Final Environmental Impact Statement (FEIS)/ Final Environmental Impact Report (FEIR)

Otis Air National Guard Base, Wastewater Treatment Facility

June 1990

National Guard Bureau
Environmental Protection Branch
Andrews Air Force Base, Maryland

Contract No.: 88-80-20

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For Further Information, Contact: Mr. Ronald Watson

Abstract

To protect the sole source aquifer and several freshwater ponds in Barnstable County (Cape Cod), Massachusetts, the Otis Air National Guard Base proposes to upgrade the current wastewater treatment facility that serves the Massachusetts Air National Guard, Army National Guard, United State Coast Guard, and all other tenants on the Massachusetts Military Reservation. The current facility does not meet Massachusetts water discharge standards for nitrogen. In addition, the current infiltration basins are located upgradient from several important freshwater ponds that receive groundwater from the current discharge area. The environmentally preferred alternative is to renovate the existing facility by adding a tertiary treatment process and discharge the water in infiltration basins next to the Cape Cod Canal. Other alternatives considered in this Environmental Impact Statement are: pump untreated effluent to the Town of Falmouth wastewater treatment facility for treatment and disposal, pump treated effluent to the Town of Falmouth wastewater treatment facility for treatment and disposal, use the current Otis facility and dispose of the wastewater by spray irrigation, upgrade the facility to tertiary standards and dispose of the effluent in the current infiltration basins, pump the current wastewater to infiltration basins next to the Cape Cod Canal, pump the current wastewater to the Cape Cod Canal for direct disposal in the canal, and continue the current treatment process (no action).

Page S-5, Table S.1:

The entries in Column I under Archaeological and Historical Resources should be exchanged with the entries in Column I under Human Health.

AS AMENDED

TABLE S.1 Projected Environmental Impacts[a] of the Otis ANG Wastewater-Treatment Alternatives

Alternative	Air Quality I	Air Quality II	Floodplains I	Floodplains II	Groundwater I	Groundwater II	Surface Water I	Surface Water II	Biota I	Biota II	Threatened Endangered Species[b] I	Threatened Endangered Species[b] II
1	1	1	0	0	2	2	1	1	1	1	1	1
1a	1	1	0	0	3	3	1	1	1	1	1	1
2	1	1	0	0	1	1	1	1	2	2	1	1
3	1	1	0	0	1	1	2	2	2	2	1	1
4	1	1	0	0	1	1	1	1	1	1	1	1
4a	1	1	0	0	0	0	1	1	2	2	1	1
4b	1	1	0	0	1	1	1	1	1	1	1	1
5	1	1	0	0	3	3	3	3	3	3	0	0

Alternative	Human Health I	Human Health II	Archaeological and Historical Resources[c] I	Archaeological and Historical Resources[c] II	Social and Economic I	Social and Economic II	Transportation I	Transportation II	Land Use I	Land Use II
1	0	1	0	0	1	1	1	0	2	1
1a	0	0	0	0	1	1	1	0	2	1
2	0	0	-[d]	0	1	1	1	0	2	2
3	0	1	-[d]	0	1	1	1	0	2	1
4	0	0	-[d]	0	1	1	1	0	2	1
4a	0	0	-[d]	0	1	1	1	0	2	1
4b	0	0	-[d]	0	1	1	1	0	2	2
5	0	0	0	0	0	2	0	0	0	0

AS AMENDED

[a]Degree of environmental impact: 0 = None, 1 = Negligible, 2 = Low, 3 = Moderate, 4 = High.

[b]No known populations in any potentially affected location; survey required.

[c]Survey required, mitigation under Cultural Resources Act.

[d]Assumes that all affected groundwater users are placed on alternative sources of potable water.

Comment 3, Insert for Page 1-1 at paragraph 2, line 10:

The 1984 permit requires that the Otis wastewater treatment facility meet a discharge standard of 10 mg/L of total nitrogen. Since the facility does not, on average, meet this standard, the Air National Guard must seek an alternative process that will meet Massachusetts wastewater discharge standards. The purpose of this EIS is to investigate the environmental impacts of alternative proposals that could be used to meet all discharge standards. AS AMENDED

Comment No. 4, Page S-13, Par. 7:

The statement currently reads "Alternatives 4, 4a, and 4b may adversely archaeological sites that exist at the proposed infiltration basins, along the route of the force main (Alternative 4a would only apply to the pipeline route), and at the proposed pumping station". This should read as follows: "Alternatives 4, 4a, and 4b would not be expected to have any adverse effect on the archaeological sites that exist at the proposed infiltration basins, along the route of the force main (Alternative 4a would only apply to the pipeline route), and at the proposed pumping station".

AS AMENDED

Comment 7, Page 1-1, Insert after 2nd paragraph; also place this section as the first paragraph on Page S-3:

The primary issue relevant to the proposal to upgrade the current wastewater treatment process is protection of the sole source aquifer on Cape Cod. Treatment and disposal of the wastewater must be done such that the long-term use of this aquifer is not adversely affected by the proposed action(s). Because most freshwater ponds on Cape Code are connected to the sole source aquifer, impacts to groundwater can directly affect surface water quality. Thus, another issue relevant to this EIS is protection of freshwater ponds in the vicinity of the alternatives examined in this study. Of importance to local and state officials and the general public is eutrophication of Ashumet Pond and projected impacts to this pond from the proposed alternatives. Because all groundwater on Cape Cod discharges to the ocean, impacts to groundwater have the possibility of affecting coastal zone resources. Estuaries on Cape Cod are key coastal zone resources that must be protected from human impacts. This EIS addresses the issue of potential impacts to ocean resources.

AS AMENDED

Comment 8, Page 4-61, Insert as Last Paragraph to Section 4.4.4.3:

There will be no impacts to the Coastal Zone Management Program under Alternative 4, 4a, or 4b.

AS AMENDED

Comment No. 9, Page 2-1, Par.2, lines 6-7:

The statement that currently reads "Each of the five action alternatives also disturbs some land areas (Table 2.1)." should be replaced by "Each of the four action alternatives also disturbs some land areas (Table 2.1)."

AS AMENDED

Comment No. 10, Page 2-5, Par.3:

Add the following sentence to the end of this paragraph: "The proposed improvements to Falmouth's WWTP are not in accordance with the town's plan."

AS [illegible]

Comment No. 11, Page 2-14, Par.1, line 1:

Add the following section immediately following the end of the first sentence: "Implementation of this alternative would require the construction of Bardenpho tertiary treatment system (first anoxic stage, nitrification stage, secondary anoxic stage, and the reaeration stage), and the sludge management system. The secondary clarifiers could utilize the existing clarifiers at the Otis Air National Guard WWTP."

AS AMENDED

Comment 12, Page 3-29, Insert as last paragraph in Section 3.10.2:

There are no prime farm lands located at any of the areas considered in the alternatives. A small wetland has been identified by the Town of Falmouth within the industrial boundaries of the town wastewater treatment facility. This wetland is not located within the areas that would be directly impacted by construction activities for any of the alternatives.

AS AMENDED

Comment 15, Page 3-15, Par.4, line 9:

Add the following section after the sentence that begins "In addition, past practices generated...". Delete the last two sentences of paragraph 4.

There were several possible of VOCs at the MMR (Current Fire Training Area, Civil Engineering Facilities, and the Defense Property Disposal Office) that could contribute to the plume, however; due to the lack of disposal data and groundwater data that presently exists, the precise origin and extent of the VOC plume cannot be determined. Consequently, there is uncertainty in the origin and extent of the organic chemicals in the groundwater plume (E>C> Jordan 1987).

Comment 19, Table 4-1:

For Table 4.1, Alternative 3 should be identified as Alternative 5 and Alternative 5 should be identified as Alternative 3. Change accordingly.

AS AMENDED

TABLE 4.1 Basis for Air Quality Analysis of Otis WWTP Alternatives

Alternative	Added VOC Sources	Eliminated VOC Sources
1, 1a	Air venting from wet well and pump station through carbon column at Otis WWTP 3 infiltration basins at site near Cape Cod Canal, or direct discharge to the canal	
2	Air venting from wet well and pump station through carbon column at Otis WWTP 2 aerated ponds at Falmouth WWTP 3 infiltration basins at Falmouth WWTP	Otis WWTP deactivated (except emergency generators)
5 [3]	Air venting from wet well and pump station through carbon column at Otis WWTP 3 infiltration basins at Falmouth WWTP	
4, 4a, 4b	11.1 acres of storage lagoons at Otis WWTP 60 acres of irrigation fields at Otis WWTP	Otis infiltration basins deactivated
3 [5]	Existing clarifiers to 2 aeration stations converted, and 2 anoxic stages for Bardenpho process at Otis WWTP Existing Imhoff tanks to activated sludge storage converted at Otis WWTP New secondary clarifiers built at Otis WWTP	Existing secondary clarifiers no longer used as final settling chambers at Otis WWTP Existing Imhoff tanks no longer used as solids digesters at Otis WWTP Trickling filters deactivated at Otis WWTP

Comment 21, page 4-10, Par.2, For Section 4.2.4.1:

Change "This is a relatibely small area and involves the loss of less than 5 acres" to "This is a relatively small area and involves the loss of less than 5 acres that has not already been altered by previous construction activities."

AS AMENDED

Comment No. 23, Page 2-7, Par.2:

Add a new paragraph as follows: "Due to control of heavy metals as hazardous wastes under the Resource Conservation and Recovery Act (RCRA), heavy metals should be at minimal concentrations and as such would not have any significant impact on the wastewater treatment operations under Alternative 1a. Further, due to the decay in residual chlorine along the pipeline route, the residual chlorine reaching the Falmouth WWTP should be present at concentrations far below the 1.0 mg/L discharge limit. Thus, neither heavy metals nor residual chlorine should have any significant adverse effect on the wastewater treatment operations." AS AMENDED

Comment No. 23, Page 2-10, Par.2:

Add a new paragraph as follows: "Due to control of heavy metals as hazardous wastes under the Resource Conservation and Recovery Act (RCRA), heavy metals should be at minimal concentrations and as such would not have any significant impact on the wastewater treatment operations under Alternative 2. Further, due to the decay in residual chlorine along the pipeline route to the spray irrigation fields, the residual chlorine reaching the spray irrigation area should be present at concentrations far below the 1.0 mg/L discharge limit. Thus, neither heavy metals nor residual chlorine should have any significant adverse effect on the wastewater treatment operations utilizing spray irrigation."

AS AMENDED

Comment No. 27, Page 4-1, Bullet No. 6:

Change this bullet to read as follows: "VOCs can exit the plant in the effluent. This pathway is unlikely at the Otis WWTP, due to the volatile nature of the VOCs, the small quantities involved, and the intimate liquid/air contact in the mixing operations and trickling filters."

AS AMENDED

Comment No. 28, Page 4-4, Insert Between Pars. 1-2:

Insert the following paragraph between paragraphs 1 and 2: "The specific source(s) of the VOCs is not known, although household solvents may account for part of the VOC source."

AS AMENDED

Comment No. 30, Page 4-1, Par. 3:

Insert the following sentence toward the end of line 5: "The specific source(s) of the industrial VOCs is not known, although industrial solvents may account for the majority of the industrial VOC source."

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LISTING OF ACRONYMS USED

ACEC	areas of critical environmental concern
AFR	Air Force Regulation
ANG	Air National Guard
ANL	Argonne National Laboratory
APR	areas for preservation or restoration
AQCR	Southeastern Massachusetts Air Quality Control Region
BOD	biological oxygen demand
CCPEDC	Cape Cod Planning and Economic Development Commission
CDM	Camp Dresser & McKee, Inc.
CDP	census-designated place
CEQ	Council on Environmental Quality
CFEST	Coupled Fluid, Energy, and Solute-Transport computer code
CFR	Code of Federal Regulations
CMR	Commonwealth of Massachusetts Regulations
CZM	Massachusetts Coastal Zone Management
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
DEIS	draft environmental impact statement
DEP	Department of Environmental Protection
DLA	Defense Logistics Agency
DO	dissolved oxygen
DOD	U.S. Department of Defense
EIR	environmental impact report
EIS	environmental impact statement
ENF	Environmental Notification Form
EPA	Environmental Protection Agency
FEIS	final environmental impact statement
FEMA	Federal Emergency Management Agency
HYDROCOIN	hydrologic code intercomparison
MBAS	methylene blue analytic standard (detergent)
MCD	minor civil division
MDPH	Massachusetts Department of Public Health
MEPA	Massachusetts Environmental Protection Agency
MMR	Massachusetts Military Reservation
MSL	mean sea level
NEPA	National Environmental Policy Act
NPDES	National Pollution Discharge Elimination System

O&M	operation and maintenance
PM-10	particles less than 10 μm in aerodynamic diameter
RCRA	Resource Conservation and Recovery Act
USGS	United States Geological Survey
VOC	volatile organic compound
WWTP	wastewater treatment plant

SUMMARY

S.1 BACKGROUND

The Otis Air National Guard (ANG) Base wastewater treatment plant (WWTP) is located at the southern boundary of the Massachusetts Military Reservation (MMR) in the Town of Sandwich at the Falmouth town line. The plant was constructed in 1936 to provide 900,000 gallons per day (gal/day) of primary wastewater treatment for Camp Edwards. In 1941, a new 3.0 million gal/day secondary treatment facility was constructed at the same location to replace the original primary treatment process. The secondary treatment facility was rehabilitated in 1983, but the treatment process remained unchanged from the original 1941 design. As part of the joint-use agreement among the current tenants of the MMR, the Otis ANG Base is responsible for providing wastewater treatment for the entire reservation. The Otis WWTP is owned by the United States and is licensed to the Commonwealth of Massachusetts Department of Military Affairs for operation. Operational funding is from mixed federal and state sources.

Present flows being treated by the WWTP average about 300,000 gal/day. All foreseen or proposed additions to the present flows would result in flows of up to 500,000 gal/day.

In 1976, the Town of Falmouth constructed a municipal water supply well about 1.5 mi south of the Otis wastewater treatment facility. The well was operated through 1979. In 1979, the town was made aware of detergent in the well water through a U.S. Geological Survey (USGS) study concerned with how sewage effluent interacts with a sole source aquifer system. The Massachusetts Department of Environmental Protection (DEP)* ordered the well to be shut down and a subsequent study to be performed to determine the causes, extent, and groundwater conditions that existed in the area of the municipal well. Water from the well contained detergent concentrations up to 0.9 milligrams per liter (mg/L). Additional studies revealed a plume of altered groundwater approximately 3,000 ft wide, 75 ft thick, and 11,000 ft long that originates from the Otis ANG Base wastewater treatment facility.

In 1984, the Massachusetts DEP, Division of Water Pollution Control, issued a discharge permit to the Massachusetts ANG that set limits on the constituents present in the final effluent. In order to comply with the final parameter values in the permit, the ANG is proposing to further modify the Otis WWTP. In addition, to meet the requirements of the National Environmental Policy Act (NEPA) of 1969 in the federal decision-making process, the ANG is evaluating the environmental consequences of five alternatives under consideration as ways of treating MMR wastewater. This Final Environmental Impact Statement (FEIS) evaluates the environmental effects that would result from implementing each of the alternatives.

*Formerly the Massachusetts Department of Environmental Quality Engineering.

S.2 IDENTIFICATION OF ALTERNATIVES

To achieve compliance with the final Massachusetts DEP 1984 discharge permit requirements, the ANG is evaluating the environmental effects of five alternatives for disposal of wastewater (four main action alternatives, with options to two; and a no-action alternative). The alternatives are:

1. Pump *untreated* effluent via a 40,000-ft pipeline to the Town of Falmouth WWTP for treatment and disposal in existing and new infiltration basins.

1a. Pump *treated* effluent via a 32,000-ft pipeline to the Town of Falmouth WWTP for disposal in existing and new infiltration basins.

2. Use the existing Otis ANG WWTP and dispose of the treated effluent using spray irrigation.

3. Upgrade the existing Otis WWTP to provide tertiary treatment for nitrogen removal and to dispose of the final effluent in existing infiltration basins.

4. Pump secondary-treated effluent via a 50,000-ft pipeline to the Cape Cod Canal area at the northern end of the MMR for disposal in new effluent infiltration basins.

4a. Pump secondary-treated effluent via a 50,000-ft pipeline to the Cape Cod Canal area at the northern end of the MMR for direct disposal in the canal.

4b. Pump tertiary-treated effluent via a 50,000-ft pipeline to the Cape Cod Canal area at the northern end of the MMR for disposal in new effluent infiltration basins.

5. Continue to operate the current facility using its present treatment capabilities (no action).

Assessment of the no-action alternative is required under NEPA regulations and allows a comparison of environmental impacts with the other alternatives. The four action alternatives being considered by the ANG and evaluated in this FEIS were selected based on (1) preliminary engineering analyses to determine technical feasibility and cost-effectiveness, and (2) the potential ability for each alternative to comply with all disposal regulations.

The five alternatives addressed involve three separate locations: (1) the Town of Falmouth wastewater treatment facility and pipeline routes from the Otis WWTP to the Town of Falmouth facility (Alternatives 1 and 1a); (2) the current Otis WWTP and approximately 80 acres adjacent to the WWTP (Alternatives 2, 3, and 5); and (3) a

100-acre site on the MMR next to the Cape Cod Canal in the Town of Bourne and a pipeline route from the Otis WWTP to this site (Alternatives 4, 4a, and 4b). Construction activities for the action alternatives would be limited to these locations.

Subsequent to the public hearings, Alternative 4b was added to the alternatives being considered in this FEIS. Upon further consideration, Alternative 4b is the preferred alternative for discharge of treated effluent from the Otis WWTP.

The scoping process indicated that most of the environmental concerns identified by the public and state and federal agencies are directed at the impacts on groundwater and surface water and the subsequent effects on groundwater and surface water supplies of potable water. In addition, because groundwater and surface water are dynamically connected through groundwater flow on Cape Cod, issues were raised concerning the potential for impacts on surface water and aquatic ecosystems from groundwater alteration. Other key concerns raised during the scoping process were potential impacts to cultural resources, threatened and endangered species, and air quality.

S.3 CHARACTERIZATION OF AFFECTED ENVIRONMENT

The alternatives considered in this FEIS have environmental consequences for the inner part of Barnstable County (Cape Cod), Massachusetts. The Otis ANG Base is located on the MMR, which falls within the towns of Bourne and Sandwich. The Town of Falmouth's wastewater treatment facility is located in a sparsely populated area bordered on the north by Landers Road, on the south by Blacksmith Shop Road, and on the west by State Rt. 28. The Otis WWTP is located at the southern border of the MMR in the town of Sandwich, along the Falmouth town line. A small part of the MMR, proposed as a disposal site under Alternatives 4, 4a, and 4b, is located adjacent to the Cape Cod Canal, but separated from the canal by U.S. Rt. 6A and a Conrail railroad line. The Cape Cod Canal separates Cape Cod from the mainland and connects Buzzards Bay and Cape Cod Bay.

Air quality on the Cape is generally good. The region is "in attainment" with respect to all air quality standards except ozone. However, the entire state of Massachusetts is classified "nonattainment" for ozone.

Surface waters potentially affected by the five alternatives include the Cape Cod Canal, and ponds, lakes, and streams that are recharged by groundwater. Groundwater on the Cape eventually flows to the Atlantic Ocean, Cape Cod Bay, or Buzzards Bay, or evaporates from groundwater-fed lakes. Groundwater flowing into the Cape Cod Canal is subsequently discharged to Cape Cod Bay, Buzzards Bay, or both. Most of the ponds, lakes, and rivers on Cape Cod form where the land surface intersects the water table. Many of these small ponds occur on the MMR and in the town of Falmouth. The largest groundwater-fed bodies of fresh water that exist within the areas of the five alternatives are Coonamessett, Ashumet, Johns, Long, and Jenkins ponds. Of particular concern in the context of the proposed alternatives are Ashumet and Long ponds. Long Pond is the primary drinking water source for the Town of Falmouth, while Ashumet Pond is an important aquatic ecosystem that provides various recreational opportunities to residents of Cape Cod. Ashumet Pond is currently undergoing eutrophication as a result of nutrient enrichment from natural processes, residential septic systems, runoff from abandoned cranberry bogs, and the Otis WWTP.

Most of the groundwater on Cape Cod (including the inner Cape) is of good chemical quality for drinking and other uses. It is low in dissolved solids and virtually free of toxic heavy metals and organic compounds. Of particular importance in the context of the proposed alternatives are changes in groundwater that have resulted from past and present disposal operations at or near the locations considered in this FEIS. Because land disposal has been used at the Otis WWTP since 1936, a sewage plume of groundwater extends more than 2 mi south from the disposal site. While the current effluent does not contain hazardous substances or volatile organic compounds (VOCs), certain past disposal practices have resulted in plumes of volatile organic contaminants located in parts of the larger wastewater plume. The origin of these organic contaminants is unknown.

The Town of Falmouth WWTP currently disposes of approximately 300,000 gal/day of wastewater. The town has received a Class III land-disposal permit from Massachusetts that restricts the use of any groundwater containing total nitrogen levels above the drinking water standard of 10 mg/L. Because Class III groundwaters are not potable, the town supplies all water users within the designated Class III area with municipal water supplies.

In addition to the Class III area, a plume of altered groundwater originates from the Town of Falmouth landfill. Current studies and model simulations indicate that this plume is moving toward the town's wastewater facility.

Because the proposed location for Alternatives 4, 4a, and 4b occurs entirely on federal or state controlled land, no private or public use of groundwater would be affected by these actions. The location is traversed by several transmission-line easements, and there are no known waste disposal areas in the vicinity of the Alternative 4, 4a, and 4b disposal site.

Table S.1 summarizes the projected degree of environmental impacts associated with each of the alternatives. (Following the table, the impacts are briefly described, by alternative.) A relative scale of impacts is presented in the table to allow a comparison of alternatives. Negligible and low impacts result in changes to the ambient environment that would be difficult to measure. Mitigation would effectively minimize these impacts. Moderate and high impacts would be difficult to mitigate or result in large, permanent changes to an environmental parameter that would alter some index of environmental quality.

Impacts of short-term duration are associated with construction and start-up phases of the wastewater disposal operations. Short-term negative impacts can be mitigated with sound engineering practices and preconstruction surveys that reduce impacts to sensitive locations (e.g., cultural resources and threatened and endangered species). Impacts of long-term duration are associated with the ongoing operations and will last throughout the operational period of the activity (20-50 yr). Mitigation strategies must be incorporated in the daily operations of the facility. In addition, long-term impacts can result in the irretrievable commitment of environmental resources.

