A Preliminary Analysis of Wastewater Disposal at the Falmouth Wastewater Disposal Facility

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Background

For the past several years, the Buzzards Bay Project National Estuary Program, a unit of Massachusetts Coastal Zone Management, has worked with the town of Falmouth and the Cape Cod Commission to document nitrogen sources in the West Falmouth Harbor watershed and their impacts on the harbor. The Buzzards Bay Project's objective in this endeavor is to provide technical, and where feasible, financial assistance to help the Town of Falmouth to develop a nitrogen management strategy for West Falmouth Harbor. Such a nitrogen management plan is not only a requirement by DEP for the upgrade of the town's wastewater plant, but is also essential for ensuring that the town protects the valuable coastal resources of West Falmouth Harbor.

In an August 1996 report to the town, the Buzzards Bay Project included a number of recommendations, including the formation of an interagency-citizen workgroup to develop a consensus on management options for the West Falmouth Harbor watershed. On January 29, 1997, the Buzzards Bay Project convened the West Falmouth Harbor Nitrogen Management Workgroup to explore management options and issues relating to West Falmouth Harbor. At its first meeting, Joe Costa outlined the Buzzards Bay Project's findings to date, Falmouth Facilities Manager Ray Jack gave presentation to the workgroup on the town's upgrades to the Falmouth Sewage Treatment Facility and newly installed wells, Sean O'Brien summarized recent testing by the Barnstable County Health Department at the land fill and Ed Eichner of the Cape Cod Commission described the explained the described the CCC's loading evaluation of the watershed. An important outcome of this meeting was that the Buzzards Bay Project was asked by workgroup members to consider any recommended upgrades to the town's sewage treatment plant in the light of larger sewering needs and water quality in Falmouth's other coastal ponds.

This report describes the Buzzards Bay Project's preliminary evaluation of wastewater flows and loadings and the treatment plant based on town flow data and monitoring, and how this information will bear on a nitrogen management strategy for West Falmouth Harbor. These findings have not been reviewed by the town or other agencies and should be considered preliminary. Revisions to the loading and flow estimates reported here will be included in a future nitrogen management report for the watershed.

Sewage Influent to the Wastewater plant

The Falmouth Wastewater treatment plant has a permit to discharge 880,000 GPD. Actual influent flows to the plant are seasonal, with a wintertime average of around 300,000 GPD and a summertime average of 500,000 GPD discharge (Fig.1).

