In Table 4 of the August 11 report, a sensitivity analysis was conducted for loadings from the sewage treatment facility using different potential nitrogen limit concentrations using a discharge volume of 1.0 MGD. In Table 2 below, this assessment is repeated using a 1.8 MGD discharge volume. At the higher discharge volume, the facility would need to reduce its discharge concentration to 10 ppm for the facility to equal existing loadings from a 1.0 MGD flow and an 18 ppm discharge concentration.

Table 2. Revised sensitivity analysis for the Wareham sewage treatment plant using a discharge volumes of both 1.8 MGD. "Benefit" column based on current assumed discharge of 1.0 MGD and 18 ppm, for a total load of 24,867 kg/y.

ppm	1.8 MGD	Kg/y benefit
4	7,460	14,920
5	9,947	12,434
6	14,920	9,947
7	17,407	7,460
8	19,894	4,973
10	24,867	0
12	29,841	gain
16	39,788	gain
18	44,761	gain

### Implications for facility discharge limits

In the August 11 report, existing nitrogen loading was estimated to be approximately 67,900 kg/y whereas the recommended limit for the estuary based on BBP N limit methodologies was calculated to be approximately 55,700 kg/y. Using a 1.8 MGD plant discharge, what discharge concentration limit would be needed to achieve a 12,200 kg reduction of **existing** wastewater loads?

Clearly a 10 ppm nitrogen discharge limit concentration is inadequate to meet the 55,700 kg/y recommended loading limit for the estuary since this would merely equal the current 18 ppm discharge at 1.0 MGD. Thus, the only benefit of a 10 ppm limit would be the 3,600 kg/yr reduction achieved from the sewerage of existing homes. At 6 ppm, however, the sewerage plan would still result in a 3,600 kg/yr reduction from the sewerage of existing homes in the watershed, but at 1.8 MGD, the facility would discharge 9,950 kg/y less nitrogen than at current

conditions. Thus at a 6 ppm discharge limit, the combined benefits of the elimination of septic loadings in the watershed through new sewerage combined with the direct benefits of reduced nitrogen loading to the estuary from existing sewerage homes would exceed the 12,200 kg/y reduction of existing loads necessary to meet BBP recommended limits for the Wareham River estuary.

This analysis does not account for impacts of future growth. Presuming that the new 1.8 MGD volume at the facility also accounts for potential new lots on unbuilt parcels within the sewer districts proposed, there is still considerable growth potential in other parts of the Wareham River watershed that would ultimately need to be addressed through point and nonpoint source management strategies.