TABLE S.1 Projected Environmental Impacts[a] of the Otis ANG Wastewater-Treatment Alternatives

Alternative	Air Quality I	Air Quality II	Floodplains I	Floodplains II	Groundwater I	Groundwater II	Surface Water I	Surface Water II	Biota I	Biota II	Threatened Endangered Species[b] I	Threatened Endangered Species[b] II
	Parameter, by Phase for Which an Impact Is Projected: Construction (I), Operational (II)											
1	1	1	0	0	2	2	1	1	1	1	1	1
1a	1	1	0	0	3	3	1	1	1	1	1	1
2	1	1	0	0	1	1	1	1	2	2	1	1
3	1	1	0	0	1	1	2	2	2	2	1	1
4	1	1	0	0	1	1	1	1	1	1	1	1
4a	1	1	0	0	0	0	1	1	2	2	1	1
4b	1	1	0	0	1	1	1	1	1	1	1	1
5	1	1	0	0	3	3	3	3	3	3	0	0

Alternative	Human Health I	Human Health II	Archaeological and Historical Resources[c] I	Archaeological and Historical Resources[c] II	Social and Economic I	Social and Economic II	Transportation I	Transportation II	Land Use I	Land Use II
1	0	1	0	0	1	1	1	0	2	1
1a	0	0	0	0	1	1	1	0	2	1
2	0	0	-[d]	0	1	1	1	0	2	2
3	0	1	-[d]	0	1	1	1	0	2	1
4	0	0	-[d]	0	1	1	1	0	2	1
4a	0	0	-[d]	0	1	1	1	0	2	1
4b	0	0	-[d]	0	1	1	1	0	2	2
5	0	0	0	0	0	2	0	0	0	0

[a]Degree of environmental impact: 0 = None, 1 = Negligible, 2 = Low, 3 = Moderate, 4 = High.

[b]No known populations in any potentially affected location; survey required.

[c]Survey required, mitigation under Cultural Resources Act.

[d]Assumes that all affected groundwater users are placed on alternative sources of potable water.

S.4 ENVIRONMENTAL IMPACTS AND MITIGATION STRATEGIES

S.4.1 All Alternatives

Air Quality

Because Massachusetts as a whole is in noncompliance for ozone, a worst-case VOC analysis was performed for emissions at the Otis WWTP. Emission levels were calculated to be less than 0.6 tons per year (ton/yr) under all alternatives. This is a very small source of VOC input to the atmosphere and is not a significant impact on air quality.

Floodplains

None of the existing or proposed facilities or pipelines would occupy 100-yr or 500-yr floodplains. Also, the proposed alternatives would not result in, or encourage, further development in floodplains. Thus, the proposed action would not affect floodplains.

Coastal Zone Management

All of Cape Cod is within the Massachusetts Coastal Zone Management (CZM) area. Of the 27 coastal zone management policies that serve as regulatory guidelines, five are specifically relevant to the proposed alternatives. Four of these are regulatory policies, one is a nonregulatory policy. The alternatives are consistent with CZM policies if these actions result in (1) no construction or direct discharge to coastal waters, (2) no increased future development in CZM areas, and (3) no measurable deterioration in coastal waters or coastal resources. The alternatives are consistent with the first two items. The results of the modeling analyses also indicate that none of the alternatives would have a significant impact on coastal waters or coastal resources. Alternative 4a is inconsistent with CZM policies in a regulatory sense.

Human Health Effects

Based on studies conducted to date by the Massachusetts Department of Public Health (MDPH), there is no evidence that discharges from the Otis WWTP have affected human health. Alternatives 3 and 4b would provide tertiary treatment of the wastewater and the production of effluent that meets drinking water standards. All other alternatives would produce treated effluent that meets drinking water standards, except for total nitrogen. Modeling analyses indicate that except for a small area in the immediate vicinity of the infiltration areas, nitrogen in the groundwater would remain below 10 mg/L (the drinking water standard) for all of the alternatives.

Regulatory Compliance

The Massachusetts ANG will comply with all applicable Massachusetts and federal regulations relevant to the disposal of treated wastewater. These regulations control discharges to Class I, II, and III groundwater supplies and are designed to protect human health and the environment. By complying with the discharge requirements, human health and the environment will be protected under each alternative. In addition, direct disposal into the Cape Cod Canal will require permits from the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency (EPA). Direct disposal is prohibited by the Massachusetts Ocean Sanctuary Act and is in conflict with ANG compliance with the Coastal Zone Management Act (CZMA) of 1972.

S.4.2 Alternative 1

Water Resources

A quantitative analysis at all alternative sites was needed to determine the areal extent of nitrogen concentrations exceeding 10 mg/L produced by land disposal of treated effluent. Because of the complex geology on the Cape and the evocation of simplifying assumptions in analytical solutions, it was necessary to use a numerical model. The coupled fluid, energy, and solute transport (CFEST) computer code, which is well documented and has undergone extensive verification and validation, was chosen to calculate groundwater-flow and solute transport for each of the alternatives under consideration. The calibration process involved adjusting the input parameters (within reasonable limits) until the best match was obtained between projected water levels and water-table elevations measured in the field.

The groundwater-flow and contaminant-transport model predicted impacts of land disposal of 300,000 and 500,000 gal/day of effluent containing a concentration of 19.7 mg/L of nitrogen. (The 19.7 value was the average concentration of total nitrogen measured at the Falmouth WWTP from September 1987 through October 1988). For 300,000 gal/day, a maximum concentration of 17.7 mg/L of nitrogen in the groundwater was predicted in the simulations; the 500,000 gal/day loading resulted in a maximum concentration in groundwater of 19.3 mg/L. Under all loading rates, the area defined by the 10 mg/L nitrogen-concentration boundary was located within the current Class III area that has been approved by Massachusetts and the Town of Falmouth for the Falmouth WWTP. Assuming that the Falmouth WWTP operates at full capacity, the 300,000 gal/day loading rate from the Otis WWTP results in a 10 mg/L nitrogen-concentration boundary incorporating approximately 29 acres; the 500,000 gal/day loading rate results in a similar boundary incorporating approximately 60 acres.

In all simulations, groundwater mounding was observed only in the area of the Falmouth treatment facility and was calculated to increase water-level elevations by a maximum of 1.5 and 2.0 ft, respectively, for the 300,000 and 500,000 gal/day loading rates. Maximum summer pumping rates at Long Pond would not affect the water-table elevations near the Falmouth WWTP. Based on these simulations, the groundwater flow and subsequent contaminant movement from the Falmouth landfill would not affect Long Pond under this alternative.

Natural and Cultural Resources

While there are no known populations of the federally listed endangered sandplain gerardia (*Agalinis acuta*) that would be affected by this alternative, the U.S. Fish and Wildlife Agency will notify the Massachusetts ANG if a survey is necessary.

Construction activities would temporarily affect 2.8 acres and permanently remove approximately 5.4 acres of forest and managed (mowed) vegetation cover at the Falmouth WWTP. However, this is a small amount of forest cover relative to the surrounding forest area, and its removal would not have a significant impact. The best available construction practices would be followed to limit impacts on soil and vegetation during construction, and reclamation activities would include reseeding disturbed areas.

The Town of Falmouth has designated the area of the wastewater treatment facility as a wildlife corridor. All proposed land use within the corridor requires the submission of site plans to and subsequent approval by the Massachusetts Division of Wildlife Resources.

There are no fresh water pond, lake, or stream ecosystems that would be affected by Alternative 1. Impacts of nitrogen would have a negligible effect on primary productivity within the marine ecosystems. All other constituents in the effluent are below drinking water standards and would have no effect on the marine ecosystems.

The Massachusetts Historical Commission has determined that Alternative 1 would have no adverse effects on significant archaeological sites or historic structures.

Social and Economic Resources

Alternative 1 would not change the number of people employed at the MMR. Minor traffic impacts, primarily during the rush hour, will occur during the short period of construction of the force main along Sandwich, Landers, and Blacksmith Shop roads, and State Rt. 151. Traffic delays along these roads would be worse during the summer tourist season if construction occurred during this period. However, because of the short construction period, these impacts are not significant.

The area of altered groundwater occurs entirely within the Falmouth Class III area. Because this area is already designated as Class III by Massachusetts and Falmouth, there would be no impacts on groundwater users or potable water supplies under this alternative.

S.4.3 Alternative 1a

Water Resources

A groundwater-flow and contaminant-transport model predicted impacts of land disposal of 300,000 and 500,000 gal/day of effluent containing concentrations of 15 mg/L of nitrogen. For both the 300,000 gal/day and 500,000 gal/day rates, a maximum concentration of 15.1 mg/L of nitrogen in the groundwater was projected in the simulations. The boundary of the 10 mg/L nitrogen-concentration isopleth extends north of the currently designated Falmouth Class III area. The increase in the Class III area, as defined by the 10 mg/L isopleths, is a consequence of the proposed location of the infiltration basins rather than the wastewater loading rates or the initial nitrogen concentration. Moving wastewater discharges to the Alternative 1 disposal location would result in concentrating the altered groundwater within the current Town of Falmouth Class III area.

For the 300,000 gal/day loading rate, the 10 mg/L nitrogen boundary includes approximately 9 acres; for the loading rate of 500,000 gal/day, the modeling projected approximately 11 acres.

Groundwater mounding was observed only near the Falmouth WWTP and the area proposed for the infiltration basins, and was calculated to increase water-level elevations a maximum of 1.3 and 1.8 ft, respectively, for the 300,000 and 500,000 gal/day loading rates. Maximum summer pumping rates of 4.14 million gal/day at Long Pond would not affect the water-table elevations near the Falmouth wastewater treatment facility. Based on these results, the groundwater flow and subsequent contaminant movement from the Falmouth landfill would not affect Long Pond under this alternative.

Natural and Cultural Resources

While there are no known populations of the federally listed endangered sandplain gerardia in the areas potentially affected by this alternative, the U.S. Fish and Wildlife Agency will notify the Massachusetts ANG if a survey is required. The route for this alternative passes very close to populations of the reticulate nut-rush and the decodon stem-borer moth, two state-listed species. These populations would have to be surveyed to determine whether they occur along the pipeline; if populations are found, the pipeline route would be altered to avoid habitat disturbance.

Construction activities would temporarily affect about 2.2 acres and permanently remove approximately 2.6 acres of forest cover at the Falmouth WWTP. However, this is a small amount of forest cover relative to the surrounding forest area, and its removal is not a significant impact.

Current zoning conditions at the Falmouth WWTP are consistent with Alternative 1a. Current siting of new infiltration basins for Alternative 1a would occur approximately 100 ft from Maple Swamp. This wetland is protected by the Massachusetts Wetlands Protection Act and local ordinances. To mitigate potential construction impacts, siting of the infiltration basins could be moved several hundred feet farther from the boundaries of Maple Swamp. In addition, the Town of Falmouth has designated the area of the wastewater treatment facility a wildlife corridor.

No fresh water pond, lake, or stream ecosystems would be affected by Alternative 1a. Impacts on marine ecosystems would be insignificant. The predicted level of nitrogen concentrations would have a negligible effect on primary productivity. All other constituents in the effluent are below drinking water standards and would have no effect on the marine ecosystems.

The Massachusetts Historical Commission has determined that Alternative 1a would have no adverse effects on significant archaeological sites or historic structures.

Social and Economic Resources

Alternative 1a would not change the number of people employed at the MMR. Minor traffic impacts, primarily during the rush hour, would occur during construction of the force main along State Rt. 151. Traffic delays along this highway would be greatest during the summer tourist season. However, this impact is not significant since construction activities and planning would be performed during late fall and winter to minimize effects on traffic.

The area of altered groundwater would extend north of the current Town of Falmouth Class III area. The Massachusetts ANG must apply for a Class III disposal permit under this alternative. All groundwater users would have to use municipal water supplies.

S.4.4 Alternative 2

Water Resources

The effects of disposing of effluent by spray irrigation at the Otis WWTP on groundwater and surface water were simulated for loading rates of 300,000 and 500,000 gal/day, and a nitrogen loading concentration of 9.0 mg/L. For a loading rate of 300,000 gal/day, the highest projected concentration of nitrogen in groundwater was 1.7 mg/L, while 2.4 mg/L were found for the 500,000 gal/day loading rate. The nitrogen concentrations projected for groundwater in the vicinity of Ashumet Pond were highest at the northwest corner of the pond -- 1.2 mg/L for 300,000 gal/day, and 1.5 mg/L for 500,000 gal/day.

Water-level elevations in the immediate vicinity of the spray-irrigation area increased approximately 0.2 and 0.4 ft, respectively, with the application of 300,000 and 500,000 gal/day.

Natural and Cultural Resources

Approximately 80 acres of forest would be converted to grassland under Alternative 2, and 11 acres would be permanently converted into a storage lagoon for the treated effluent. This forest conversion would negatively affect forest-dwelling wildlife, but it would benefit species that use open grassy areas.

The chemical composition of the treated effluent would enhance soil and plant productivity, and the managed grassland can be expected to remove in excess of 60% of the nitrogen in the wastewater. Phosphorus will be underutilized by terrestrial vegetation and can be expected to accumulate in the upper soil layers.

Ashumet Pond would continue to receive small amounts of nitrogen and phosphorus under Alternative 2. This would cause minor increases in plant productivity in the pond. The other elements found in the wastewater would be removed or diluted to an extent that they would not affect Ashumet Pond. The amounts of nitrogen and phosphorus entering Ashumet Pond under this alternative would be reduced compared to the no-action alternative, resulting in less eutrophication.

Because archaeological or cultural resources may exist in the construction areas, final design plans would have to be submitted to the Massachusetts Historical Commission, and a survey of the affected area could be required.

Social and Economic Resources

There would be negligible social or economic impacts under Alternative 2. The spray-irrigation areas and storage lagoon would be built entirely on MMR property and are consistent with land use in this area.

S.4.5 Alternative 3

Water Resources

A conservative estimate of the result of the Bardenpho tertiary treatment process was a nitrogen concentration of 10 mg/L; a more realistic estimate was 4 mg/L. For the 10 mg/L simulation, maximum nitrogen concentrations of 8.9 mg/L and 9.8 mg/L were projected in the groundwater for loading rates of 300,000 and 500,000 gal/day, respectively. Maximum nitrogen concentrations in the vicinity of Ashumet Pond are projected to be 1.5 mg/L for the 300,000 gal/day loading rate, and 2.9 mg/L for the 500,000 gal/day loading rate. Maximum nitrogen concentrations of 3.6 mg/L and 3.8 mg/L were projected in the groundwater at loading rates of 300,000 and 500,000 gal/day, respectively, for an initial concentration of 4 mg/L. Near Ashumet Pond, the maximum nitrogen concentration was 0.6 mg/L for the 300,000 gal/day loading rate, and 1.1 mg/L for the 500,000 gal/day loading rate.

Maximum mounding was in the immediate vicinity of the infiltration basins with groundwater elevations projected to increase approximately 0.5 and 0.8 ft, respectively, for the 300,000 and 500,000 gal/day loading rates.

Natural and Cultural Resources

There would be no impact on terrestrial resources under Alternative 3. All construction would occur within the current boundaries of the Otis WWTP. This area is already disturbed from previous construction activities.

Ashumet Pond would continue to receive nitrogen and phosphorus under this alternative. This would cause a continued enhancement in plant productivity in this pond and increase the rate of eutrophication compared to that under natural conditions. In addition, aquatic productivity would be enhanced in Coonamessett Pond.

There would be no impact on archaeological or historical resources under this alternative.

Social and Economic Resources

There would be minimal social or economic impacts under Alternative 3. All construction would take place within the existing boundaries of the wastewater treatment facility.

S.4.6 Alternatives 4, 4a, and 4b

Water Resources

The groundwater and contaminant-transport model was used to project the effects of land disposal of 300,000 and 500,000 gal/day of effluent containing initial nitrogen concentrations of 15 mg/L for Alternative 4, and 4 mg/L and 10 mg/L for Alternative 4b.

For Alternative 4, disposal of 300,000 gal/day resulted in a maximum nitrogen concentration of 4.7 mg/L in the groundwater; the 500,000 gal/day loading rate resulted in a maximum nitrogen concentration of 6.8 mg/L. Groundwater mounding was observed only in the vicinity of the proposed locations of the infiltration basins, with groundwater elevations projected to increase approximately 0.7 ft. and 1.1 ft, respectively, for the 300,000 and 500,000 gal/day disposal rates.

A conservative estimate of the result of the tertiary treatment process was a nitrogen concentration of 10 mg/L; a more realistic estimate was 4 mg/L. The two initial nitrogen concentrations were both evaluated for Alternative 4b. Using an initial nitrogen concentration of 10 mg/L, the maximum concentrations in the groundwater are projected to be 3.1 mg/L and 4.5 mg/L for loading rates of 300,000 and 500,000 gal/day, respectively. On the basis of simulations for an initial nitrogen concentration of 4 mg/L, maximum concentrations of 1.3 mg/L and 1.8 mg/L were projected in the groundwater for loading rates of 300,000 gal/day and 500,000 gal/day, respectively. Maximum mounding for Alternative 4b is the same as for Alternative 4 (0.7 ft and 1.1 ft for loading rates of 300,000 and 500,000 gal/day, respectively) because the loading rates and infiltration basin locations are identical.

For Alternatives 4, 4a, and 4b, effluent disposal will increase the nitrogen concentration in the Cape Cod Canal. For option 4a, direct disposal of effluent containing nitrogen concentrations of 15 mg/L into the canal will produce an increase in the canal nitrogen load of 0.005 mg/L, assuming a conservative dilution factor of 3,000:1. For Alternative 4, maximum increases in the canal's nitrogen concentration will be even less because of additional dilution by the groundwater. For Alternative 4b, maximum increases in the nitrogen concentration in the canal will be 0.003 and 0.001 mg/L for effluent nitrogen concentrations of 10 mg/L and 4 mg/L, respectively. These increases are based on a conservative total dilution factor of 3,000:1 for canal mixing, and no additional dilution by the groundwater.

Natural and Cultural Resources

The U.S. Fish and Wildlife Agency will notify the Massachusetts ANG if a survey of the federally listed endangered sandplain gerardia is necessary. There are no known populations of the species that would be affected by Alternatives 4, 4a, or 4b.

Construction activities would temporarily alter about 3.4 acres and permanently remove approximately 4.0 acres of forest cover on the MMR. However, these are not significant impacts since the amount of forest removed is small relative to the surrounding forest area.

There would be no impacts on fresh water from Alternatives 4 and 4a because the effluent at this location would pass to the groundwater and then enter the Cape Cod Canal.

The effects on the marine resources of the Cape Cod Canal, Buzzards Bay, and Cape Cod Bay would be negligible. Nitrogen levels entering the canal from the groundwater would result in either no measurable change or a slight increase in primary productivity. Alternative 4a would result in higher concentrations of nitrogen entering the canal at the discharge point. These higher concentrations would be quickly diluted (3,000:1), however, and should result in very small increases of primary productivity. All other constituents entering the canal are also below the drinking water standard (i.e., the constituents more than meet the standard).

Alternatives 4, 4a, and 4b may adversely affect archaeological sites that exist at the proposed infiltration basins, along the route of the force main (Alternative 4a would only apply to the pipeline route), and at the proposed pumping station. Archaeological sites have been identified by the Massachusetts State Historic Preservation Officer and in a recent survey completed by the Corps of Engineers and the Massachusetts Army National Guard (Davin and Gallagher 1989). During the autumn of 1989, the

Massachusetts ANG conducted a survey of areas not previously surveyed for archaeological sites that would be affected by these alternatives. The survey design, as well as a plan for mitigating adverse effects to any archaeological sites determined to be eligible for the *National Register of Historic Places*, was developed in consultation with the Massachusetts State Historic Preservation Officer.

Social and Economic Resources

Alternative 4 would not change the number of people employed at the MMR, while Alternatives 4a and 4b would result in a small increase. Minor traffic impacts, primarily during the rush hour, would occur during the construction of the force main at Connery Road and at the entrance gate to the MMR. For Alternative 4a, moderate traffic impacts would also occur during construction of the pipeline across Sandwich Road (State Rt. 6A).

There are no groundwater users located within the projected plume of altered groundwater; this area occurs entirely on government property (federal and state).

S.4.7 Alternative 5

Water Resources

The modeling projected groundwater changes based on land disposal of 300,000 and 500,000 gal/day of secondarily treated effluent containing nitrogen concentrations of 15 mg/L. Maximum nitrogen concentrations of 13.4 mg/L and 14.6 mg/L were projected for loading rates of 300,000 and 500,000 gal/day, respectively. Maximum nitrogen concentrations of 2.2 and 4.2 mg/L were projected in groundwater in the vicinity of Ashumet Pond for 300,000 and 500,000 gal/day, respectively.

For the 300,000 gal/day loading rate, the 10 mg/L nitrogen-concentration boundary in the groundwater includes approximately 3.3 acres; for a loading rate of 500,000 gal/day, approximately 8 acres were projected.

Maximum groundwater mounding was in the immediate vicinity of the infiltration basins, with groundwater elevations projected to increase approximately 0.7 and 1.2 ft, respectively, for the loading rates of 300,000 and 500,000 gal/day.

Natural and Cultural Resources

The no-action alternative results in no impact on terrestrial resources.

Fresh water resources are most adversely affected under this alternative. Ashumet Pond would receive the highest levels of nitrogen and phosphorus under the no-action alternative. Because there will be more nutrients available for aquatic plants and phytoplankton, these primary producers will show increased growth rates compared to natural background conditions. The increased growth rates will lead to greater plant biomass in Ashumet Pond. Aquatic productivity would also be further enhanced in Coonamessett Pond.

There would be no impact on archaeological or historical resources under this alternative.

Social and Economic Resources

Because the effluent exceeds 10 mg/L of total nitrogen, continued disposal will require the acquisition of a Class III permit from the Commonwealth of Massachusetts. Altered groundwater in the Class III area will not be available for human use. In addition, increased eutrophication in parts of Ashumet Pond would adversely affect swimming, boating, and fishing.

S.5 COST-BENEFIT ANALYSIS OF ALTERNATIVES

A preliminary cost analysis of the four alternatives that require capital for operation and maintenance (the no-action alternative is not included), shows that the total present worth of the alternatives ranges from $5.6 to $11.8 million. Because these are preliminary cost estimates, it was assumed in the Draft Environmental Impact Statement (DEIS) that all alternatives would have similar total costs. In response to the comments supplied during the public hearings and response period, Alternative 4b was added, which involves tertiary wastewater treatment resulting in the disposal of Class I water into new sand infiltration beds near the Cape Code Canal. The cost of this option is more than double that of the least costly alternative (Alternative 1).

S.6 MAINTENANCE AND MONITORING OF GROUNDWATER

All proposed locations for the final disposal of wastewater currently have upgradient and downgradient groundwater monitoring wells. Depending on the alternative selected by the ANG, additional wells could be required to monitor groundwater flow and quality. The parameters that would be monitored, as well as the appropriate quality-assurance procedures, would be specified in the land disposal permit that the ANG must obtain from the Massachusetts DEP. The Otis ANG Base is presently monitoring its WWTP effluent according to the schedule and procedures in the current disposal permit issued by the DEP (Appendix A). The parameter values measured under the current permit are sent to both the Massachusetts DEP and the EPA Region 1 office in Boston. Direct disposal in Cape Cod Canal would require regular sampling at several locations in the canal to monitor water quality. In addition, the National Pollutant Discharge Elimination System permit required by the EPA would further stipulate monitoring and disposal requirements.