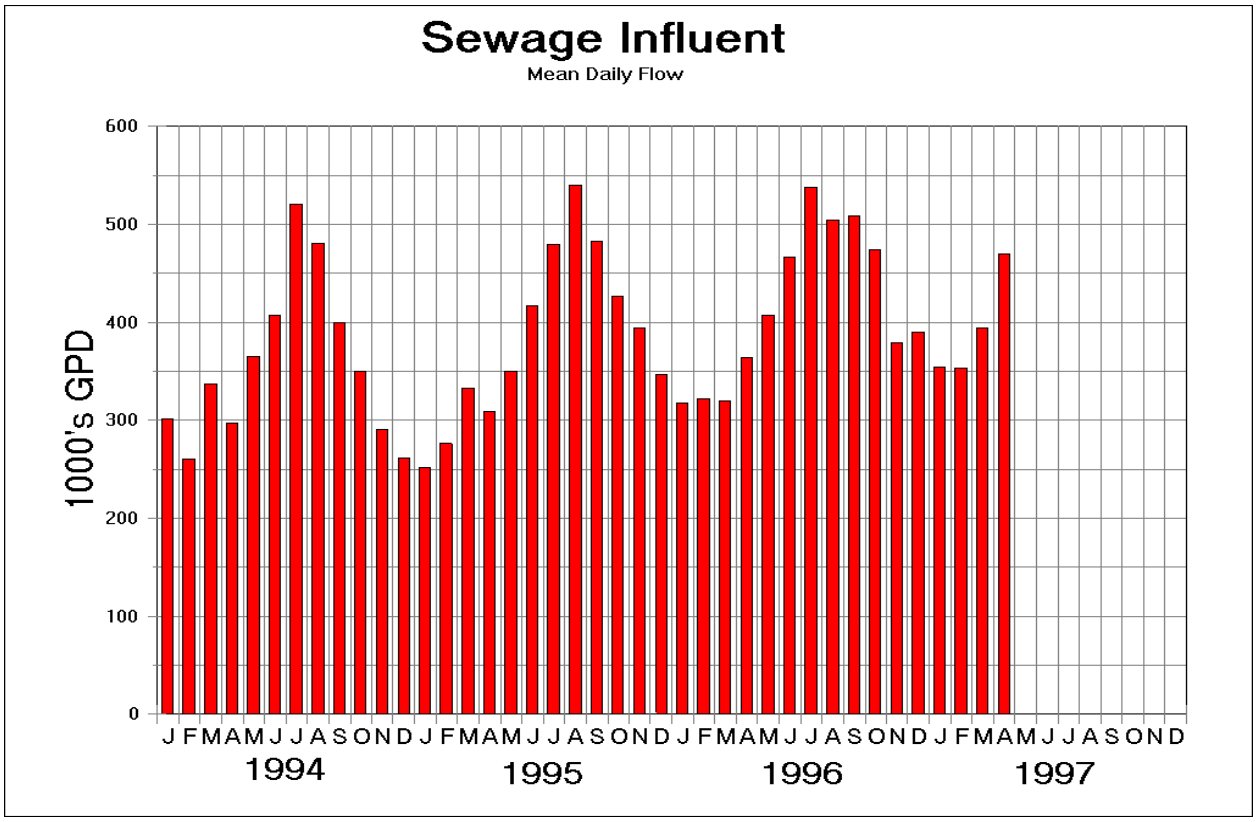

Figure 1. Mean daily sewage influent volumes by month.

Both summertime and wintertime flows however have been increasing by approximately 8% per year (Fig. 2). These increases could be the result of several factors including new connections, increased occupancy rates, and increased year-round occupancies.

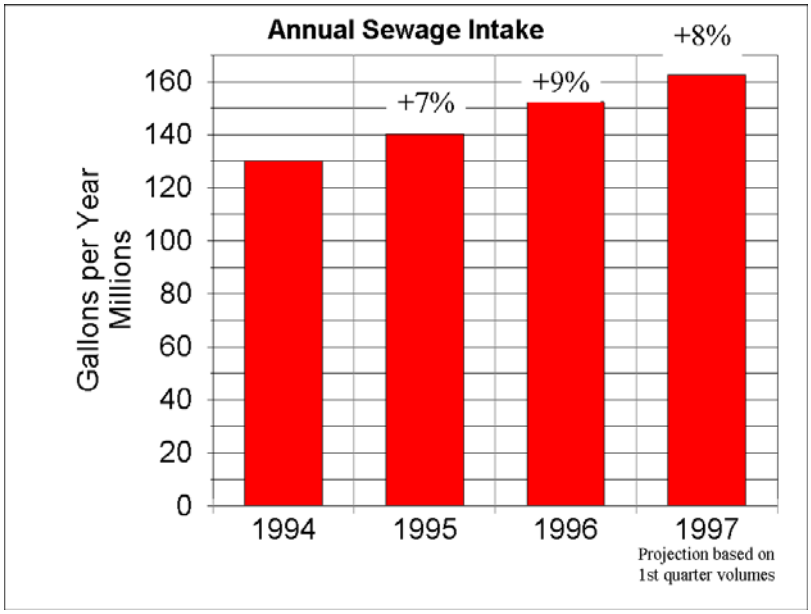

Figure 2. Year total sewage volume received.

Septage Disposal at the Treatment Plant

Like sewage flows, septage disposal at the plant shows a seasonal cycle, with wintertime lows around 9,000

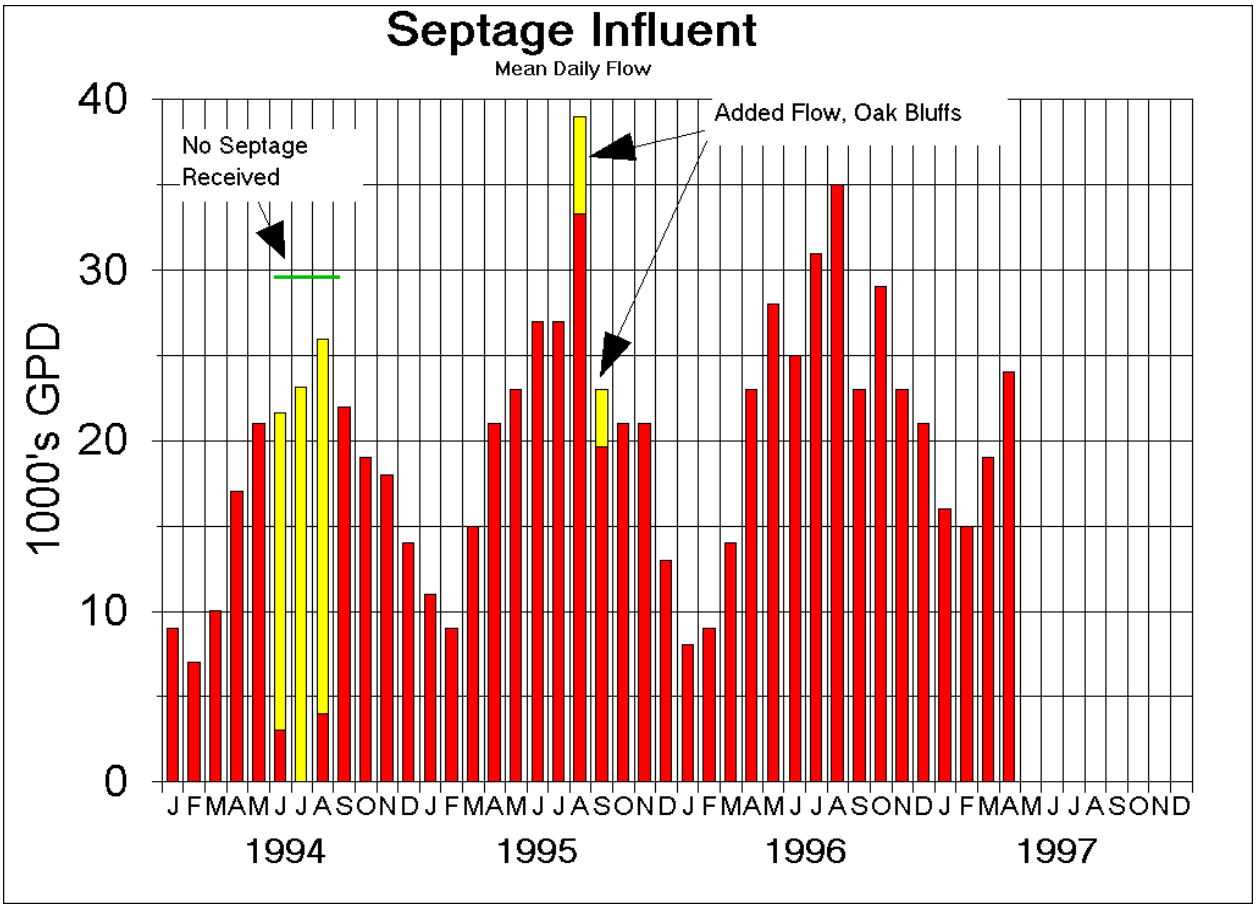

Figure 3. Mean daily septage volumes received.

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GPD, and summertime highs exceeding 25,000 GPD (Fig. 3). During the past year, flows appear to have increased markedly, and overall septage volumes at the plant are increasing more rapidly than the sewerage volume increases (Fig. 4). In the summer of 1994, sewage was collected at the treatment plant but shipped off-site because of cleaning of the septage lagoons. During the summer of 1995, septage was accepted from the town of Oak Bluffs because of closure of the septage lagoons there. Figure 4 is based only on septage generated in Falmouth.

Like the trends in increased sewage volumes, the increased septage volume could be the result of several factors including new connections, increased occupancy rates, and increased year-round occupancies. However, new Title 5 inspection requirements at property transfer are probably the most important reasons for the increased volumes of septage during the past year because pumping is required for the inspection.

Another contributing factor to increased septage volumes received in Falmouth may be the local pricing structure for accepting septage. For example, septage pumped in the town of Mashpee is now supposed to be disposed of in the town of Barnstable since Mashpee's septage lagoons were closed three years ago. However Barnstable charges $70.36 per 1000 gallons, but Falmouth charges only $41.00 per 1000 gallons. If a hauler with a 4000-gallon capacity truck pumps 2000 gallons from customers in Falmouth and 2000 gallons from customers in Mashpee, there is little incentive for the hauler to split disposal of the septage in his truck.

Combined sewage and septage received

In Figure 5, combined sewage and septage volumes are shown.