1 PURPOSE OF AND NEED FOR ACTION

1.1 PURPOSE AND NEED

The Otis ANG Base operates a WWTP at the southern boundary of the MMR in the Town of Sandwich (Barnstable County) on Cape Cod, Massachusetts (Fig. 1.1). The facility provides wastewater treatment services for the principal tenants of the MMR -- the Massachusetts Air National Guard (Otis ANG Base), the Massachusetts Army National Guard (Camp Edwards), and the U.S. Coast Guard (Coast Guard Air Station).

The defense mission assigned to the MMR is considered vital to national defense and must be continued. This priority has been established at all decision-making levels of the U.S. Department of Defense (DOD). Rescue missions are also conducted at the base. The vital character of the MMR missions has been acknowledged by the National Command Authority through specific inclusion of MMR funding in annual Presidential budget submissions and has been confirmed by the Congress. To continue to carry out these defense and rescue missions, the Otis ANG Base must continue to support them by operating the WWTP. The facility is operating under a 1984 discharge permit issued by the Masachusetts DEP (Appendix A). The WWTP discharge meets the parameters listed in the 1984 discharge permit. After upgrading of the treatment system is completed, the Otis ANG Base proposes to develop and implement a wastewater disposal option in accordance with Massachusetts discharge limitations. Easements will be required for several of the various alternatives considered in this FEIS. Interagency agreements will be required for these easements.

The ANG is evaluating five alternative actions for disposal of wastewater: four main action alternatives, with options to two, and a no-action alternative. The alternatives are as follows:

Alternative 1:

Pump *untreated* effluent via a 40,000-ft pipeline to the Town of Falmouth WWTP for treatment and disposal in existing and new infiltration basins.

Alternative 1a:

Pump *treated* effluent via a 32,000-ft pipeline to the Town of Falmouth WWTP for disposal in existing and new infiltration basins.

Alternative 2:

Use the existing Otis ANG WWTP and dispose of the treated effluent using spray irrigation.

FIGURE 1.1 The Otis ANG Base Wastewater Treatment Plant

Alternative 3:

Upgrade the existing Otis WWTP to provide tertiary treatment for nitrogen removal and to dispose of the final effluent in existing infiltration basins.

Alternative 4:

Pump secondary-treated effluent via a 50,000-ft pipeline to the Cape Cod Canal area at the northern end of the MMR for disposal in new effluent infiltration basins.

Alternative 4a:

Pump secondary-treated effluent via a 50,000-ft pipeline to the Cape Cod Canal area at the northern end of the MMR for direct disposal in the canal.

Alternative 4b:

Pump tertiary-treated effluent via a 50,000-ft pipeline to the Cape Cod Canal area at the northern end of the MMR for disposal in new effluent infiltration basins.

Alternative 5:

Continue to operate the current facility using its present treatment capabilities (no action).

The preliminary engineering analyses of the technical feasibility of these alternatives were conducted by Camp Dresser & McKee, Inc. (CDM 1985). Easements would be required in Alternatives 1, 1a, and 4a for pipeline to cross established land features such as highways and power lines. Interagency agreements will be required for these easements.

1.2 FACILITY HISTORY AND CURRENT STATUS

1.2.1 History

The original wastewater treatment facility was constructed in 1936 to provide 900,000 gal/day of primary wastewater treatment for Camp Edwards. In 1941, a new 3.0 million gal/day secondary treatment facility was constructed at the same location to replace the original primary treatment process. During World War II, about 70,000 troops trained at Camp Edwards, and wastewater flows averaged 1 to 2 million gal/day (CDM 1985).

As a result of a series of administrative and command changes through the years, the military facility is now called the Massachusetts Military Reservation and encompasses Air National Guard, Army National Guard, and U.S. Coast Guard operations. The permanent population of the MMR is now about 2,500, and the summer population peaks at about 6,000 because of National Guard training activities. The Otis WWTP is owned by the United States and is licensed to the Massachusetts Department of Military Affairs for operation. Operational funding is from mixed federal and state sources. The Otis ANG provides wastewater treatment for the entire MMR.

Previous to this FEIS, two other environmental assessments relevant to wastewater production were performed at the MMR (Babij and Simmons 1985, Salamon and Hall 1988). The first was an environmental assessment of the Camp Edwards Military Reservation in terms of its Master Plan/Multiple Construction. This assessment addressed rehabilitation, new construction, alternative locations, and no action. The study concentrated particularly on the cantonment, range, and training areas. The Camp Edwards Training Site operates as a 3,000-person, year-round, major facility. For this design population of 3,000 troops, the daily contribution to the wastewater treatment plant was estimated to be about 200,000 gal/day. The assessment report concluded that no adverse impacts on the groundwater were expected for any of the projects in the cantonment area (Babij and Simmons 1985).

The second assessment addressed the proposed renovation and removal of 558 housing units by the U.S. Coast Guard; 180 housing units were planned for renovation. Salamon and Hall (1988) estimated that these 180 housing units would increase the water demand at the base by about 40,000 gal/day, and increase the wastewater flow by about 15%. Salamon and Hall concluded that if the wastewater treatment facility were upgraded to provide for nitrate removal, there would not be any significant impact on groundwater or surface water because of the additional sewage flow.

The secondary treatment facility was rehabilitated in 1983, but the actual treatment process remained unchanged from the original 1941 design (CDM 1985). The facility uses a secondary treatment process and discharges the effluent to any of four infiltration basins. Each infiltration basin consists of a filter bed designed to be flooded with an average of 125,000 gal/day of treated effluent. After being applied, effluent percolates through the basin to the groundwater. The surface of the beds is about 20 ft above the water table, and the beds (from the land surface downward) consist of 1 ft of sand, 2 ft of sandy loam and silt, and 18 ft of medium sand (LeBlanc 1984d; Kerfoot and Ketchum 1974). Figure 1.2 shows process flows resulting from the 1983 rehabilitation.

In 1976, the Town of Falmouth drilled a municipal water supply well about 1.5 mi south of the Otis wastewater treatment facility. The well was operated through 1979. Detergents, with concentrations up to 0.9 mg/L (E.J. Flynn Engineers 1985), were found in the well water in 1979 in a USGS study concerned with how sewage effluent interacts with a sole source aquifer system. In 1979, the Massachusetts DEP ordered that the well be shut down and a subsequent study performed to determine the causes and extent of the elevated detergent concentrations and to investigate the general groundwater conditions in the area of the Ashumet well. Additional studies revealed a plume of altered groundwater approximately 3,000 ft wide, 75 ft thick, and 11,000 ft long that

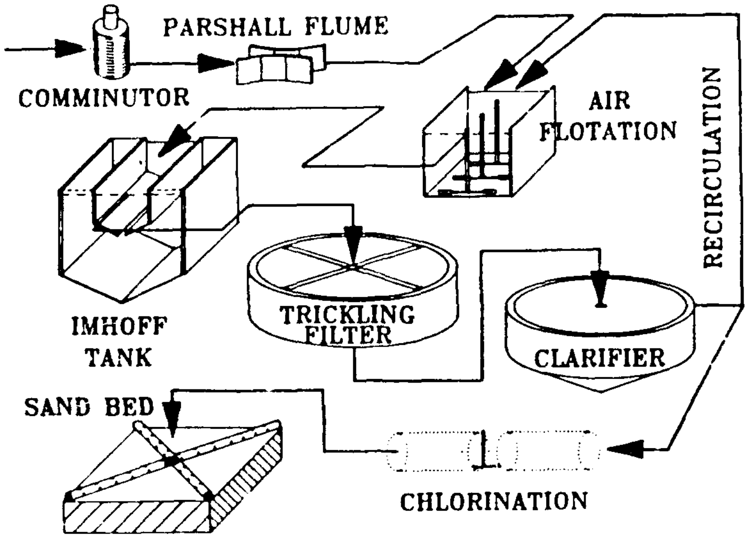

FIGURE 1.2 Schematic Flow of 1983 Wastewater Treatment at Otis ANG Base

originates from the Otis ANG Base wastewater treatment facility (LeBlanc 1984a, 1984b; E.C. Jordan 1987). General characteristics of the plume are summarized in Table 1.1.

In 1984, the Massachusetts DEP, Division of Water Pollution Control, issued a discharge permit to the Massachusetts ANG that set interim and final effluent discharge limits that could be present in the final effluent of the WWTP (Appendix A). The Massachusetts ANG subsequently developed five alternative options to the present treatment system that could be implemented to meet the requirements of the 1984 discharge permit (CDM 1985).

The Massachusetts DEP indicated that the disposal of treated effluent into infiltration basins near the Cape Cod Canal was its preferred alternative (Appendix A). The ANG initiated the Environmental Impact Statement (EIS) process. The scoping of the alternatives considered in this FEIS is based primarily on the options considered in the CDM report [CDM 1985]; the EPA, Region I, raised the issue of considering Alternative 4a (Appendix A).

1.2.2 Current Status

To increase nitrogen-removal efficiency, the ANG performed a series of plant investigations and modifications from October 1987 through March 1988. The effort sought to optimize system operation by reducing the amount of nitrogen-bearing compounds entering the treatment facility and by lowering the effluent concentration of measured parameters in the final effluent (ANL 1988).

The investigations and modifications focused on conditions that could be adjusted within the constraints of the existing secondary treatment processes utilized at the Otis WWTP. Specific actions were taken in the following areas: review of facility records,

TABLE 1.1 Characteristics of the Sewage Plume in the Ashumet Valley Area

	Reported Maximum Value, by Report Source[a]			
			LeBlanc (1984c,d)	
Parameter	K-V Associates and IEP (1987)	E.J. Flynn Engineers (1985)	1978-1979	1983
Specific conductance (μmho/cm)	377	325	405	322
pH	---	---	---	6.9
Boron (mg/L)	0.41-0.77	0.290	0.410	0.380
MBAS[b] (mg/L)	---	0.275	---	2.0
K (mg/L)	---	---	---	8.1
Li (mg/L)	---	---	---	12.0
Na (mg/L)	---	35	---	35
Cl (mg/L)	27-34	26	---	30-33
NH_4-N (mg/L)	0.13-0.14	---	---	12.0
NO_3-N (mg/L)	3.2	---	---	14.0
NO_2-N (mg/L)	---	---	---	< 0.06
TKN (mg/L)	16	---	---	---
Total N (mg/L)	---	---	---	22.0
Total P (mg/L)	1.70	---	---	---
Dissolved phosphorus (mg/L)	2.0	---	---	0.74
Dissolved organic carbon (mg/L)	---	---	---	4.2
Total VOC (mg/L)	430.79	---	---	681.7
Al (μg/L)	---	---	---	669.0
Ba (μg/L)	---	---	---	64.0
Mn (μg/L)	---	---	---	2662.0
Fe (μg/L)	---	---	---	7657.0
Be (μg/L)	---	---	---	0.6
Ca (mg/L)	---	---	---	17.0
Mg (mg/L)	---	---	---	9.4
Co (μg/L)	---	---	---	29.0
Cu (μg/L)	---	---	---	85.0
Mo (μg/L)	---	---	---	30.0
Pb (μg/L)	---	---	---	11.0
Si (mg/L)	---	---	---	22.0
Sr (μg/L)	---	---	---	126.0
V (μg/L)	---	---	---	< 6.0
Zn (μg/L)	---	---	---	639.0
Alkalinity (meq/L)	---	---	---	1.77
SO_4 (mg/L)	---	---	---	31.0

[a]Dashed line signifies not reported.

[b]Methylene blue analytic standard (detergent).

infiltration/inflow analyses, operation of treatment facility hydraulics, evaluation of temperature and pH effects on nitrogen removal, use of coagulants (iron salts), and determination of flow rate.

Investigations in these areas revealed a number of conditions that appeared to be reducing system operating efficiencies. The conditions discovered and corrective actions taken to enhance certain aspects of efficiency (ANL 1988) were as follows.

- A series of smoke bomb and dye tests and an analysis of precipitation and pump station records indicated that infiltration and inflow account for about 15% of the total flow to the WWTP.
- Nitrogen removal depends on temperature and pH conditions; biological reactions in the Imhoff tank convert organic nitrogen to ammonia, and the trickling filters serve to volatilize the ammonia.
- Biological oxygen demand (BOD) levels were lowered by changing the treatment conditions from aerobic to anaerobic.
- A secondary treatment system generally removes 10 to 30% of the nitrogen; the optimization program resulted in removals in the range of 30 to 60%.
- Disinfection of the effluent was begun.
- The Otis ANG Base implemented a program to clean and modify WWTP oil and grease separators.

Figure 1.3 shows the present configuration of the process flows at the treatment facility, which now incorporates results of the 1987-1988 optimization studies and

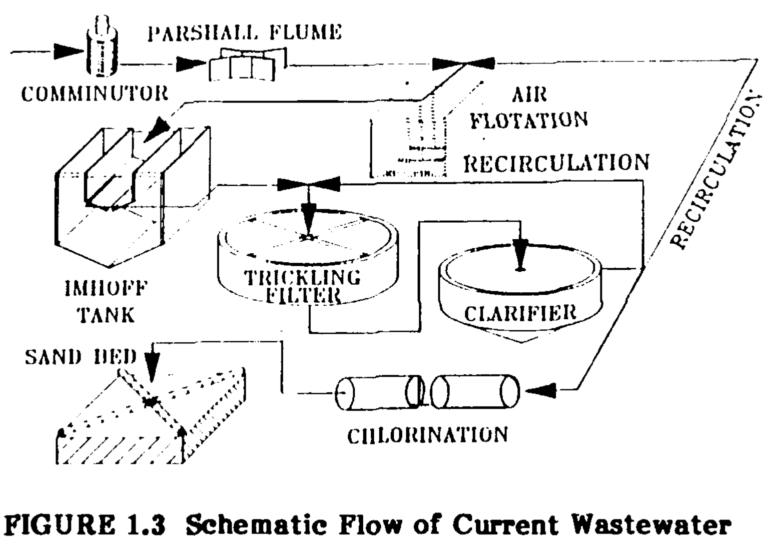

FIGURE 1.3 Schematic Flow of Current Wastewater Treatment at Otis ANG Base

modifications. The influent enters the comminutor and moves through the Parshall flume to the aeration tank and then to the Imhoff tank for primary treatment by means of anaerobic digestion. The wastewater then flows to the trickling filter, to a clarifier, and finally to a chlorinator before being disposed of in the infiltration basins. A small portion of the clarified effluent is recycled to the aeration and Imhoff tanks to convert as much of the nitrogen as possible to ammonia. The 1984 discharge permit (see Appendix A) limits flow to a maximum of 800,000 gal/day.

Before treatment system improvements are made, the Otis WWTP must meet discharge limitations imposed in the 1984 discharge permit (see Appendix A) for flow, biological oxygen demand (BOD_5), total suspended solids, and settleable solids. After treatment system improvements are made, the facility must in addition meet discharge limitations for total coliform bacteria, nitrate nitrogen as N, total nitrogen as N, oil and grease, fluoride, chlorine, boron, and methylene blue analytic standard (MBAS) detergents.

Table 1.2 lists the current average values of the effluent parameters that are measured to evaluate compliance with the 1984 discharge permit. These values reflect the changes incorporated as a result of the facility optimization program and define (1) the current baseline operating conditions of the Otis ANG Base wastewater facility and (2) the current operating state of the facility in the analysis of alternatives. Currently, the WWTP meets all permit levels applicable before the system is improved; only total nitrogen now exceeds the 1984 final permit levels, but these nitrogen levels will not be applicable until after the system has been improved.

TABLE 1.2 Current Average Values of WWTP Operating Conditions and Effluent Values

Parameter	Influent	Effluent	Reference
Flow rate (gal/day)	212,500	212,500	Plant records[a]
pH	7.37	7.22	Plant records
BOD (mg/L)	239	17	ANL 1988
Nitrogen (mg/L as N)			
Total	34.8	14.5	Plant records
NH_3	19.9	4.6	Plant records
NO_3	3.9	7.0	Plant records
Nitrogen removal efficiency (%)	N/A	58.2	N/A

[a]Water Pollution Control Utility Operating Logs, General and Supplementary, August-November 1988.

1.3 SUMMARY OF ENVIRONMENTAL STUDY REQUIREMENTS

Under the NEPA of 1969, federal agencies are required to take into consideration the environmental consequences of proposed actions in the decision-making process. The intent of the NEPA is to protect, restore, or enhance the environment through well-informed federal decisions. The process calls for the preparation of an EIS for federal actions deemed to have a potential for "significant" environmental impact.

The methodology for preparation of the EIS entails a five-step process: (1) description of the existing baseline conditions; (2) projection of the baseline conditions to the years of interest, where applicable, including the influence of projects that may cumulatively interact with the proposed action; (3) identification and evaluation of the impacts of each alternative; (4) determination of the level of impact of each alternative; and (5) determination of the significance of their respective impacts. The *level* of an impact is determined by measuring the effect on the resource or parameter of concern and then comparing this quantity with the baseline condition. The *significance* of an impact is determined by evaluating its context and intensity, as regulated by the Council on Environmental Quality (CEQ).

Under the definition of *context*, CEQ regulations specify that significance varies with the setting of the proposed action. In this FEIS, the setting for each alternative includes activities and associated impacts; these are characterized both by site and local spatial boundaries. Site-level impacts are those that occur in the immediate vicinity of a specific activity or disturbance. Examples include preparation of new infiltration basins, building construction, and vegetation management for spray-irrigation fields. For this FEIS, local impacts refer to those environmental disturbances that extend beyond the boundaries of the site on which an activity occurs. Examples include the transport and fate of contaminants in ground or surface water, utility construction (e.g., pipeline networks), and transportation. The boundaries of local impacts are determined by modeling the magnitude of their specific parameters. Neither regional nor national-level impacts result from the alternatives analyzed in this FEIS.

Besides boundary conditions, the context of an environmental impact refers to short- and long-term effects. Short-term or transitory impacts result primarily from construction activities or operation start-up. Long-term impacts are permanent changes to a baseline resource condition and result primarily from steady-state operational phases that occur over the lifetime of the action. For this FEIS, the primary long-term effects would occur to ground or surface water resources as a result of wastewater disposal. Long-term effects could also be caused by construction activities that destroy or irreparably damage valuable resources, or result in very slow recovery of these resources.

The CEQ (1986) has developed 10 items that should be considered when evaluating the intensity of environmental effects (40 Code of Federal Regulations [CFR] 1508):

1. The potential for beneficial as well as adverse impacts. (A significant effect may exist even if a federal agency states that, on balance, the effect will be positive or beneficial.)

2. The degree to which the proposed action and alternatives affect public health or safety.

3. The unique environmental characteristics of the geographic area (e.g., historic or cultural resources, recreational areas, parks, wetlands, wild and scenic rivers, or ecologically sensitive areas).

4. The degree to which the effects on the environment are likely to be controversial.

5. The degree to which the effects on the human environment are highly uncertain or involve unique or unknown risks.

6. The degree to which an action may establish a precedent for future actions with significant effects or represents, in principle, a decision about a future consideration.

7. The relationship, if any, of the action to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by calling an action (alternative) temporary or by breaking it down into small component parts.

8. The degree to which an action may adversely affect districts, sites, highways, structures, or objects listed or eligible to be listed in the *National Register of Historic Places* or to which it may cause loss or destruction of significant scientific, cultural, or historical resources.

9. The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been termed critical under the Endangered Species Act of 1973.

10. The extent, if any, to which an action might threaten to violate a federal, state, or local law, and the requirements imposed for the protection of the environment.

1.4 REGULATORY CONSTRAINTS

In addition to the relevance of the issues discussed in Sec. 1.3, the alternatives addressed in this FEIS are subject to applicable federal, state, and local regulations for the disposal of effluent from wastewater treatment facilities on land or by means of direct discharge into the Cape Cod Canal. Therefore, the environmental issues in this FEIS were evaluated according to current regulatory constraints on implementing each alternative. Except for the Alternative 4a option of direct discharge to the Cape Cod

Canal, no effluents would be discharged directly into surface waters under any of the actions examined; NPDES permitting procedures are not applicable to this study.

1.4.1 Water Quality Management

An areawide water quality management plan, federal law PL 92-500, Sec. 208, has been adopted for Cape Cod (Cape Cod Planning and Economic Development Commission [CCPEDC] 1978). Under this plan, many of the communities on Cape Cod have developed and implemented model health regulations or bylaws governing three aspects of management: water resources protection district zoning overlays; underground storage tanks; and toxic and hazardous materials storage, use, and disposal guidelines. The Town of Falmouth adopted the first "watershed protection district" bylaw on Cape Cod (CCPEDC 1978).

The Commonwealth of Massachusetts regulates the discharge of pollutants to groundwater in Statute 314 CMR 5.00 (Commonwealth of Massachusetts 1984), and groundwater quality standards in 314 CMR 6.00. (Appendix A includes a copy of these regulations. The regulations follow the first part of the appendix, which includes the actual discharge permit issued by Massachusetts to the Otis ANG Base.) The provisions of 314 CMR 5.00 require that any person or facility discharging or proposing to discharge pollutants onto or below the surface of the land must obtain a state permit. Section 6.00 of the regulations designates groundwater classifications and assigns the uses for which the various groundwaters of the commonwealth shall be maintained and protected; establishes water quality criteria necessary to sustain the designated uses; and sets forth regulations necessary to achieve the designated uses or maintain the existing groundwater quality.

Throughout this document, the categories of Class I and Class III water are applied to either the quality of water discharged from the WWTP, or the quality of the groundwater. The definitions of Class I and Class III appear in Appendix A as part of the regulations issued by the Massachusetts DEP. These regulations explicitly give the limitations for constituents found in the groundwater under Class I and Class III conditions. Class I water is suitable for potable use, while Class III water cannot be used for human consumption. While these definitions are used in the context of effluent from a wastewater treatment facility or groundwater, the quality of the water under Class I or Class III conditions is not dependent on the location of the water. Therefore, effluent leaving a treatment facility can be classified as being Class I or Class III discharge based upon the values of the constituents found in the water. If the water is sampled from an aquifer, definitions of Class I or Class III would be made based upon the constituents found in that water. As a result, one could dispose Class III water into an aquifer, but because of dilution in the aquifer, the water would meet Class I constituent values. In the groundwater flow and contaminant-transport models presented in this document, the limitations for constituents under Class I and Class III conditions are applied at two points in the disposal process: (1) at the point of discharge of effluent from the facility or alternative, and (2) in the groundwater.

Permits are based on the point of discharge. At the point of discharge, Alternatives 3 and 4b meet the requirements of Class I water discharge, while all of the other alternatives would require a Class III permit. Under all alternatives, the groundwater models determine the extent of Class III conditions within the groundwater.