Nitrogen loading from sewage and septage

Septage has a considerably higher concentration of nitrogen than sewage. This is illustrated by

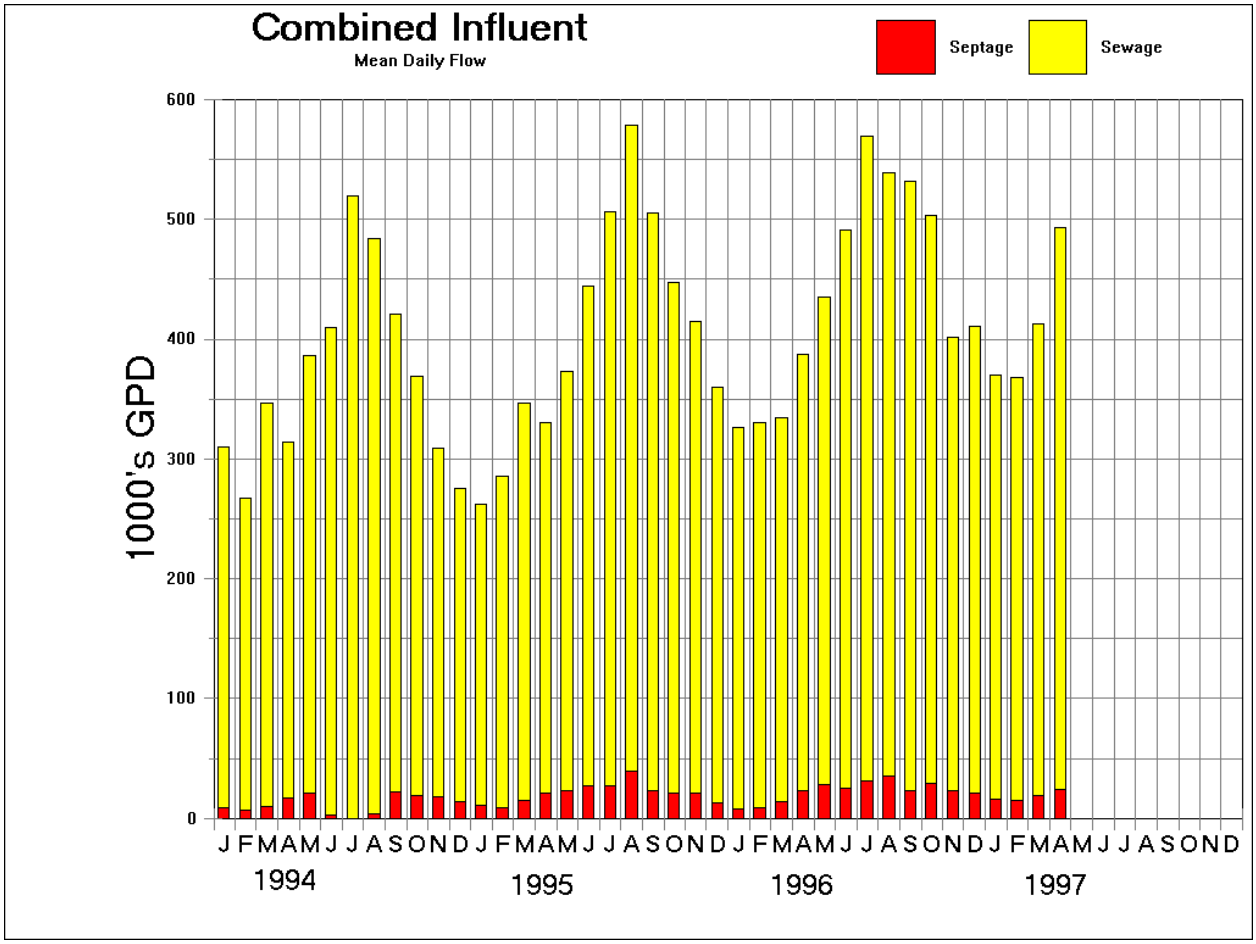

Figure 5. Combined volume of sewage and septage received.

results of samples collected by the wastewater plant and analyzed by Barnstable County Health Department (BCHED) as shown in the following table.

Table 1. Nitrogen concentration of septage and sewage on selected dates.