1.4.2 Coastal Zone Management

All of Cape Cod is within the CZM area. The CZMA provides coastal states with the opportunity and funding to develop comprehensive management plans for their coastal regions. The primary focus of the CZMA is to allow states to approve or deny federally funded transportation or sewage projects, or actions related to dredging and navigation improvement projects. The Massachusetts Coastal Zone Management Program (CZMP) currently has 27 coastal zone management policies that serve as regulatory guidelines to protect and manage the coastal zone (U.S. Department of Commerce 1978). The purpose of the Massachusetts CZMP is to protect and carefully manage the development and use of the state's coastal zone. The alternative selected must meet the consistency requirements of the CZMA and must comply with the intent of the act. Barnstable County, which includes the Otis ANG Base, has some of the most extensive coastal resources in Massachusetts in terms of acres and numbers of salt marshes, tidal flats, barrier beaches, salt ponds, and tidal inlets (Hankin, Constantine, and Bliven 1985; Bliven and Hankin 1985).

Five of the 27 CZMP policies (those numbered 1, 2, 3, 10, and 26 -- see below) appear specifically relevant to the action alternatives. The regulatory policies are used in conjunction with state regulatory programs and decision making. The nonregulatory policies reflect state management priorities but are not enforceable through regulation.

1.4.2.1 Applicable CZMP Regulatory Policies

Policy 1. Protect ecologically significant resource areas (salt marshes, shellfish beds, dunes, beaches, barrier beaches, and salt ponds) for their contribution to marine productivity and value as natural habitats and storm buffers.

Policy 2. Protect complexes of marine resource areas of unique productivity (Areas of Preservation or Restoration [APR] or Areas of Critical Environmental Concern [ACEC]); ensure that activities in or affecting such complexes are designed and carried out to minimize adverse effects on marine productivity, habitat values, water quality, and storm buffering of the entire complex.

Policy 3. Support attainment of the national water quality goals for all waters of the coastal zone through coordination with existing water quality planning and management agencies. Ensure that all activities endorsed by the CZMA in its policies are consistent with federal and state effluent limitations and water quality standards.

Policy 10. Ensure that all development conforms to existing applicable state and federal requirements governing subsurface waste discharges, sources of air and water pollution, and protection of inland wetlands.

1.4.2.2 Applicable CZMP Nonregulatory Policy

Policy 26. Ensure that state and federally funded transportation and wastewater projects primarily serve existing developed areas, assigning highest priority to projects that meet the needs of urban and community development centers.

1.4.2.3 Ocean Sanctuaries

The Commonwealth of Massachusetts Ocean Sanctuaries Act has designated the coastal waters of Cape Cod as suitable for swimming and shell fishing, except for the Cape Cod Canal and Falmouth Inner Harbor, where shell fishing is restricted (CCPEDC 1978).

1.4.3 Massachusetts General Requirement

The Massachusetts Environmental Protection Agency (MEPA) requires that an Environmental Notification Form (ENF) be completed for projects being planned that may or may not have significant impacts on the environment. The purpose of the ENF is to identify general types of impacts from a project without having to perform a final design or detailed analysis. After filing the ENF, there is a public review process and a determination by the Secretary of Environmental Affairs whether or not an Environmental Impact Report will be required, and if so, what topics should be covered.

2 ALTERNATIVES

To achieve regulatory compliance, environmental protection, and meet the need for wastewater treatment, the ANG is evaluating the environmental effects of five wastewater-disposal alternatives, two of which have options. The preliminary engineering analyses to determine the technical feasibility of the action alternatives were conducted by CDM (1985). The alternatives in summary form are as follows.

- *Alternative 1:* Pump *untreated* effluent via a 40,000-ft pipeline to the Town of Falmouth WWTP for treatment and disposal in existing and new infiltration basins.
- *Alternative 1a:* Pump *treated* effluent via a 32,000-ft pipeline to the Town of Falmouth WWTP for disposal in existing and new infiltration basins.
- *Alternative 2:* Use the existing Otis ANG WWTP and dispose of the treated effluent using spray-irrigation.
- *Alternative 3:* Upgrade the existing Otis WWTP to provide tertiary treatment for nitrogen removal and to dispose of the final effluent in existing infiltration basins.
- *Alternative 4:* Pump secondary-treated effluent via a 50,000-ft pipeline to the Cape Cod Canal area at the northern end of the MMR for disposal in new effluent infiltration basins.
- *Alternative 4a:* Pump secondary-treated effluent via a 50,000-ft pipeline to the Cape Cod Canal area at the northern end of the MMR for direct disposal in the canal.
- *Alternative 4b:* Pump tertiary-treated effluent via a 50,000-ft pipeline to the Cape Cod Canal area at the northern end of the MMR for disposal in new effluent infiltration basins.
- *Alternative 5:* Continue to operate the current facility using its present treatment capabilities (no action).

Each of these alternatives is described in more detail in the following sections. Descriptions include treatment processes, work force requirements, and preliminary cost assessments. (Work force requirements and preliminary cost estimates, initially prepared by CDM (1985), have been updated and are shown in Appendix B. Appendix B also provides a summary of the requirements for operation and maintenance for all five alternatives.) Each of the five action alternatives also disturbs some land areas (Table 2.1).

TABLE 2.1 Preliminary Estimates of Areas Disturbed by Each Action Alternative

Action Alternative	Flow (10^6 gal/day)	Pipeline Length (ft)	Pipeline Area and/or Lagoon (acres)	Infiltration Basins or Irrigation Area (acres)	Other Areas Disturbed at Otis WWTP (acres)	Total Area Disturbed (acres)
Nos. 1 & 1a (pipe to Falmouth)	0.3	40,000	2.8 (Alt. 1)	5.4	Negligible	8.2
	0.5		2.8	9.0	Negligible	11.8
	0.3	32,000	2.2 (Alt. 1a)	2.6	Negligible	4.8
	0.5		2.2	4.3	Negligible	6.5
						9.1
No. 2 (spray irrigation)	0.3	NA	11.1	71.1	< 0.5	< 71.6
	0.5		18.5	118.5	< 0.8	< 119.3
No. 3 (upgrade Otis WWTP)	0.3	NA	NA	NA	< 0.5	< 0.5
	0.5		NA	NA	< 0.5	< 0.5
Nos. 4, 4a, & 4b (pipe to canal site)	0.3	50,000	3.4 (Alts. 4 and 4b)	2.1	Negligible	5.5
	0.5		3.4	3.5	Negligible	6.9
	0.3	50,000+	3.5 (Alt. 4a)	NA	Negligible	3.5
	0.5		3.5	NA	Negligible	3.5

Source: Adapted from CDM 1985.

2.1 ALTERNATIVE 1: PUMP UNTREATED EFFLUENT TO FALMOUTH FOR TREATMENT AND DISPOSAL

Under this alternative, the existing wastewater treatment facility at the MMR would be abandoned. The wastewater would instead be sent, via a new pumping station and a 40,000-ft force main, to the Falmouth wastewater treatment facility for treatment and disposal (Fig. 2.1). To treat the increased flow from the MMR, Falmouth would need to increase the capacity of its plant. This alternative has two primary components: a new conveyance system and a treatment and disposal system.

The conveyance system would consist of a prefabricated pumping station, wet well, and force main. The pumping station would be located near the headworks of the existing wastewater treatment facility at the MMR and would be equipped with two 50-horsepower (hp) centrifugal wastewater pumps, each with a capacity of 1 million gal/day (CDM 1985). Centrifugal pumps of this size would be required to maintain a minimum linear velocity of 2 feet per second within the force main (to prevent or minimize the solids from settling out). Systems would need to be provided for the control of hydrogen sulfide and other obnoxious odors from the raw sewage pumping facilities. Provision would be made at the pumping station for the addition of hydrogen peroxide, sodium hydroxide, or sodium hypochlorite for controlling the formation of hydrogen sulfide in the wet well and force main. In addition, an activated carbon adsorption column would be provided for control of odors vented from the wet well and pumping station. To ensure continuous operation of the pumping station during power outages, the station would be automatically connected to the existing back-up generator at the existing wastewater treatment facility.

The wet well would be 10 ft in diameter and constructed of reinforced concrete. It would have an operating capacity of 3,500 gal. Three starts per pump per hour would normally be required to pump the design flows (CDM 1985).

A 12-in.-diameter ductile iron force main would run from the pumping station to the headworks of the Falmouth WWTP. The total length of pipe required to transport the wastewater in this alternative is about 40,000 ft. Starting at the existing MMR facility, the force main would proceed to Sandwich Road, then southwesterly along Sandwich Road to Landers Road; it would then proceed northwesterly to intersect Blacksmith Shop Road. The main would follow Blacksmith Shop Road to the Falmouth WWTP (see Fig. 2.1). Given the length of this force main, a resultant friction head loss of about 90 ft, a 40-ft increase in elevation from the MMR to the Falmouth WWTP, and miscellaneous piping head losses, CDM estimated that the total dynamic head on the MMR pumping station would be about 140 ft (CDM 1985).

Wastewater from the MMR would be treated and disposed of at the Falmouth WWTP. That plant employs a series of aerated lagoons followed by infiltration basins. During the months of March through October, a portion of the Falmouth plant's effluent is applied to woodlands using spray irrigation. The plant now has an ultimate design-year summer flow of 1.29 million gal/day (CDM 1985). For those conditions, its present facilities include three aerated lagoons, five infiltration basins, and associated spray-irrigation areas.

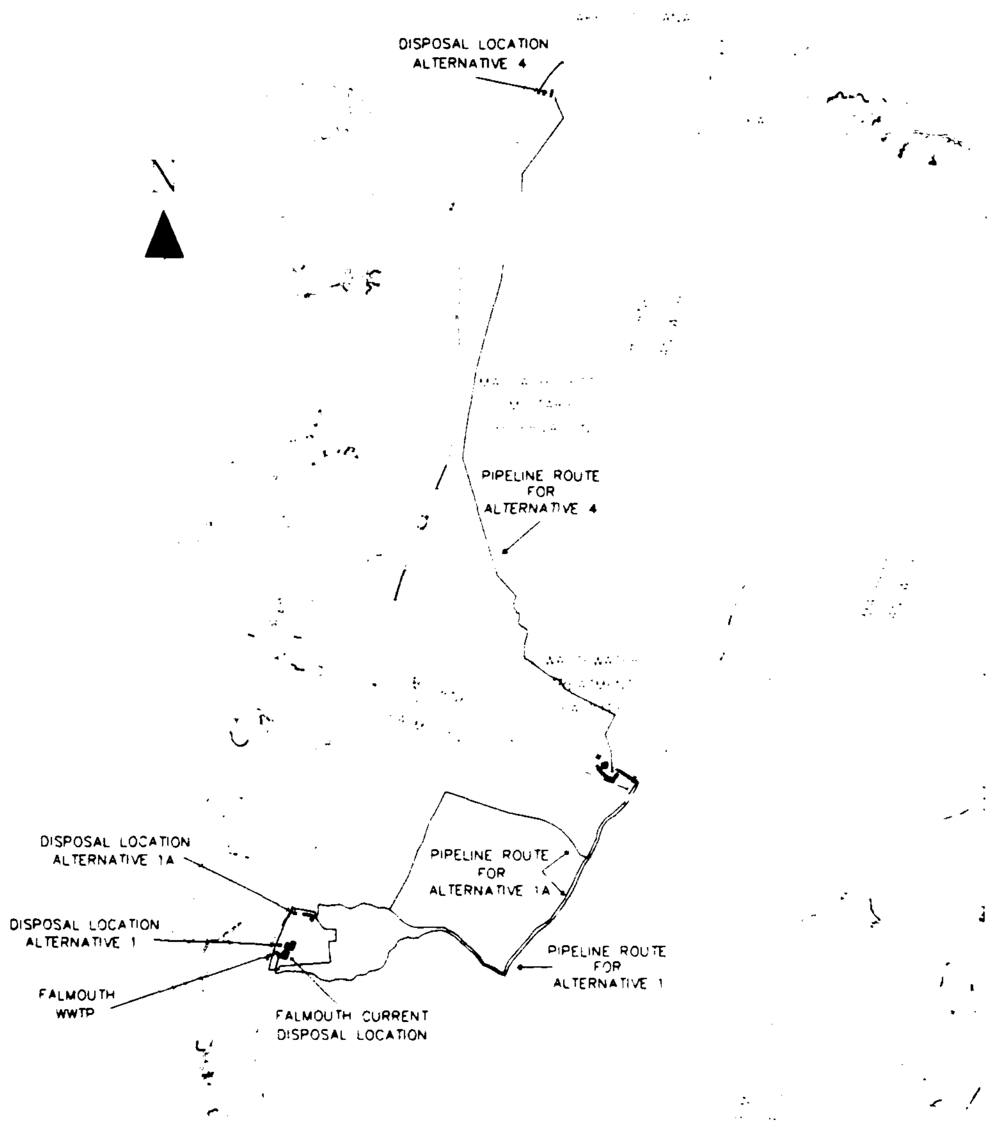

FIGURE 2.1 Pipeline Route and Location of Treatment Facilities for Alternatives 4, 4a, and 4b; and Pipeline Routes for Alternatives 1 and 1a

Currently, Falmouth treats an average flow of 300,000 gal/day -- 80,000 gal/day (28%) of the total effluent is disposed of in infiltration basins and 220,000 gal/day (72%) is disposed of by spray irrigation (Witt 1988). The estimated maximum disposal rate for the Otis WWTP is 500,000 gal/day. Combining the current average flow from Falmouth with the maximum flow from the MMR, 500,000 gal/day, would place the flow at the upper limit of the permitted capacity for the Falmouth WWTP (800,000 gal/day).

The maximum design capacity of Falmouth's WWTP is 800,000 gal/day. There are no exact specifications for the percentage of wastewater that would be disposed of via infiltration basins and spray irrigation; the breakdown was therefore estimated using the current disposal percentages of 28% for infiltration basins and 72% for spray irrigation. These percentages mean that 224,000 gal/day would be disposed of into infiltration basins and 576,000 gal/day of wastewater would be spray irrigated. If the maximum flows from both the MMR and the Town of Falmouth were treated at Falmouth's WWTP, the wastewater treated would total 1.3 million gal/day. Under this condition, the design capacity of Falmouth's WWTP would be exceeded and would require modifications to accommodate such a flow rate.

With the increased flows that would be sent from the MMR, the Falmouth plant's present design treatment capacity would potentially be exceeded. The increased flow would require two additional aeration ponds (for a total of seven) and three more infiltration basins (for a total of eight). The present blower capacity for the aerated ponds is sufficient to handle the increased flow from the MMR. The two new aerated ponds would require additional aeration piping. Figure 2.2 shows a plan view of the Falmouth WWTP, with the additional aerated ponds and infiltration basins also identified.

2.2 ALTERNATIVE 1a: PUMP TREATED EFFLUENT TO FALMOUTH FOR DISPOSAL

This alternative is very similar to Alternative 1. For this option, however, the existing MMR wastewater treatment facility would remain fully operational. Treated effluent would be chlorinated and then pumped to the Falmouth plant for disposal using a new pumping station and a 32,000-ft force main. Three new infiltration basins would be built at the site of the Falmouth WWTP for exclusive application to the flows from the MMR (CDM 1985). This alternative has two primary components: a conveyance system and an infiltration basin disposal system.

The conveyance system would consist of a prefabricated pumping station, wet well, and force main. The pumping station and wet well would be similar to those for Alternative 1. The effluent is currently chlorinated for disinfection and for control or elimination of any odors present.

The 12-in.-diameter ductile iron force main would run from the pumping station to three new infiltration basins located on the northern border of the Town of Falmouth's WWTP property. Figure 2.1 shows two possible routes for the force main (CDM 1985). Both routes would be constructed cross-country to Sandwich Road and then proceed southerly to Rt. 151. In the first routing option, the force main would head southerly to Landers Road, where it would turn westerly to the Falmouth site for disposal. The total force main length for this option would be roughly 32,000 ft. In the second routing

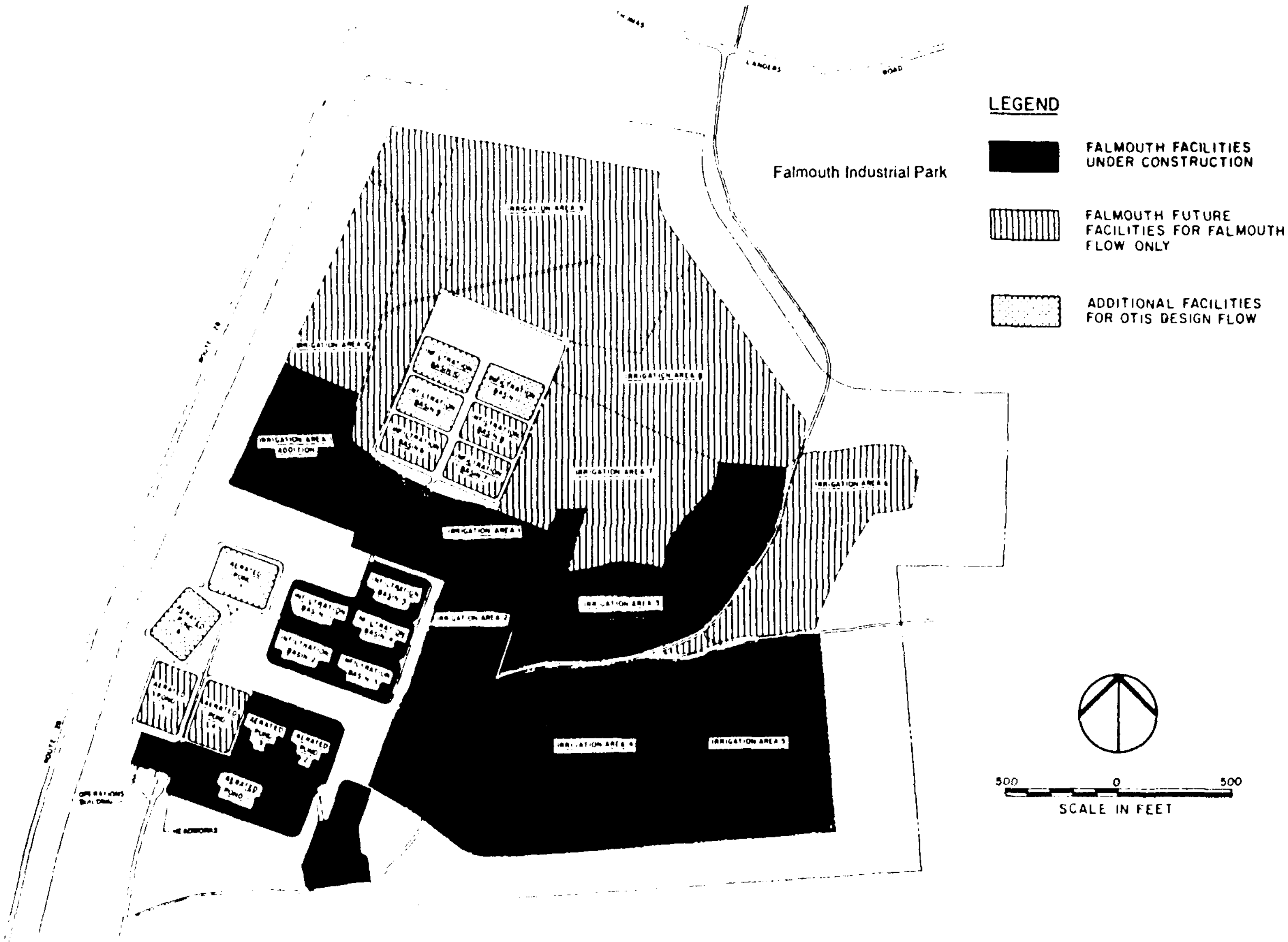

FIGURE 2.2 Plan of the Falmouth WWTP, Expanded for Added Flows from the MMR for Treatment and Disposal (Source: CDM 1985)

option, the force main would proceed along Rt. 151 to Sam Turner Road, then head southerly; it would follow a telephone easement to Landers Road, from which point it would proceed west to the Falmouth site. The force main in the second routing option would be about 32,500 ft in length.

Because of the increased flow of treated MMR effluent, CDM (1985) estimated that three additional infiltration basins would need to be constructed at the Falmouth WWTP site (Fig. 2.3). Each basin would be approximately 37,500 ft^2 in area and 5 ft deep, with a side slope of 2:1 (CDM 1985). The basins would operate at a hydraulic loading rate of about 3 gal/day per ft^2 using the gravity flow principle. Flow would be controlled by manual valves so that the basins could be used alternately. These infiltration basins would be placed judiciously so that the Class III area would not be affected.

2.3 ALTERNATIVE 2: USE EXISTING OTIS WWTP AND DISPOSE OF TREATED EFFLUENT WITH SPRAY IRRIGATION

Under this alternative, the existing MMR wastewater treatment facility would continue operating, but, instead of the effluent from the clarifiers being sent to the sand filter beds, the clarified effluent would be sent to a storage lagoon system. During the eight warmer months of the year, the effluent would be pumped from the storage system, passed through a chlorine contact chamber, and then applied using spray-irrigation techniques to managed grassland/alfalfa areas within the MMR (Fig. 2.4) The primary components for this alternative are one or more storage lagoons, a pumping station, and a spray-irrigation system for the land treatment. Sludge would be disposed of in a Massachusetts DEP-permitted facility.

For an average design flow of 300,000 gal/day, a storage area of about 36 million gal would be required. This volume would be provided by one or more lagoons (CDM 1985). Providing 4 months of storage, each lagoon would be 15 ft deep, with a sidewater depth of 12 ft. The lagoons needed for an average daily flow of 300,000 gal/day would cover 11.1 acres; for an average daily flow of 500,000 gal/day, 18.5 acres would be needed. To prevent infiltration of the wastewater effluent into the surrounding soil, the entire lagoon system would be lined with a cement-based soil or a synthetic liner (to minimize permeability). Effluent from the storage lagoons would be pumped to the chlorine contact chamber where the effluent would be detained for at least 15 min at the peak pumping rate (500,000 gal/day). The chlorine contact chamber would be constructed between the storage lagoons and the pumping station.

The land treatment (spray irrigation) system for Alternative 2 would be designed for 24-hours (hr)-per-day operation for 5 days per week (wk), resulting in an irrigation rate of about 440 gallons per minute (gal/min) (CDM 1985). The pumping station would be constructed in a below-grade concrete chamber with a brick and block superstructure. The station would be equipped with two end-suction centrifugal pumps, each rated at 440 gal/min, and 40-hp motors would be connected to the existing stand-by generator at the wastewater treatment facility (CDM 1985).

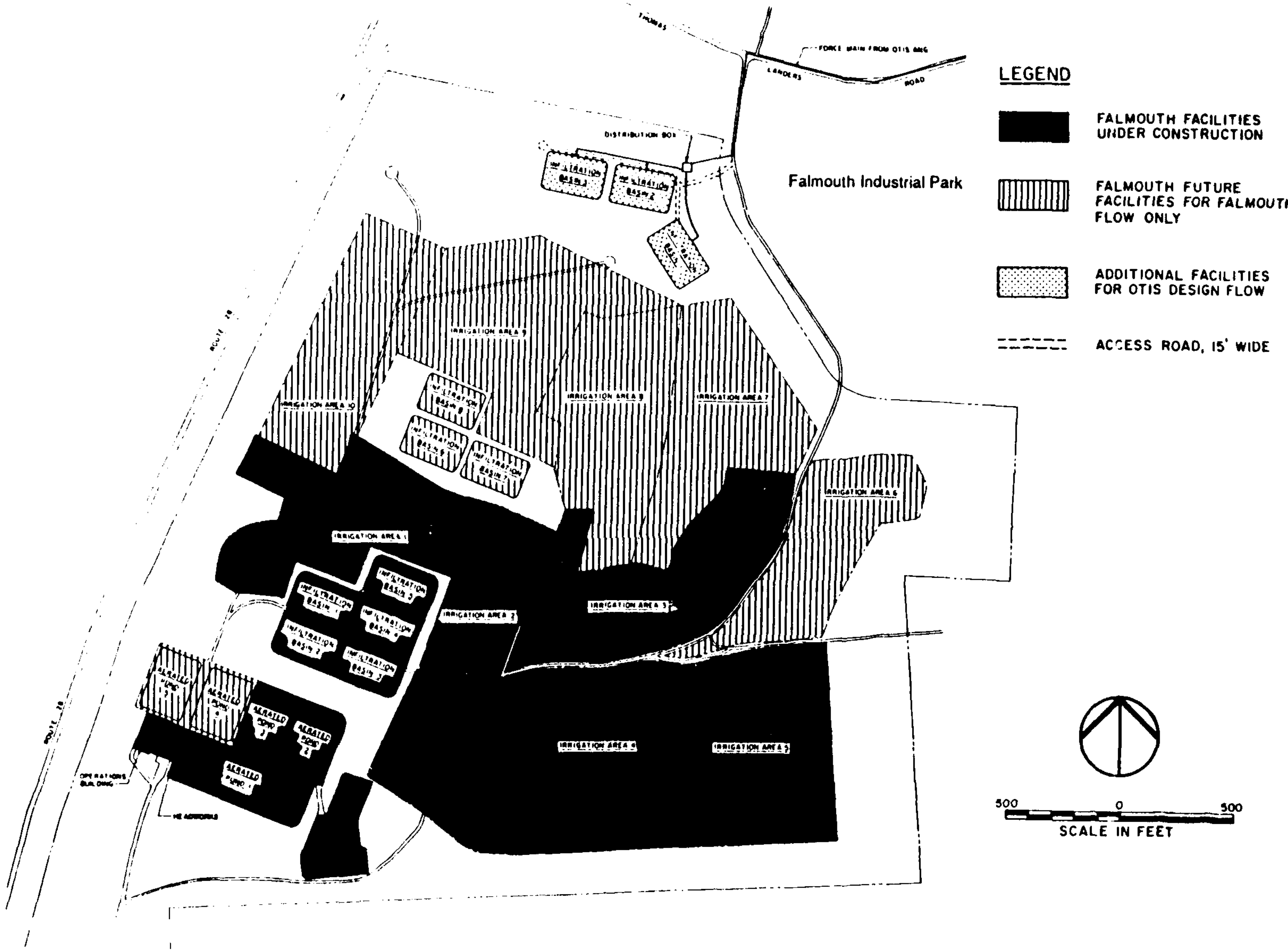

FIGURE 2.3 Site Layout for Falmouth WWTP under Alternative 1a

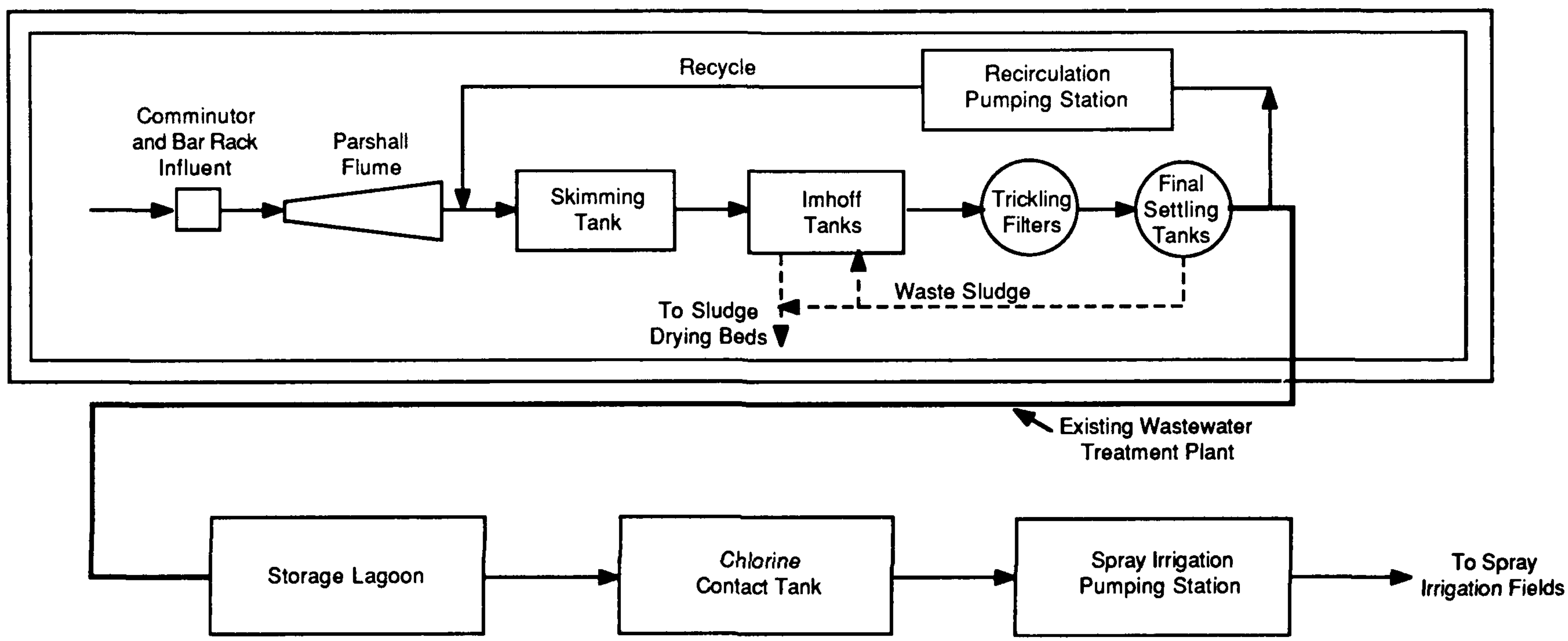

FIGURE 2.4 Process Flow Diagram for Alternative 1a Showing the Existing Wastewater Treatment Followed by Land Treatment (Source: CDM 1985)

The irrigation areas were sized (CDM 1985) for a loading rate of 2 in. per acre per wk, the same rate as established for the Falmouth WWTP. The individual irrigation fields would each be about 12 acres in area. Each area would have 3-in.-diameter aluminum pipe (laterals) laid on-grade, with pipes spaced at 100-ft intervals. On each lateral, a sprinkler system would be placed every 100 ft, providing a grid of sprinklers. An estimated 230 sprinklers would be required (CDM 1985). The laterals would be connected to a 6- or 8-in.-diameter force main leading from the pumping station.

This system would allow the application of wastewater to one field at a time and would be controlled by manually operated valves at the pumping station. The site layout for Alternative 2 is shown in Fig. 2.5. This figure shows the five spray-irrigation areas that would surround the existing MMR wastewater treatment facility.

2.4 ALTERNATIVE 3: UPGRADE THE OTIS WWTP AND DISPOSE OF EFFLUENT IN EXISTING INFILTRATION BASINS

A new facility using the Bardenpho process would provide advanced tertiary treatment for the biological removal of nitrogen prior to chlorination; the upgraded Otis treatment plant would then discharge effluent to the existing sand filter beds.

The current total nitrogen concentration of the effluent averages 14.5 mg/L (see Table 1.2). The design specifications of the tertiary nitrogen removal process would provide a maximum nitrate-nitrogen concentration of 10 mg/L and a maximum total nitrogen concentration of 10 mg/L.

The Bardenpho process uses a tertiary-treatment technology capable of meeting the various nitrogen standards contained in the 1984 discharge permit. The Bardenpho process is shown schematically in Fig. 2.6. The process basically is a four-stage, complete-mixing, activated-sludge process; it applies anoxic and aerobic conditions in alternating stages. The two anoxic stages are characterized by very low concentrations (near zero) of dissolved oxygen (DO), with nitrate-nitrogen present. The two aerobic stages are characterized by a DO concentration of about 2 mg/L, which is maintained by mechanical aerators or diffused aeration.

The first anoxic stage in the treatment process is the most important of the four stages. A large portion of the fully nitrified mixed liquor from the second (nitrification) stage is recycled back to this first stage where it is mixed with raw wastewater and activated sludge returned from the final clarifiers. In the absence of free DO, bacteria use the BOD in the raw wastewater to reduce the nitrates present in the recycle to gaseous nitrogen. Nearly two-thirds of the total nitrogen removed during the Bardenpho process is released as nitrogen gas during this stage.

In the second (nitrification) stage, oxygen is introduced to oxidize both BOD and ammonia. The BOD is converted to new cell mass and carbon dioxide. To allow the nitrifying bacteria to predominate during this stage, a much longer hydraulic detention time is needed (as compared to the other stages in this process).

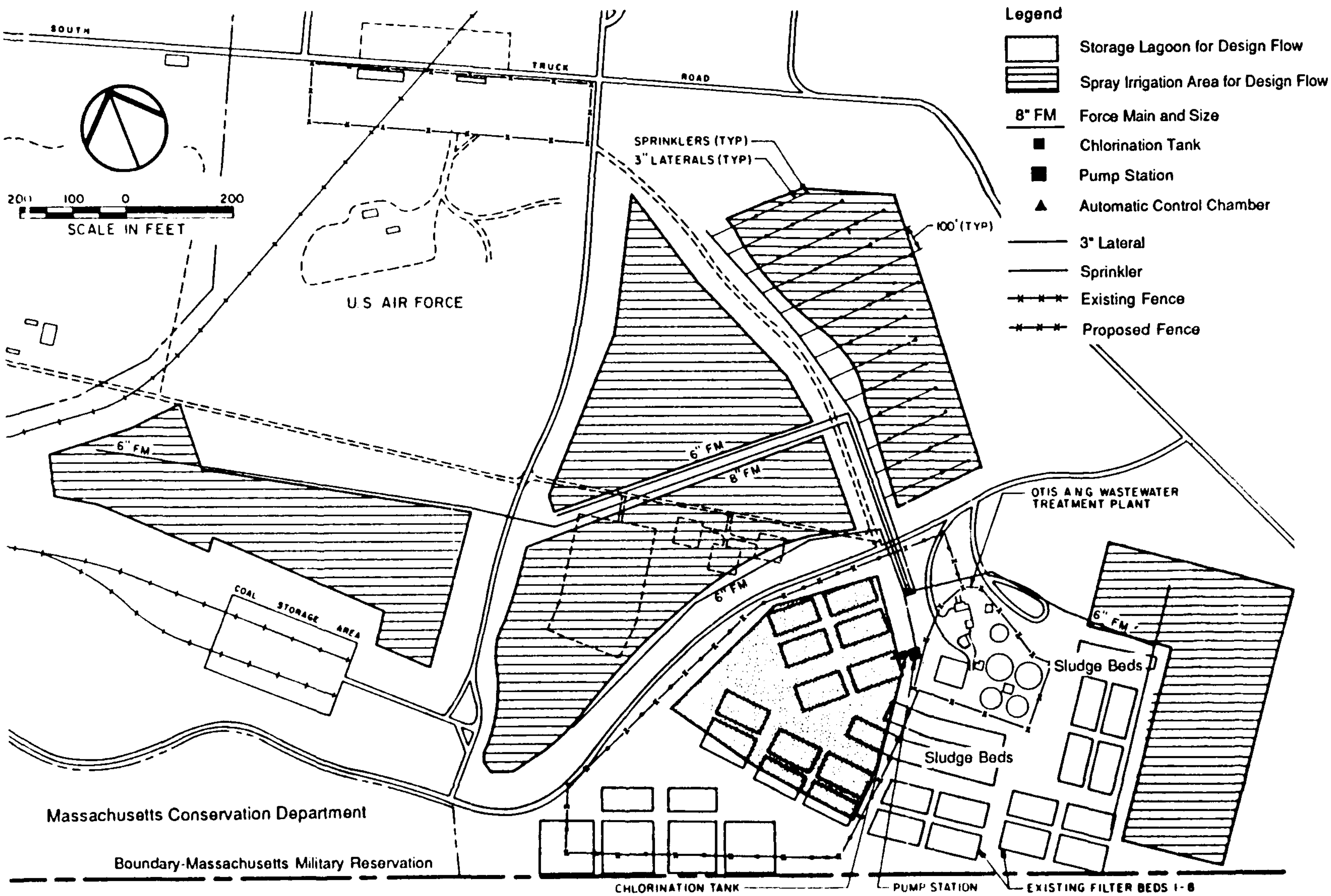

FIGURE 2.5 Site Layout for Alternative 2 at the MMR (Source: CDM 1985)

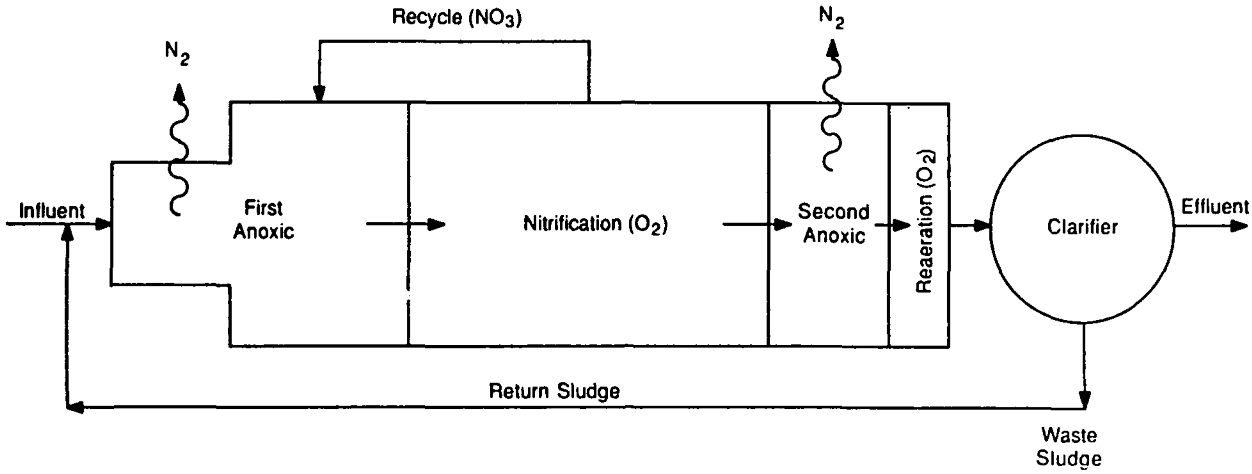

FIGURE 2.6 Process Flow Diagram of Alternative 3, Using the Bardenpho Process for Tertiary Treatment (Source: CDM 1985)

In the third stage (second anoxic stage), nitrate not recycled back to the first stage is further reduced in the absence of free DO to form nitrogen gas. The remaining nitrogen is removed during this stage.

The fourth stage of the process involves a reaeration step, accomplished by means of a relatively short hydraulic detention time. The DO concentration is increased to about 3 to 4 mg/L before wastewater is sent to the final clarifier, preventing anaerobic conditions in the effluent and return sludge streams.

Design criteria for Alternative 3 are listed in Table 2.2. The assumptions employed are average daily flow rates of 300,000 and 500,000 gal/day and a total hydraulic detention time of 18 hr for a flow of 500,000 gal/day for the entire four stages of the Bardenpho process (CDM 1985). Two 30-ft-diameter clarifiers would be required for this option. The treated wastewater would go to a chlorine contact chamber and then be sent to the existing infiltration basins.

Waste-activated sludge is well stabilized during the processing because of the long residence time of the solids in the system. The sludge could be pumped to existing Imhoff tanks for storage. Periodically, the sludge would be applied to a sludge drying bed. Dried sludge would be disposed of at a Massachusetts DEP-permitted facility. Although records are not available concerning the current sludge production rate, the sludge quantities generated annually with the Bardenpho process are estimated to be nearly equal to the present quantities (CDM 1985).

In designing the Bardenpho treatment facilities, CDM sought to maximize the utility of the existing facilities and to maintain existing treatment operations during construction. Existing facilities that could become a part of the new upgraded system are the WWTP headworks, including the comminutor and the Parshall flume measuring system; the administration building housing the plant laboratory; the sludge transfer station to be retrofitted with return and waste-activated sludge pumps; Imhoff tanks, which would be converted to sludge storage basins; secondary clarifiers, which could be

TABLE 2.2 Alternative 3 Preliminary Criteria for Biological Nutrient Removal[a]

Parameter	Value by Flow Rate in gal/day 300,000	500,000
First anoxic stage		
Detention time (hr)	5.0	3.0
Volume (gal)	62,500	62,500
Nitrification stage		
Detention time (hr)	18.5	11.1
Volume (gal)	231,000	231,000
Second anoxic stage		
Detention time (hr)	5.0	3.0
Volume (gal)	62,500	62,500
Reaeration stage		
Detention time (hr)	0.8	0.5
Volume (gal)	10,400	10,400
Total reactor system		
Detention time (hr)	29.3	17.6
Volume (gal)	366,400	366,400
Secondary clarifiers		
Number	2	2
Diameter (ft)	30	30
Surface area (ft^2)	1,414	1,414
Loading rate ($lb/ft^2 \cdot d$)	74	123
Loading rate ($gal/day \cdot ft^2$)	212	350
Chlorine contact tanks		
Peak flow (gal/min)	560	560
Detention time (min)	25	15
Volume required (ft^3)	666	1,110
Volume supplied (ft^3)	1,500	2,500
Sludge management		
Waste sludge (lb/day)	187	312
Waste sludge (gal/wk)	15,600	26,000
Imhoff tank capacity (10^6 gal)	1.040	1.040
Detention time (wk)	67	40
Sludge drying beds (number)	1	1
Area of sludge drying bed (ft^2)	4,800	4,800
Cake requiring disposal (yd^3/wk)	1.6	2.7

[a]Volume held constant for the two flow rate scenarios (300,000 and 500,000 gal/day) to assure that all design parameters are satisfied.

Source: Adapted from CDM 1985.

converted to aeration basins for the Bardenpho treatment process; and sand filter beds. Figure 2.7 shows the plant layout under Alternative 3. The main portion of the plant would be located to the south of the existing trickling filters, primarily because of considerations regarding the influent sewer elevation and the elevation of the effluent discharge line to the sand filter beds.

In accordance with Massachusetts regulations, two process trains would be required to ensure that the entire treatment plant would not be out-of-service for an equipment repair. Each train would be capable of accepting the average daily flow with provision for the peak flow of the influent wastewater. Each train would include the four-stage Bardenpho process, a 30-ft-diameter clarifier, and a chlorine contact tank. The first and third stages of the Bardenpho process would be equipped with mixers, while the second and fourth stages would be equipped with mechanical surface aerators or a diffused aeration system. Liquor-recirculation pumps would be housed in the existing recirculation pumping station. The sludge pumps would be housed in the existing sludge transfer station.

2.5 ALTERNATIVES 4, 4a, AND 4b: CONSTRUCT PIPELINE TO CONVEY TREATED EFFLUENT EITHER TO NEW MMR INFILTRATION BASINS OR DIRECTLY TO CAPE COD CANAL

For Alternatives 4 and 4a, the existing WWTP would continue to operate with its current treatment flow configuration (see Sec. 2.6). The effluent from the Otis WWTP would then be chlorinated and pumped via a new pumping station and a 50,000-ft force main (Fig. 2.1) across MMR property. The effluent would either be discharged to new infiltration basins in an area occupying about 90,000 ft^2 located near the Cape Cod Canal or (in Alternative 4a) discharged directly into the canal. Under these alternatives, the existing wastewater treatment plant would remain fully operational. Alternative 4 has two primary components: a conveyance system and a sand infiltration basin disposal system. Sludge would be disposed of in a Massachusetts DEP-permitted facility.

The new conveyance system would consist of a prefabricated pumping station, wet well, and force main. The force main would run from the pump station to the disposal site. It would be routed through the portion of the base to a power line right-of-way, along which it would proceed northerly on the western edge of the base to the disposal site. The total length of the forced main has previously been estimated to be about 50,000 ft (CDM 1985). The new 90,000-ft^2 infiltration basin system would be located about 800 ft from the roadway that borders the east side of the Cape Cod Canal.

For Alternative 4a, a pipeline would be constructed from the end of the 50,000-ft force main to a discharge point at the Cape Cod Canal. So that treated effluent could be disposed of directly into the Cape Code Canal, the pipeline would cross Sandwich Road (State Rt. 6A), a Conrail right-of-way, and U.S. Army Corps of Engineers property next to the canal.

Alternative 4b involves the use of tertiary treatment (nitrification/ denitrification operations) performed at the Otis WWTP, with subsequent disposal into the proposed new infiltration basins adjacent to the Cape Code Canal area. This

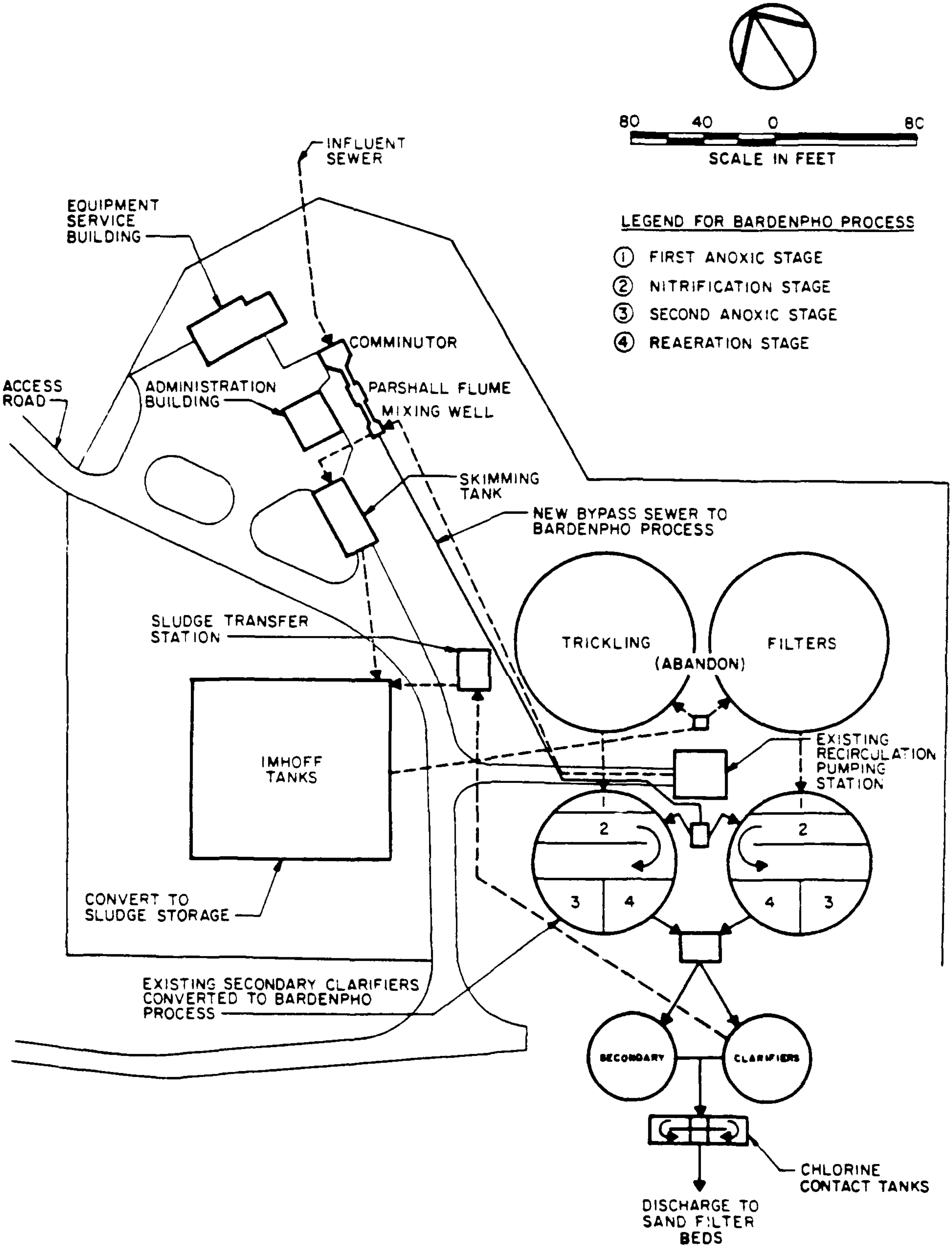

FIGURE 2.7 Site Plan for MMR Alternative 3 (Source: CDM 1985)

alternative was added to the FEIS, in part, because of comments received during the public hearings and public comment period for the DEIS. Basically, this alternative represents a combination of Alternatives 3 and 4 (see descriptions of these alternatives in Sec. 2.4 and this section). Alternative 4b involves disposal of Class I water into the sand infiltration basins.