	NOx	TKN	TOT N
Influent			
01/22/97	0.15	25.6	25.8
01/17/97	0.15	20.7	20.9
		mean=	23.3
Septage			
12/02/97	0.65	170.7	171.4
12/04/97	0.16	120.2	120.4
12/12/97	0.39	148.0	148.4
12/18/97	0.21	85.2	85.4
		mean=	131.4

Literature values for septage nitrogen concentrations of >600 ppm are well above the 131 ppm mean shown in Table 1. The sewage sample nitrogen concentration is typical. The Buzzards Bay Project will review the septage data with the Town and BCHED to ensure it is adequate for a loading analysis but it is conceivable that local septage is both variable and lower than literature values as shown.

When the volumes of sewage and septage flow shown in Figure 5 are multiplied by the mean concentrations in Table 1, the resulting relative nitrogen loads of each wastewater fraction are shown in Figure 6.The increased inputs of sewage and septage during the past several years has also resulted in a 10% annual increase in nitrogen received by the plant.

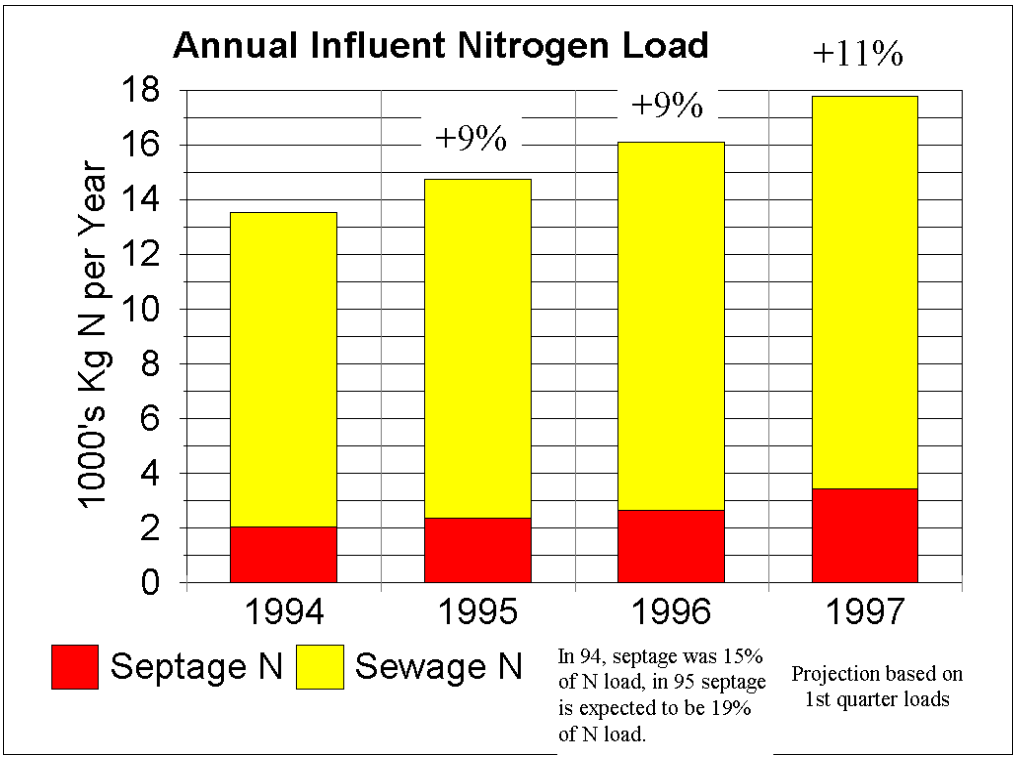

Figure 6. Nitrogen inputs to the wastewater facility from sewage and septage

Impact of upgrade

Have recent improvements in plant operation resulted in improvements in nitrogen concentrations of the effluent?

Figure 7 shows nitrate (Nox) and Total Kjeldahl Nitrogen (TKN) in the wastewater plants effluent (before it is discharged to either the spay area or infiltration lagoons).
As shown, maintenance activities affect both nitrate and total nitrogen concentrations in the effluent. The presence of nitrates is an indication that the ponds are aerated which is an important factor in controlling odors. Although some increases in nitrogen concentrations appear to coincide with maintenance activities, the plant improvements do not have appeared to have reduced nitrogen concentrations in the effluent in any appreciable way.