2.6 ALTERNATIVE 5: CONTINUE TO OPERATE CURRENT FACILITY USING THE PRESENT TREATMENT CAPABILITIES — NO ACTION

The MMR wastewater treatment plant currently treats a flow of less than 300,000 gal/day. Table 1.1 shows current operating conditions and effluent concentrations, and these would remain the same under this alternative. The unit operation sequence employed at the existing WWTP employs a comminutor with a bar screen, air flotation tank, Imhoff tanks, trickling filters, clarifiers, disinfection equipment, and sand filter beds for land disposal (Fig. 1.3). A portion of the clarified effluent is recycled back to the trickling filter; another portion is sent back to the headworks of the aeration tanks. Sludge would be disposed of in a Massachusetts DEP-permitted facility.

3 AFFECTED ENVIRONMENT

3.1 GENERAL DESCRIPTIONS

The MMR occupies about 32.7 mi^2 of inner Cape Cod, in the part of Barnstable County near the Massachusetts mainland (Fig. 3.1). The MMR lies within the boundaries of the described limits of the towns of Bourne and Sandwich. The Town of Falmouth is located near the southern boundary of the reservation, and the Town of Mashpee is located to the east of the MMR (Fig. 3.2). Residential areas surround the MMR, with the largest populations concentrated near the commercial districts of Falmouth, Sandwich, Mashpee, and Buzzards Bay.

The Otis ANG Base, one of three principal MMR tenant organizations is in the southern portion of the reservation (Fig. 3.3). Otis provides all utilities on the MMR, including wastewater treatment. The treatment plant is located at the southern boundary of the base in the Town of Sandwich along the Falmouth town line (Fig. 3.2).

The alternatives evaluated in this document potentially affect three sites: (1) the Town of Falmouth WWTP, which is in West Falmouth, about 4 mi southwest of the Otis WWTP (Alternatives 1 and 1a); (2) the area around the current Otis WWTP (Alternatives 2, 3, and 5) (Fig. 3.2); and (3) a portion of the MMR and adjacent land bordering the Cape Cod Canal in the Town of Bourne (Alternatives 4, 4a, and 4b). The Cape Cod Canal separates Cape Cod from the mainland and connects Buzzards Bay and Cape Cod Bay; the alternative that would affect the canal requires new infiltration basins located about 800 ft southeast of Sandwich Road (State Rt. 6A) at the northwestern portion of the MMR. (The Cape Cod Canal site has been characterized in a hydrogeological investigation that is summarized in Appendix C.) The Falmouth treatment facility site is located in a sparsely populated area bordered on the north by Landers Road, the south by Blacksmith Shop Road, and the west by State Rt. 28; it is owned and operated by the Town of Falmouth. The Otis WWTP at the MMR's southern boundary is about 0.4 mi northwest of Ashumet Pond.

The environmental settings of the inner part of Cape Cod, the MMR, the Otis ANG Base, and the other potentially affected sites are described in more detail in the following sections. The discussions describe those environmental components that would potentially be affected by the alternatives evaluated.

3.2 METEOROLOGY AND AIR QUALITY

Cape Cod is considered to have a humid continental climate that is modified by its close proximity to the ocean (K-V Associates and IEP 1987). The mean annual rainfall in the Ashumet region has been recorded as 48 in. (at Otis ANG Base). The net precipitation (total rainfall minus evaporation and other losses) is 21 in. (K-V Associates and IEP 1987). The Sandwich Station, located at the east end of the Cape Cod Canal, measured an annual average of approximately 45 in. of precipitation between 1947 and 1968. The estimated annual recharge was calculated to be approximately 20 in. (45% of the annual average).

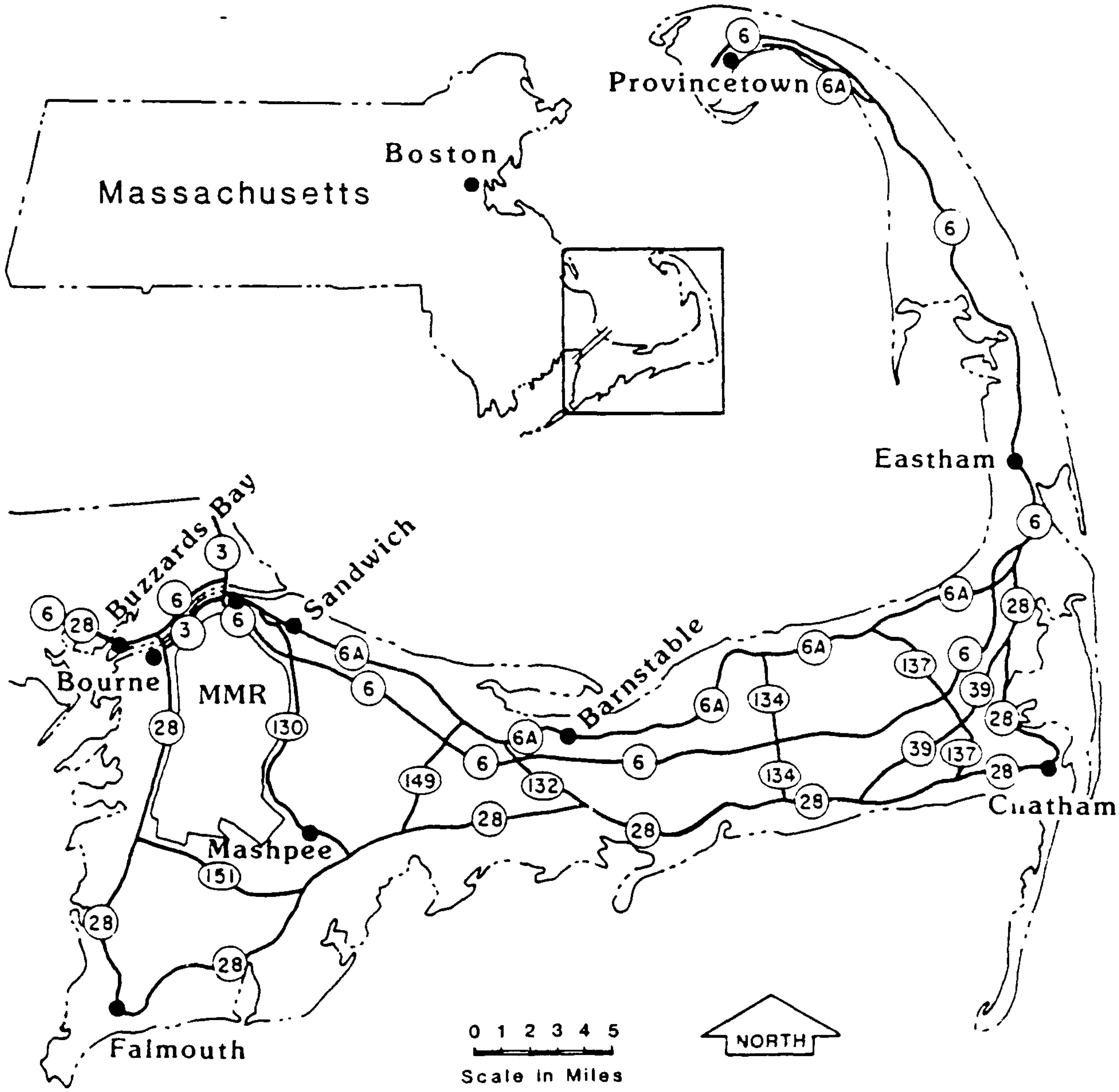

FIGURE 3.1 Geographic Setting of the MMR and Otis ANG Base

A 1-yr, 24-hr rainfall event of 2.7 in. was reported to have a significant potential for runoff and erosion by E.C. Jordan (1986). Occasional tropical storms intersecting the Cape may produce 24-hr rainfall events of 5 to 6 in. (K-V Associates and IEP 1987).

The MMR is located in the Southeastern Massachusetts Air Quality Control Region (AQCR 120). The weather fluctuates regularly from fair to cloudy to stormy conditions. The Cape is in a zone of prevailing west to east atmospheric flow. Although winds of 30 mph or higher may be expected on at least one day every month, gales are more common and more severe in winter. The ocean has a moderating influence on the

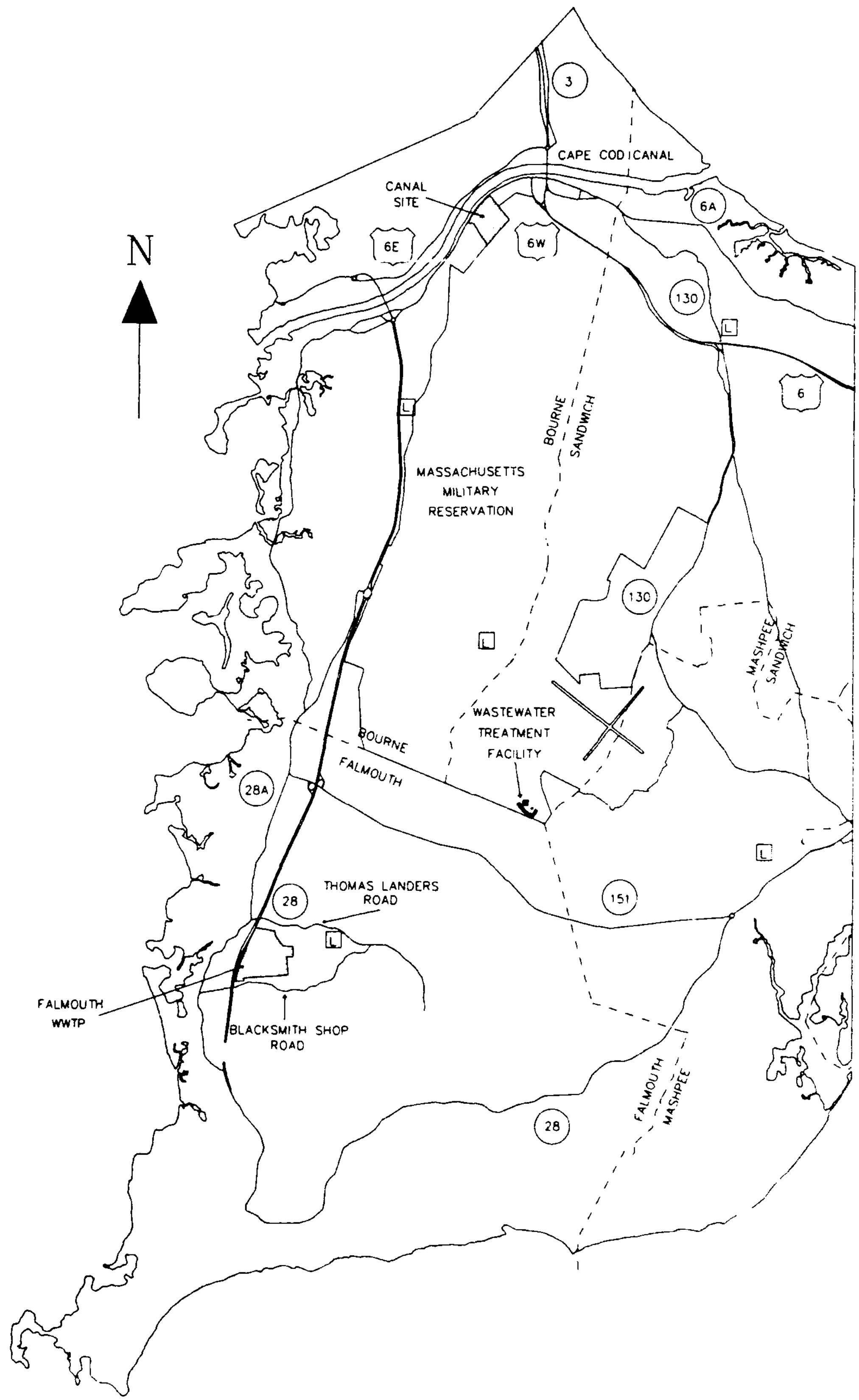

FIGURE 3.2 Base Map of Inner Cape Cod and MMR

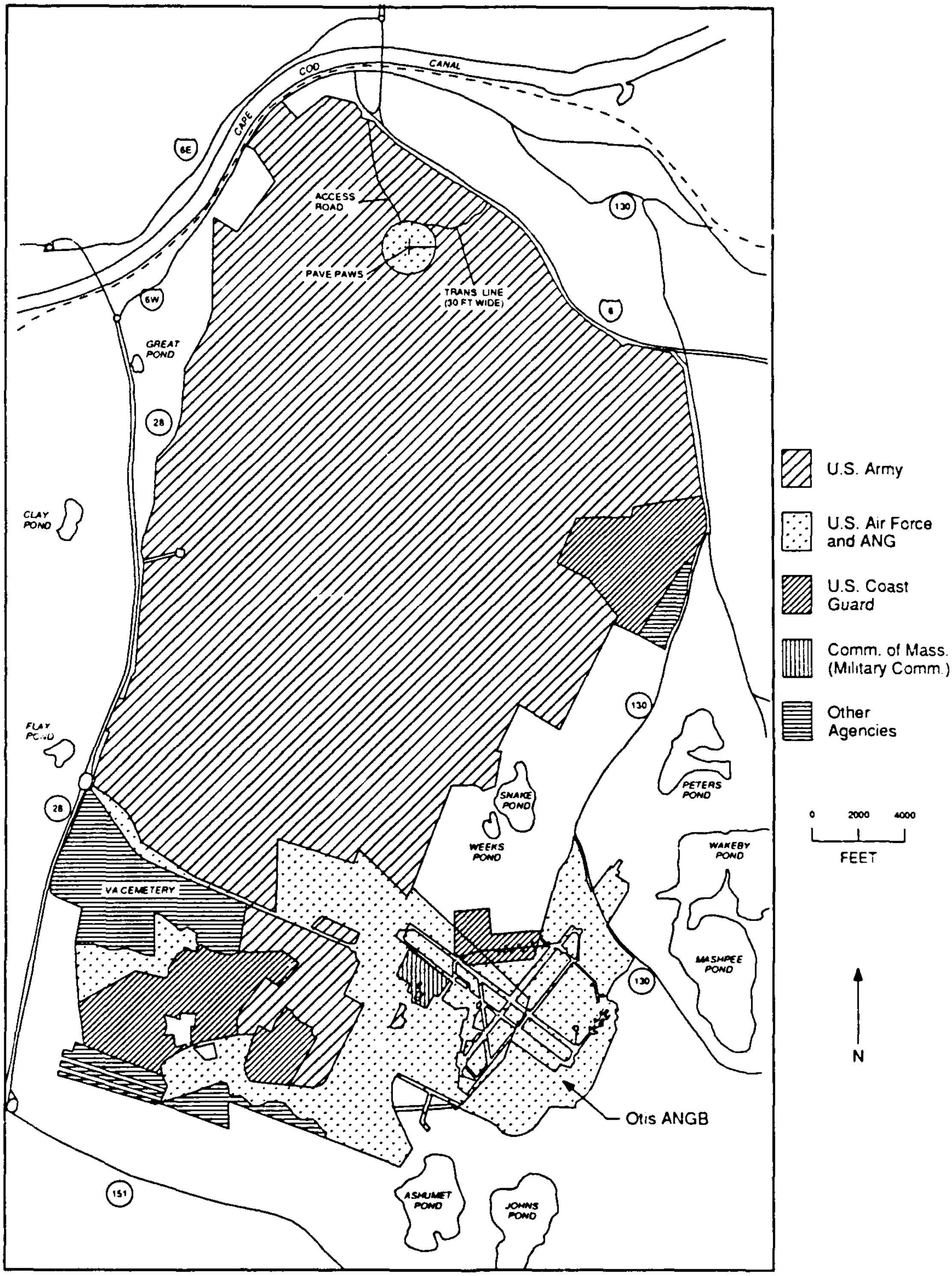

FIGURE 3.3 Tenant Organization Parcels on the MMR

temperature extremes of winter and summer. Reported minimum mean daily temperatures at the MMR range from a low of 23°F in February to a high of 63°F in July; mean maximum daily temperatures range from 30°F in January to 78°F in July (Salamon and Hall 1988).

Air quality data collected in 1985-1987 for AQCR 120 classify the region as "in attainment" for ambient air quality standards except ozone. (State and federal standards are identical.) The entire state of Massachusetts is classified as nonattainment for ozone, indicating a regional rather than a single-source problem. During 1987, the 1-hr ozone standard of 0.12 parts per million (ppm) was exceeded once at Easton, located about 35 mi northwest of the MMR, and once at Fairhaven, located about 15 mi west of the MMR across Buzzards Bay.

For 1987, no measures of any of the other ambient air quality standards in AQCR 120 were found to be in excess. For sulfur dioxide (SO_2), the only public measurement site in AQCR 120 was at Fall River, located about 30 mi west of the MMR. The maximum 3-hr concentration was 341 micrograms per cubic meter ($\mu g/m^3$), compared to a standard of 365 $\mu g/m^3$. The annual concentration was 26 $\mu g/m^3$, compared to a standard of 80 $\mu g/m^3$. There have been no measurements of VOCs. It is difficult to present the data for particulates since the PM-10 standard (for particles less than 10 μm in aerodynamic diameter) replaced the total suspended particulate standard (for particles less than about 30 μm in aerodynamic diameter) on July 1, 1987. There were no PM-10 monitors in AQCR 120 in 1987, nor any for NO_2, CO, or lead.

3.3 TOPOGRAPHY AND GEOLOGY

3.3.1 Topography

The inner Cape is located in the Atlantic Coastal Plain Physiographic Province. Land elevation ranges from sea level along the coast to more than 250 ft above mean sea level (MSL) south and southwest of the Sagamore Bridge. The topography varies from rugged, hilly terrain along the north and west sides of the inner Cape to low relief areas along the south and east. The low relief area, part of the Mashpee Pitted Outwash Plain, is characterized by many depressions and gullies (the formation of this outwash plain is discussed in Sec. 3.3.2). Some of the depressions form ponds where the water table intersects the land surface (K-V Associates and IEP 1987; LeBlanc 1984c).

Topographic conditions within the MMR also range from a rugged, hilly area along the northeast and west sides to a sloping surface on which most of the reservation is located. The MMR elevation ranges from 250 ft above MSL in the north to about 50 ft above MSL at the southern boundary.

3.3.2 Geology

A retreating continental ice sheet deposited from 100 to more than 1,000 ft of gravel, sand, silt, and clay on top of crystalline bedrock on Cape Cod about 15,000 years ago (LeBlanc 1984c). These sediments form a thick, permeable aquifer, capable of providing all the fresh water needs for the area, and of recharging most of the ponds and rivers on the Cape (CCPEDC 1978; LeBlanc et al. 1986a).

The geology of the inner Cape consists of glacial deposits (primarily outwash plains) from 100 to more than 1,000 ft thick; the deposits overlie crystalline bedrock, which generally slopes from the west to the east (Fig. 3.4). The area is not known to have any faults or folds.

The glacial deposits were formed in the Late Pleistocene Epoch (about 15,000 years ago), as the continental glacier started to recede rapidly northward by progressive melting (LeBlanc et al. 1986a). The retreat of the ice from the islands south of the Cape to a position north of Cape Cod may have taken only a few hundred years; within 1,000 years the glacier front had retreated to a point north of Boston (Oldale and Barlow 1986). Where the glacier remained in one place for a relatively long period of time, ridges of poorly sorted boulders, sand, gravel, silt, and clay were deposited. These ridges are called moraines. The inner Cape includes two large moraines: the Buzzards Bay Moraine in the western section and the Sandwich Moraine in the northern section.

Besides forming moraines in these areas, meltwater streams emanating from the glacier deposited coarse sand and gravel as an outwash plain in front of the moraines. The deposits in the outwash plain often occur in the form of a highly irregular and unorganized kame and kettle terrain. A kame is a hill of rock debris that originally filled a hole in the bottom of the ice. A kettle is a hole in the glacial debris originally filled by a large piece of ice. The upstream parts of outwash plains may also have kame and kettle terrain that results from the deposition of debris over and around a thin, uneven, stagnant wedge of ice. As the buried wedge of ice melts, collapse zones form in the outwash deposits. The collapse zones of the outwash plains on the west side of the Cape were incorporated into the moraine, while those on the lower Cape were removed by erosion. Kettle holes form the "pits" in the Mashpee Pitted Outwash Plain. The hydrology of these deposits is discussed in Sec. 3.6.

As part of the inner Cape, the geology of the MMR consists of glacial moraines and outwash plains formed during the last glacial advance (Fig. 3.4). The hilly topography is formed by the Buzzards Bay and Sandwich moraines. Southeast of the moraines is the Mashpee Pitted Outwash Plain, where 130 to 200 ft of medium-to-coarse brown sands overlie fine to very fine sands and silt (E.C. Jordan 1987). South of State Rt. 151, the sand and gravel outwash overlies fine to very fine sand, sandy silt, and dense sandy till. The till contains lenses of clay, silt, sand, or gravel (LeBlanc 1984c). The glacial deposits overlie crystalline bedrock, which probably slopes from west to east in this area.

3.4 LAND AND SOIL QUALITY

As a result of glacial action, the soils of the inner Cape are primarily sands and gravels mixed with silt and clay. The general soil associations on the inner Cape and the MMR are the Plymouth-Canton-Carver Soil Association in the north and west sectors and

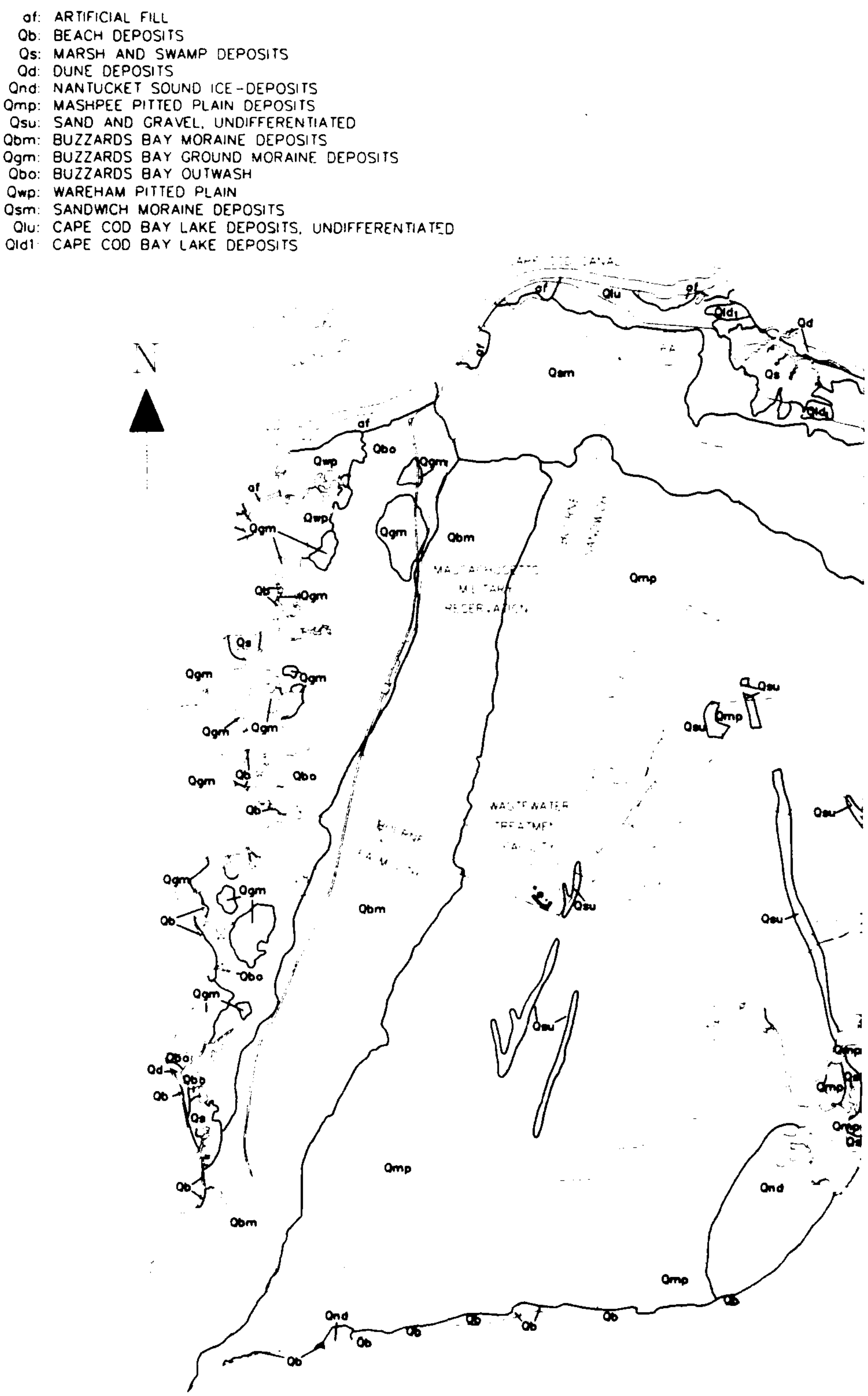

FIGURE 3.4 Geology of the MMR and Inner Cape

the Agawam and Enfield Soil Series in the south and east. The Plymouth-Canton-Carver Association is a very well-drained soil that developed in a fine sandy loam mantle over glacial till. These soils have a stony surface and are highly permeable. The Agawam and Enfield Series are also very permeable soils that formed in thick sand deposits (Agawam) or in silty material over stratified sand and gravel (Enfield) (Soil Conservation Service 1980).

High rates of surface infiltration limit the effects of surface water erosion on the natural soil structure. However, because of the numerous construction activities that have occurred in the region during the last 50 yr, especially in the cantonment area of the MMR and in the rapidly developing areas of the towns of Falmouth and Bourne, the natural soil structure has been greatly altered. Currently, the soils on the undeveloped portion of the MMR and surrounding areas are well-protected with managed or natural vegetative cover.

In general, the nutrient quality of the soils in this region is low (E.C. Jordan 1987). With proper management, however, the soils are considered good for cropland, pasture, or wildlife habitat (Soil Conservation Service 1980). The soils have slight to moderate limitations in use for building sites, roadways, lawns, or recreation; they have severe limitations for use as lagoons or sanitary landfills (Soil Conservation Service 1980). The soil is good for gravel, sand, or roadfill material.

3.5 SURFACE-WATER RESOURCES

3.5.1 Fresh Water

Most of the rivers, lakes, and ponds on Cape Cod (including the inner Cape and the MMR) are formed where the water table intersects the land surface (LeBlanc et al. 1986a). Because of this hydrologic relationship, lake inflow and outflow depend primarily on groundwater and secondarily on precipitation and evaporation (E.C. Jordan 1987). For example, Ashumet Pond, with no surface-water inflow or outflow, is recharged and discharged largely by groundwater, and to a lesser extent by precipitation and evaporation. However, there are some ponds, such as Grassy Pond (Fig. 3.5), that do not fit this description. The bottoms of these ponds are covered by sediments of low permeablility, and the groundwater and surface water are not connected (LeBlanc et al. 1986a).

As shown in Fig. 3.5, there are many small ponds on and near the MMR. The largest of these groundwater-fed bodies in the inner Cape are Coonamessett, Ashumet, Johns, Long, and Jenkins ponds. Long Pond is the primary source of drinking water for the Town of Falmouth. It is recharged mainly by groundwater and direct precipitation (CDM 1983). The water-surface elevation of the ponds, because of their connection, fluctuates with the elevation of the water table (LeBlanc et al. 1986a).

Because of the highly permeable soils and glacial material, rivers and streams are rare on the inner Cape. The Coonamessett River, which flows south from

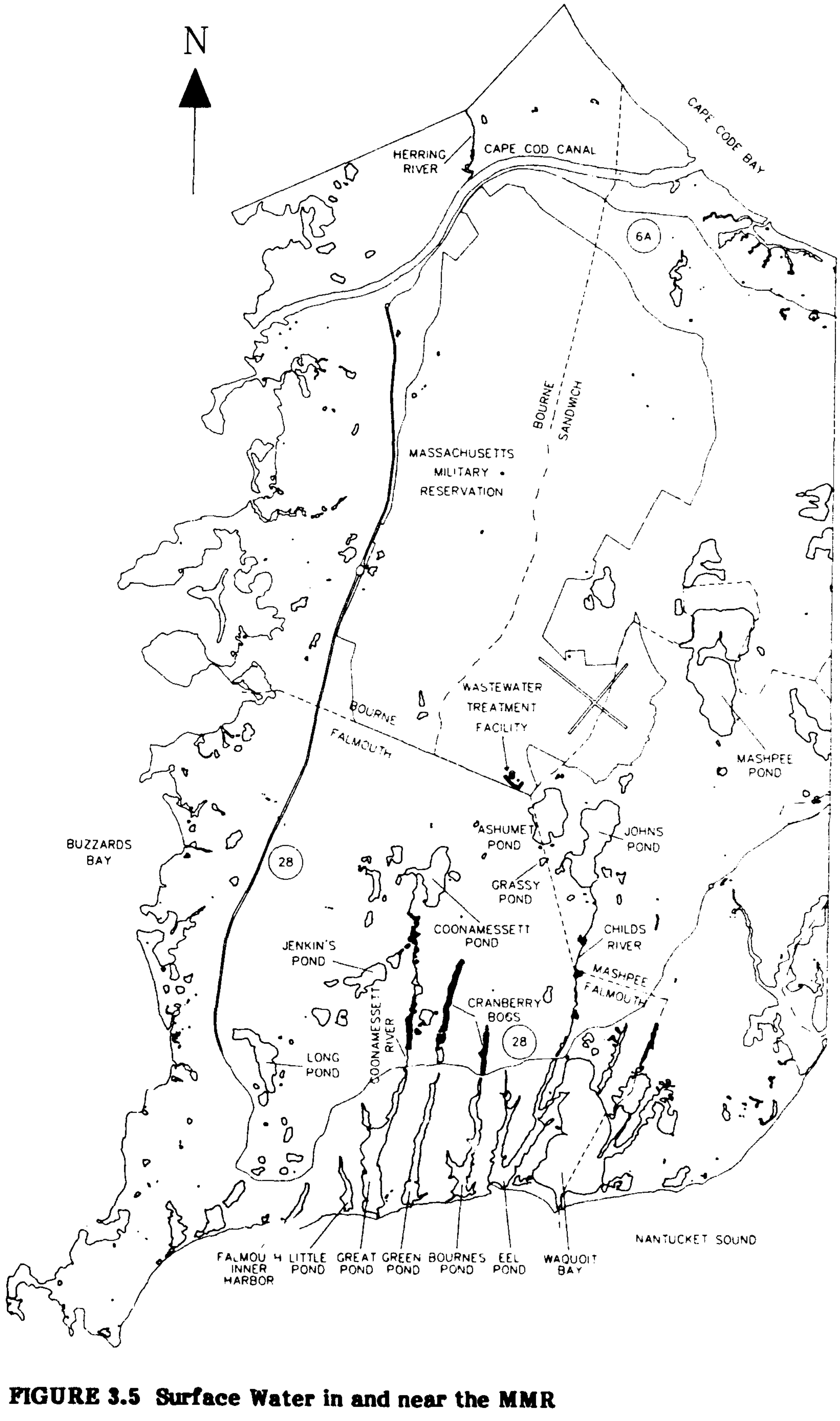

FIGURE 3.5 Surface Water in and near the MMR

Coonamessett Pond, and the Childs River, which flows from Johns Pond, are the major rivers near the MMR (Fig. 3.5).

3.5.2 Salt Water

Salt water resources located near the alternative sites include the Cape Cod Canal, Buzzards Bay, Cape Cod Bay, and the South Cape Shore. These salt water resources are discharge areas for the groundwater that flows off the inner Cape (LeBlanc 1984c). The South Cape Shore consists of salt ponds, salt marshes, and river complexes that include Great Pond, Green Pond, Bourne Pond, Eel Pond, and Waquoit Bay (Fig. 3.5).

The Cape Cod Canal is a salt water canal connecting Buzzards Bay at its western outlet with Cape Cod Bay at its eastern outlet, and separating the Cape from the mainland (Fig. 3.2). Construction at the canal began in 1909, and the canal was opened to traffic in 1914. It was completed in its present form by 1940 and is now operated and maintained by the U.S. Army Corps of Engineers. The canal is 17.4 mi long between Hog Island and Cleveland Ledge. The land cut is 8.6 mi long, 479 ft wide, and about 32 ft deep at mean low water. Three bridges (Sagamore, Bourne, and a railroad bridge) connect Cape Cod to the mainland. Tidal fluctuation and current direction and current strength in the canal are controlled by the tides in both Cape Cod Bay and Buzzards Bay. At the eastern end of the canal, high tide is concurrent with high tide in Cape Cod Bay. High tide at the western end of the canal is controlled by the Buzzards Bay high tide which occurs three hours earlier than high tide in Cape Cod Bay (Anderson-Nichols 1975; EPA 1981). Details of the tidal fluxes in the Cape Cod Canal appear in Appendix D. Water in the canal is flushed out in 1-1/2 tidal cycles (less than one day).

Within Cape Cod Bay, the southward flowing tidal wave causes the current to flow counterclockwise from northwest to southeast across the east end of the Cape Cod Canal at an average speed of 0.3 ft/sec, and then to move out to sea around Race Point. Calculations show that, on the average, about 7% of the water in Cape Cod Bay is exchanged daily (EPA 1981). There are three effects of this current on Cape Cod Bay: (1) most of the water entering the canal at its eastern end is Cape Cod Bay water from the area of Plymouth Cliffs; (2) most of the water flowing out of the canal into Cape Cod Bay is swept eastward away from the canal; and (3) any contaminated water reaching the bay from the Cape Cod Canal will, on the average, move from the bay into the ocean within about 14 days (EPA 1981).

Unlike Cape Cod Bay, the tidal-induced flow dynamics in Buzzards Bay are controlled by tidal ebb and flow conditions up the length of the bay. Currents are not well-mapped and are altered by the irregular shape of the bay (EPA 1981).

Timing differences between tides in Buzzards Bay and current reversals in the Cape Cod Canal affect flow into and out of Buzzards Bay. At the railroad bridge, the two are nearly synchronous, but at Wings Neck, located at the lower end of the bay, the tide changes precede the current changes by about 1-1/2 hr. The effects of these differences in timing, particularly at Wings Neck, result in water flowing out of the canal during the first half of its westward flow and moving southward into the open reaches of the bay (south of Wings Neck) along with ebbing waters from other bays and harbors in Buzzards Bay. During the last part of this westward flow, waters flowing out of the Cape Cod Canal will tend to be blocked by the rising tide at Wings Neck and dispersed into the upper bays and coves until the next ebb tide (EPA 1981).

3.6 GROUNDWATER RESOURCES

3.6.1 Supply and Physical Properties

The groundwater supply on Cape Cod comes from the Cape Cod aquifer, which consists of unconsolidated glacial deposits. The bedrock, at a depth of 200 to 600 ft, may contain some groundwater; however, because it does not supply water to wells on the Cape, it is not considered part of the Cape Cod aquifer system (LeBlanc et al. 1986a). The Cape Cod aquifer contains large quantities of high-quality groundwater at shallow depths, primarily in outwash deposits and from the two moraines (CCPEDC 1978; Frimpter and Gay 1979; LeBlanc et al. 1986a).

The extensive, thick outwash deposits are very permeable because they consist of well-sorted sand, with some interbedded gravel, silt, and clay (E.J. Flynn Engineers 1985; LeBlanc et al. 1986a). The moraines are believed to be less permeable because of their poorly sorted mixture of boulders, gravel, sand, silt, and clay. Yields as high as 2,000 gal/min have been reported for wells completed in the outwash deposits. Wells completed in the moraines typically have lower yields than those completed in the outwash deposits because of the lower hydraulic conductivity and greater depth to water (LeBlanc et al. 1986a).

Groundwater throughout most of Cape Cod is unconfined (water-table conditions), although confined conditions may occur along the coast (LeBlanc 1984a; LeBlanc et al. 1986a). For example, artesian (confined) wells once supplied more than 1,000 gal/min at two fish hatcheries in the Town of Sandwich (LeBlanc et al. 1986a). On the inner Cape, the lower boundary of the aquifer is bedrock, fine-grained sediments, or salt-water interface (LeBlanc et al. 1986a). Except for areas very near the coast, wells can be drilled to bedrock without encountering saline groundwater.

Groundwater flow in much of the Cape Cod aquifer is predominantly horizontal, with vertical flow occurring near the groundwater divides and at the coast (LeBlanc et al. 1986a).

Groundwater recharge occurs primarily by precipitation and is estimated to range from 16 to 21 in./yr, or about 45% of the average annual precipitation of 38 to 47 in./yr (CCPEDC 1978; LeBlanc 1984a and 1984c). Because of the permeable surface, the precipitation infiltrates rapidly into the ground; consequently, runoff is negligible (LeBlanc 1984c). Seasonal variations in aquifer recharge cause the water table to fluctuate 12 to 36 in., with the highest elevations occurring in spring and the lowest in the late fall (LeBlanc 1984a and 1984c).

Hydraulic conductivity of the sand and gravel is estimated to be in the range of 100 to 500 ft/day. A large-scale pump test and a natural-gradient transport test were performed by the USGS, and a hydraulic conductivity of 380 ft/day was calculated (E.C. Jordan 1987). Because of the nature of the sediments and the depositional environment, vertical hydraulic conductivity is less than horizontal hydraulic conductivity. In the sand and gravel, the ratio of horizontal to vertical hydraulic conductivity is 10:1 or less, but the ratio can be much greater if very fine sand, silt, and clay are interbedded with the sand and gravel (LeBlanc et al. 1986b).

The total net discharge of groundwater to wells is reported to be small because most of the water is returned to the aquifer by wastewater recharge and irrigation return flows (LeBlanc 1984d). Direct evapotranspiration of groundwater is probably small because the water table is more than 10 ft below land surface in most of the MMR area (LeBlanc 1984c).

Large quantities of high-quality groundwater are found at shallow depths under the MMR. A groundwater mound occurs in the north-central part of the reservation (LeBlanc et al. 1984a). The direction of groundwater flow on the MMR varies depending on location but tends to mimic the slope of the land surface. In general, groundwater flows north to either the Cape Cod Canal or Cape Cod Bay, east toward Bass River in the central part of the Cape, south and southeast to South Cape Shore, and west and southwest to Buzzards Bay (Fig. 3.6). The majority of the groundwater in the vicinity of the Otis WWTP flows south-southwest toward South Cape Shore, but some flows south-southeast toward the large ponds in the area (e.g., Ashumet, Coonamessett, and Johns) and the Coonamessett and Childs rivers.

The Cape Cod aquifer in the vicinity of the MMR has a maximum thickness of 270 ft and overlies crystalline bedrock (Fig. 3.7). The top 90 to 140 ft of the aquifer contains well-sorted, brown, medium to very coarse sand, with some gravel. Underlying the sand and gravel is finer-grained sand, silt, and clay. Groundwater is found at depths of less than 50 ft (LeBlanc 1984c).

Groundwater flow is horizontal at most locations on the MMR. Where groundwater elevations have been measured in well clusters, there is very little difference (less than 0.04 ft) between water levels at different depths (E.C. Jordan 1987). The only place where a significant vertical gradient has been observed is near Ashumet Pond. North of Fisherman's Cove, the groundwater flows upward into the pond. At the south end of Ashumet Pond, groundwater flows downward from the pond into the aquifer. The vertical gradients near the pond extend approximately 35 ft from the bottom of the pond. Below 35 ft, vertical gradients are not present (E.C. Jordan 1987).

South of the MMR, the water table slopes to the south and southwest at approximately 0.002 ft/ft (LeBlanc 1984c). The hydraulic conductivity of the aquifer ranges from 140 to 519 ft/day. The best documented value of hydraulic conductivity is 380 ft/day, a value established both by a pump test and a tracer test (E.C. Jordan 1987). The estimated groundwater flow velocity through the sand and gravel is 0.8 to 3 ft/day (assuming a porosity of 35%). The average groundwater velocity in the finer-grained sediments is lower because these sediments have a lower hydraulic conductivity than the sand and gravel (LeBlanc 1984c).

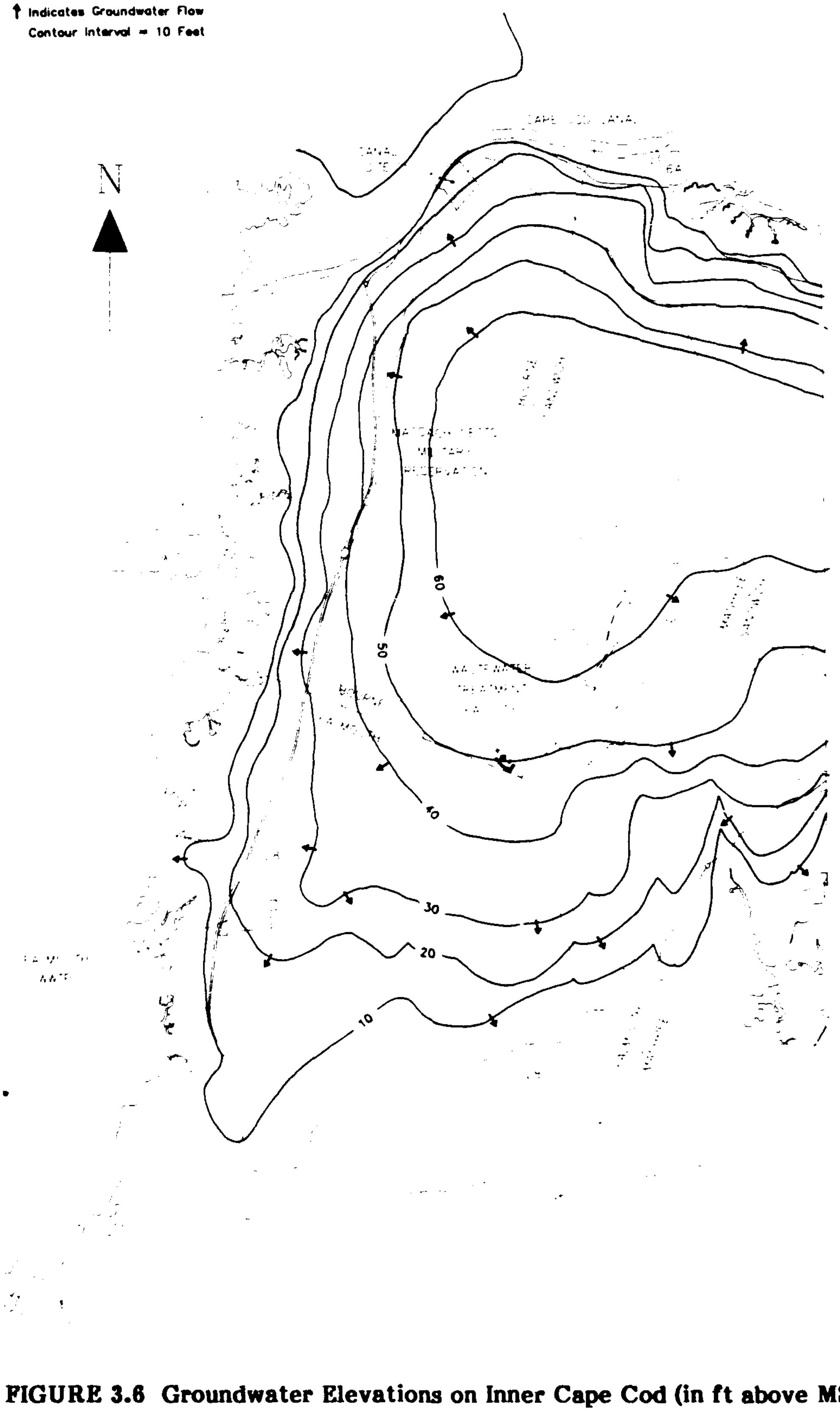

FIGURE 3.6 Groundwater Elevations on Inner Cape Cod (in ft above MSL)