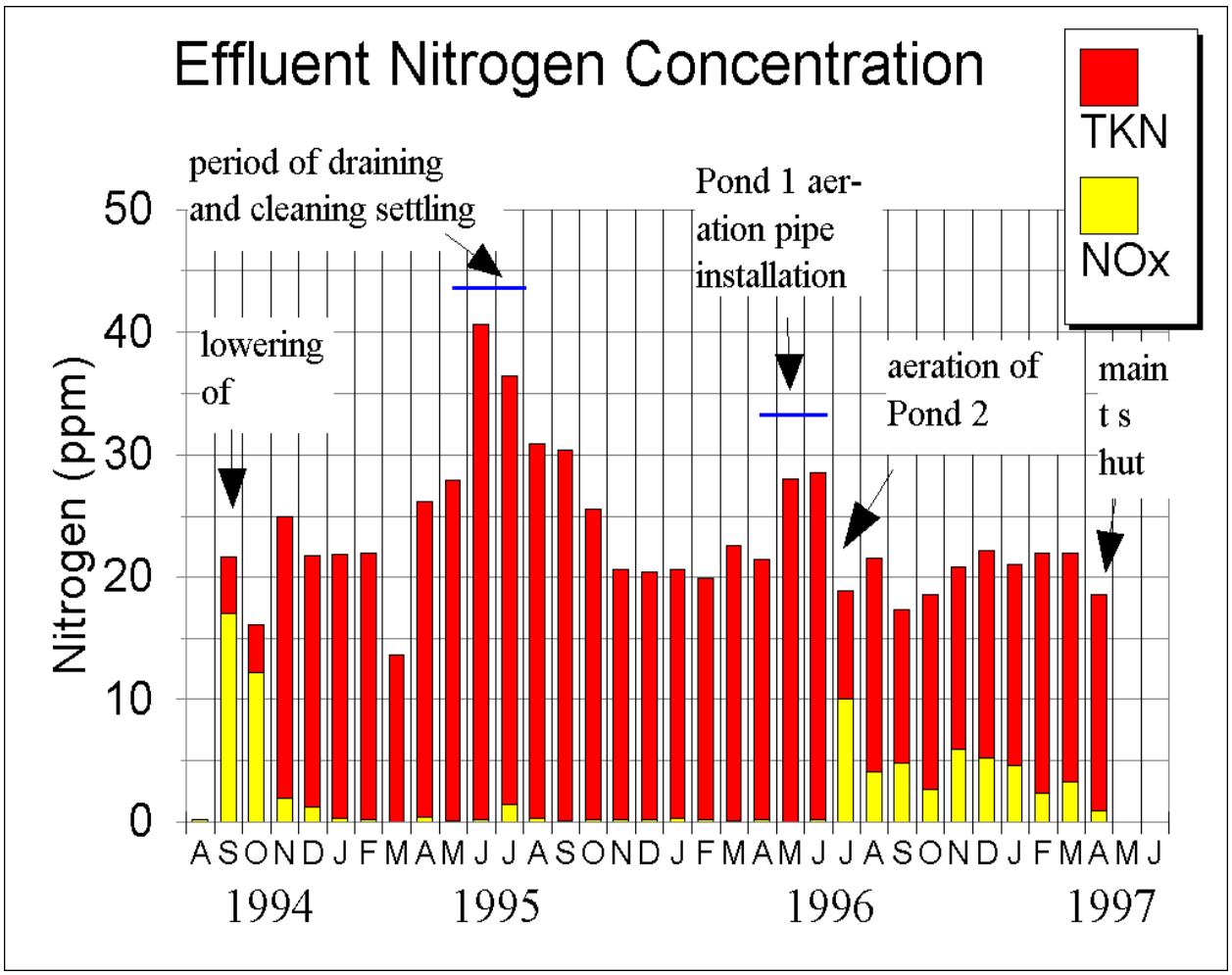

Figure 7. Nitrogen fraction of wastewater effluent.

Nitrogen levels in the groundwater wells have been variable over time so it is difficult to conclude any trends in these data. In Figure 8, well 2, closest to infiltration basin, nitrogen levels have declined somewhat during the past five years. In contrast, wells 15 and 17 under the spray area have shown a general increase except during the last sampling where both showed a marked drop

The marked variability in the well nitrate concentrations under the spray irrigation field are probably the result of both intermittent seasonal use of the irrigation areas and variability in rainfall. The fact that well 2, which is by the infiltration basins, having lower concentrations than the wells under the irrigation fields has two explanations. First, well 2 may not be directly

down gradient of the infiltration basins and is diluted with groundwater. Another possible explanation is that biological processes account for some nitrogen removal under the beds.

As of the date of this report, the results of the new monitoring wells were not evaluated by the Buzzards Bay Project.

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