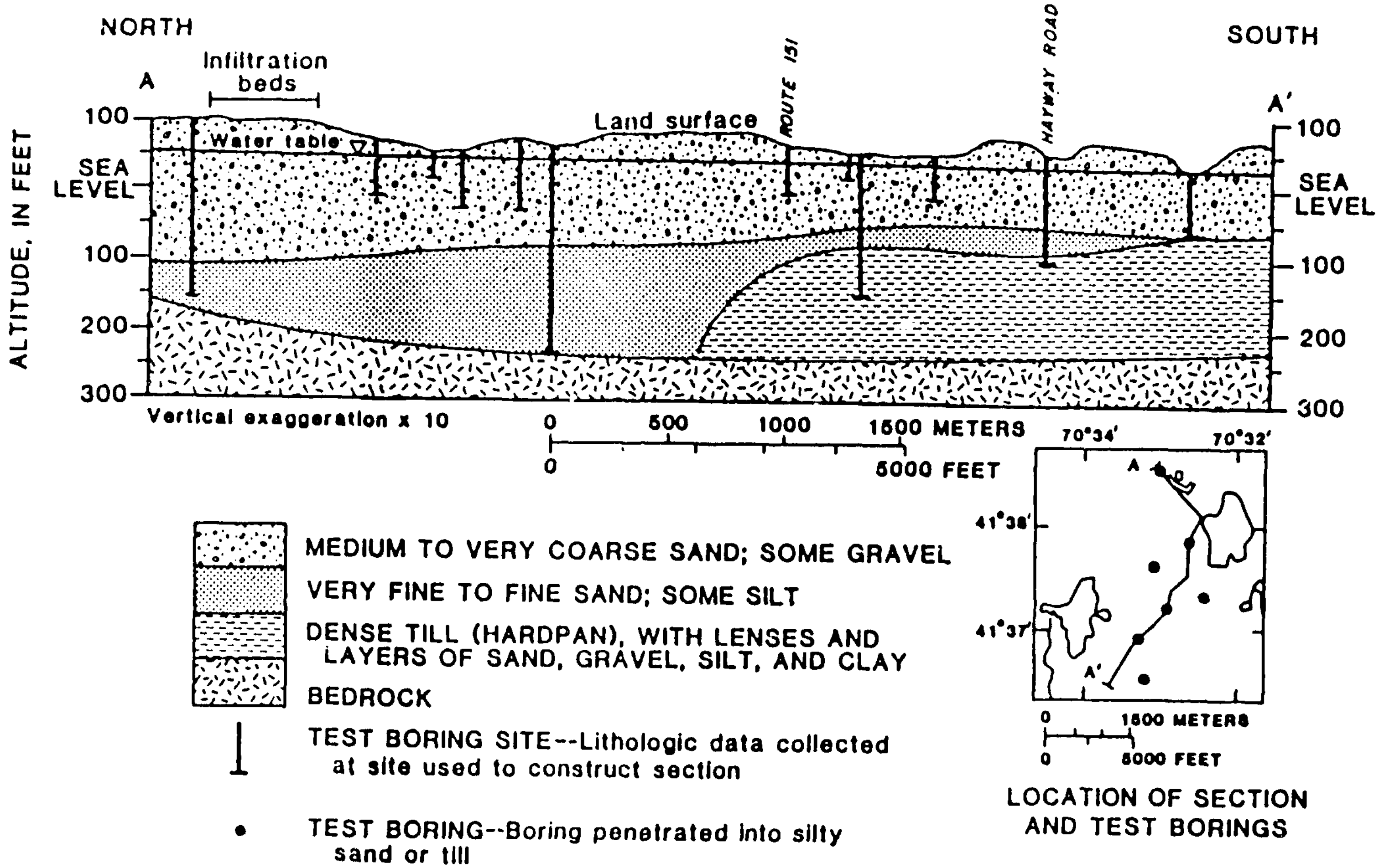

FIGURE 3.7 Cross Section South of the MMR (Source: LeBlanc 1984c)

3.6.2 Groundwater Quality

Most of the groundwater on Cape Cod is of good chemical quality for drinking and other uses (E.J. Flynn Engineers 1985). It is characteristically low in dissolved solids, soft, and virtually free of toxic heavy metals and organic compounds (e.g., insecticides and herbicides -- see Table 1.1). Constituents believed to be problems or threats to drinking water supplies include salt from sea water intrusion, coastal flooding, and highway deicing; nitrogen from domestic and municipal sewage; and iron and manganese, which occur naturally. All the heavy metal concentrations are below the current standards contained in the National Primary Drinking Water Regulations of the Safe Drinking Water Act and its amendments. Hydrogen sulfide gas and ammonia also occur naturally in inorganic sediments in a few areas (Frimpter and Gay 1979).

In similar areas dependent on groundwater supplies, certain dissolved solids, such as nitrates, tend to build up gradually over the long term (CCPEDC 1978). The major sources of nitrates in Cape Cod groundwater are municipal and domestic wastewater discharged by WWTPs, septic systems, and cesspools (CCPEDC 1978). Wastewater disposal is believed to threaten the groundwater on Cape Cod with pollution; most Cape Cod towns dispose of their waste into open pits or lagoons (CCPEDC 1978). Septic pit systems especially are prevalent in the Ashumet Pond area.

A sewage plume resulting from disposal of sewage waste and military-related activities has occurred south of the MMR (CDM 1987, LeBlanc et al. 1987, LeBlanc 1984c). The plume was first noted in the Town of Falmouth's municipal well, located 1.5 mi south of the reservation's WWTP (well data in Table 3.1).

The MMR has disposed of treated wastewater in infiltration beds since 1936. This disposal has resulted in the formation of a plume of altered groundwater extending down the Ashumet Valley (Fig. 3.8). The plume is 3,000 ft wide, 75 ft thick, and more than 11,000 ft long (E.C. Jordan 1987; LeBlanc 1984a). It contains elevated concentrations of chloride (up to 30 mg/L), sodium (up to 35 mg/L), boron (up to 410 μg/L), nitrogen (up to 22 mg/L total N), detergents (up to 2 mg/L of MBAS detergents), and other constituents of the treated sewage (LeBlanc 1984a). Table 1.1 summarizes the characteristics reported for the sewage plume. In addition, past practices generated VOCs such as tetrachloroethene, trichloroethene, and dichloroethene. Current disposal practices do not result in the presence of these compounds in effluent now being generated. There is some uncertainty as to the origin and extent of the organic chemicals in the plume (E.C. Jordan 1987).

The plume is almost entirely within the sand and gravel outwash (LeBlanc 1984b). Its bottom boundary generally coincides with the contact between the sand and gravel and the less permeable silty sand and till. A zone of unaltered groundwater, 20 to 50 ft thick, overlies the plume (LeBlanc 1984b) and is thought to be the result of recharge from precipitation. As a result of vertical recharge, there is a downward migration of water above the plume.

Groundwater contours indicate a divergence at the MMR wastewater treatment plant (E.C. Jordan 1987). This divergence causes the groundwater to flow in three directions: southeast toward Ashumet and Johns ponds, southwest toward Coonamessett

TABLE 3.1 Quality of Cape Cod Groundwater

Chemical Constituent or Physical Property	Altered Water, Well #124-1, Center of Plume[a]	Unaltered Groundwater, USGS Well #243[b]
Boron (mg/L)	290	48
Specific conductance	325	60
MBAS (mg/L)	0.275	0.00
Sodium (mg/L)	35	2.55
Chloride (mg/L)	26	5.00
Total volatile organic contaminants (μg/L)	430.79[c]	2.22

[a]Data collected 10/2/1984 at a screened elevation between -20 and -23 ft.

[b]Data collected 6/14/1984.

[c]Sample collected 6/26/1984.

Source: Adapted from E.J. Flynn Engineers, Inc., 1985.

Pond, and south toward the west edge of Ashumet Pond. At Ashumet Pond, shallow groundwater discharges into the pond, while the deeper water continues under the western edge of the pond, is diverted again toward the southwest, and flows down Ashumet Valley (E.C. Jordan 1987). Appendix E contains a review of empirical and modeling studies of the transport and fate of the plume.

From about 1958 to 1986, the Town of Falmouth disposed of sewage at the town landfill near the intersection of Thomas Landers Road and Blacksmith Shop Road (Fig. 3.2). A cooperative investigation by the USGS, the Massachusetts DEP, and the Town of Falmouth determined that the sewage plume extends southwest from the town's landfill (CDM 1987). In 1987, Falmouth began to dispose of its sewage at a new wastewater treatment facility near the intersection of Blacksmith Shop Road and State Rt. 28. Before construction of the Falmouth WWTP, the effect of recharging the aquifer with treated wastewater via spray-irrigation and rapid infiltration beds was also evaluated. Because Falmouth obtains its drinking water primarily from Long Pond (approximately 2 mi southwest of the landfill and 1.5 mi south of the municipal WWTP), a groundwater flow model of the area was developed to determine whether the WWTP would negatively affect Long Pond (CDM 1983). The model showed that the plume will migrate to Great Sippiwisset Marsh in Buzzards Bay and not to Long Pond (CDM 1987).

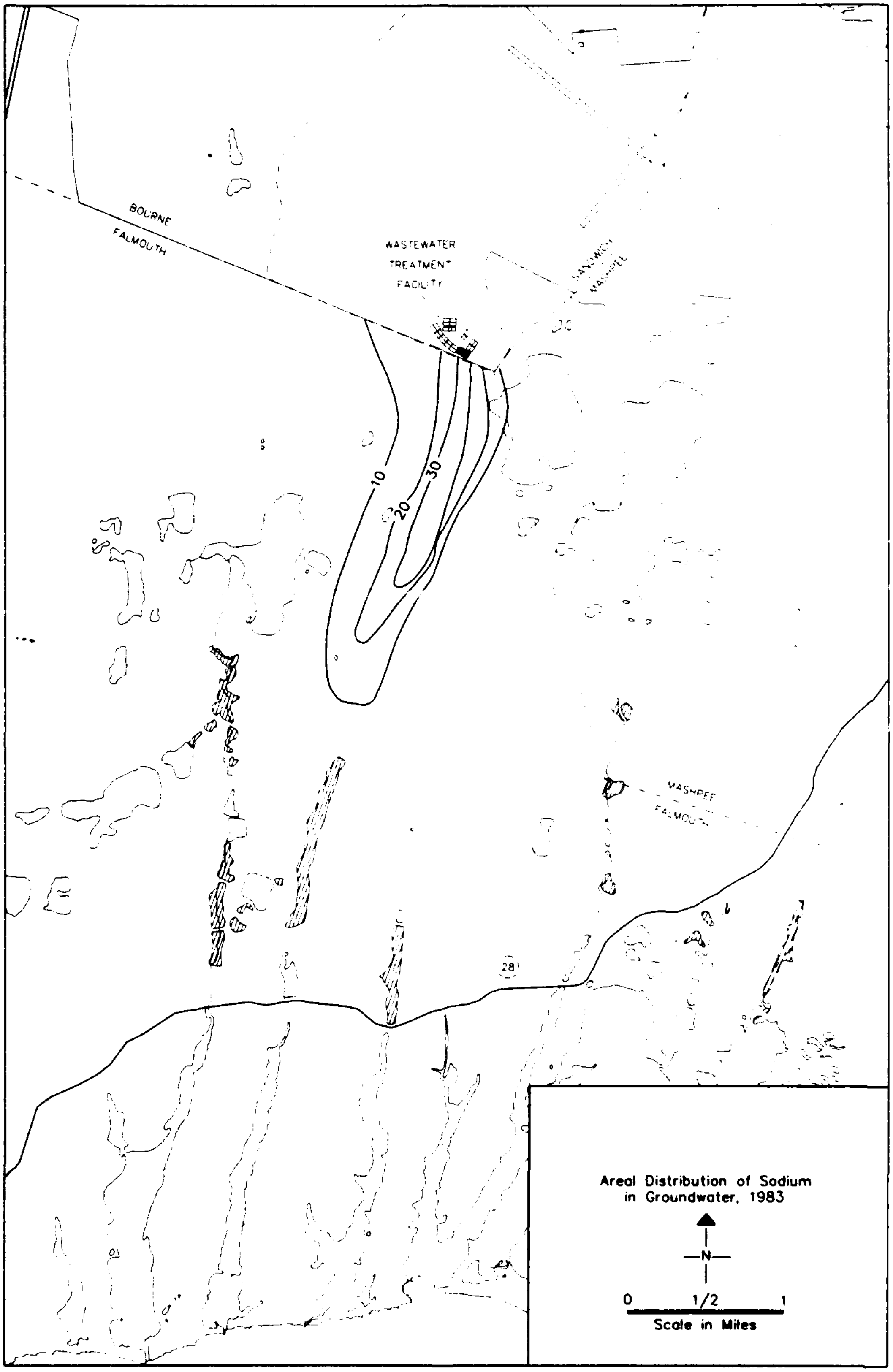

FIGURE 3.8 Map of Sewage Plume South of the MMR (Source: LeBlanc 1984a)

3.7 ECOLOGY

3.7.1 Terrestrial

The nutrient-poor, well-drained soils on Cape Cod support an oak pine forest (Kuchler 1964; Svenson and Pyle 1979). Pitch pine (*Pinus rigida*) and scrub oak (*Quercas ilicifolia*) dominate the overstory vegetation, with white oak (*Quercas alba*), scarlet oak (*Quercas coccinia*), black oak (*Quercas velutina*), red oak (*Quercas rubra*), and pin oak (*Quercas palustrus*) found on more favorable sites and where fires have been suppressed for many years. Typical understory vegetation consists of heaths (e.g. blueberry), bracken fern, sweet fern, and greenbriar (a vine).

Portions of the forest with an abundant pine component are frequently called "pine barrens" (Jorgensen 1978; Massachusetts Department of Environmental Management 1986). The pine barrens were historically maintained by wildfires recurring on a cycle of 15 to 40 yr (Schweitzer and Rawinski 1987; Massachusetts Department of Environmental Management 1986). Areas of dense pine usually have less shrub cover but a more diverse and abundant herb layer than in a more mature oak-pine forest (E.C. Jordan 1987). Extensive coverage in New England by pine barrens has become much more rare in recent decades because of land development and fire suppression, except for three areas (the New Jersey, Long Island, and Shawanguck Mountains pine barrens. The largest tracts of pine barrens are in Plymouth, Mass., and the MMR and surrounding areas (Massachusetts Department of Environmental Management 1986).

The MMR, heavily forested with oaks and pine, contains about 17,000 acres of undeveloped land. Most of this land is located in the MMR section occupied by Camp Edwards and represents a significant portion of contiguous habitat for numerous species of plants and animals. The Shawne-Crowell State Forest borders the northern edge of the reservation, and the Crane Wildlife Management Area borders the southern part of the Otis ANG base. Thus, the reservation serves as an important habitat link connecting the two state-owned natural areas. With increased development on the Cape reducing the amount of undisturbed, native vegetation (Svenson and Pyle 1979), the reservation represents an increasingly rare and important block of relatively undisturbed habitat.

A prescribed burn-management plan has been developed for Camp Edwards to reduce the wildfire hazard and to maintain the historic pine barrens habitat (Patterson 1987). This plan has been conditionally approved by the MEPA.

Certain areas of the Otis ANG Base are nonforested. Although some of these areas may be of natural occurrence, most of the nonforested areas are the result of human activities. The nonforested Otis areas that are vegetated are covered with various grasses, mosses, herbs, lichens, and occasional shrubs, with patches of bare sand/gravel interspersed. A small portion of the nonforested area is used for buildings, roads, runways, and other ANG facilities. In the quarter section of the base (160 acres) containing the WWTP and sand filter beds, about 72% of the area is forested and 28% is nonforested.

Land near the Falmouth WWTP is also heavily forested. Most areas are covered with mature oak/pine forest, but areas that were cleared of vegetation and topsoil for golf course fairways (abandoned more than 20 yrs ago) are now covered with impoverished pitch pine stands (E.C. Jordan 1987). About a third of the area has no vegetation cover (e.g., sections containing buildings and roads) or has low grass/herb/moss/lichen cover (e.g., areas cleared for irrigation pipes).

On the inner Cape, the Crane Wildlife Management Area lies south and southeast of the Otis ANG Base; this area is managed for upland gamebird production by the Massachusetts Division of Fisheries and Wildlife. Hunted species include the native mourning doves and bobwhite quail, along with farm-raised game pheasants. The Massachusetts Division of Fisheries and Wildflife maintains and fertilizes openings for game bird foraging southeast of the Sandwich Road/State Rt. 151 junction (Turner 1987). The Shawne-Crowell State Forest provides excellent animal habitat north of the MMR.

The extensive areas of natural vegetation on the MMR provide habitat for numerous bird and mammal populations, including ruffed grouse, bobwhite quail, wild turkeys, osprey, red-tailed hawk, raccoon, rabbit, squirrel, fox, shorttail weasel, woodchuck, and whitetail deer. The presence of these populations is indicative of a landscape that is relatively undisturbed by human activities. Because most of the natural vegetation is located on Camp Edwards, the highest wildlife densities probably occur in that area of the reservation. The Otis ANG Base consists primarily of buildings, runways, and managed vegetation.

The Massachusetts Division of Fisheries and Wildlife operates several deer hunting seasons on a portion of Camp Edwards each November and December. There are separate seasons for shotgun, archery, and muzzle loader hunters, and about 50 deer are harvested each year (Cordoza 1987).

Birdwatching is a popular recreational activity on the inner Cape. The Massachusetts Audubon Society maintains the Ashumet Holly Reservation and Wildlife Sanctuary south of Ashumet Pond. The sanctuary staff and members are involved in bird surveys and environmental education. Special trips occur during the year to view rare bird species occurring at Otis ANG Base (see Sec. 3.4.10). Several species of birds, including the northern harrier and the upland sandpiper, are threatened or endangered. A bird management program has been developed for the Otis ANG Base to protect these rare species (White and Melvin 1985).

3.7.2 Aquatic Resources

3.7.2.1 Fresh Water Resources

The occurrence of surficial water bodies on the MMR is very limited. There is no flowing surface water. Precipitation either evaporates, percolates into the porous soil, or drains into a nearby pond. There are about a dozen ponds on the reservation (Fig. 3.5). All of these ponds are relatively small.

Larger ponds are important recreational areas, and many are periodically stocked with trout or other game fish (CCPEDC 1978; Krause 1987). In addition, the fluctuating water levels at the shorelines of these ponds have produced a pond/shore floral community often containing one or more rare plant species (Massachusetts Department of Environmental Management 1986). Two such species, Umbella-grass (*Fuirena pumila*) and hyssop hedge-nettle (*Stachys hyssopifolia*), occur near small, unnamed ponds on the north side of Connery Avenue at the reservation's west entrance (Massachusetts Army National Guard 1985a).

None of the ponds on the MMR are near the existing WWTP or the alternative WWTP facilities and effluent pipelines under consideration. However, two ponds near the MMR occur in the area potentially affected by the alternatives: Ashumet Pond, directly southeast of the existing Otis WWTP; and Long Pond, south of the MMR and of the existing Falmouth WWTP (Fig. 3.5). The status of each of these ponds and their relationship with the proposed activity are discussed below.

The relatively large (more than 120 acres) Long Pond serves as a public water source for the Town of Falmouth. Consequently, it is not stocked with fish or used for recreational activities (Witt 1987). The water quality of Long Pond is good, but that quality is considered threatened by a variety of upgradient sources, including the groundwater plume from the Falmouth landfill and the new Falmouth WWTP (CCPEDC 1978; Witt 1987).

The 203-acre Ashumet Pond is a popular recreation area. The pond is stocked annually with trout (mainly rainbow, occasionally brown or brook trout); it also has catchable populations of smallmouth and largemouth bass, yellow perch, and bullhead catfish (Krause 1987). Concerns about water quality, algal blooms, and fish kills have been expressed from the 1970s to the present (CCPEDC 1978; K-V Associates and IEP 1987). The pond has no inlets or outlets and depends entirely on groundwater movement to provide flushing action (E. C. Jordan 1987; K-V Associates and IEP 1987). The pond is currently being affected by four primary nutrient inputs: (1) the plume from the Otis WWTP, (2) septic systems adjacent to the pond, (3) an abandoned cranberry bog, and (4) runoff from lawn fertilizer (K-V Associates and IEP 1987; E.C. Jordan 1987). These inputs increase natural eutrophication processes because enhanced nitrogen and phosphorous levels promote primary productivity.

3.7.2.2 Marine Resources

The marine ecosystems of Massachusetts support abundant marine resources; fish, shellfish, and lobsters have great commercial and sport value (Massachusetts Executive Office of Environmental Affairs 1985). Important fish species include winter flounder, pollock, bluefish, cod, mackerel, bluefin tuna, yellow fin flounder, haddock, swordfish, and striped bass. Important shellfish include sea scallops, bay scallops, quahogs, and soft-shell clams.

Declines in the harvest of marine resources in the past decade have been attributed to numerous problems: pollution, habitat loss and degradation, overfishing, international market and boundary problems, escalating insurance costs, and administrative problems (Massachusetts Executive Office of Environmental Affairs 1985; National Marine Fisheries Service 1985). Pollution problems appear most prevalent in the Boston and New Bedford harbors, while the Cape area is relatively pollution-free except for some areas of Buzzards Bay (Massachusetts Executive Office of Environmental Affairs 1977 and 1985). A summary of the marine resources of three specific areas of Cape Cod is presented because there is a possibility that these marine areas could be affected by existing or alternative wastewater treatment actions. The three areas are the Cape Cod Canal, Buzzards Bay, and the South Cape Shore from Great Pond to Waquoit Bay.

The Cape Cod Canal is a very popular bank fishing area, with about 15 mi of its shoreline open to fishermen (Corps of Engineers 1975). Striped bass, bluefish, Atlantic cod, tautog, sea perch, Atlantic mackerel, pollock, and winter flounder account for more than 90% of the fish caught (Fairbanks et al. 1971). A run of alewives through the canal and up the Herring River occurs each year between April and June (Fairbanks et al. 1971). The canal also supports a sizable population of lobster and lobster larvae and may play an important role in dispersing the abundant lobsters of the warm waters of Buzzards Bay to the cooler waters of Cape Cod Bay (Collings et al. 1981). The canal supports a diverse assemblage of fish (at least 44 adult species and 24 species of eggs or larvae), invertebrates (100 species), and algae (26 species), in part because it is a transition area between biogeographic regions (Corps of Engineers 1973). Cold water species from the Boreal Region to the north, and warmer water species from the Mid-Atlantic Temperate Region to the south intermingle in the Cape Cod area (Curley et al. 1971; Corps of Engineers 1973). There has been concern about coliform contamination, especially as it relates to shellfish contamination (Ciccone 1987; Fiske 1987).

Buzzards Bay has diverse and abundant marine resources that support a very large commercial and sport fishery fleet (Massachusetts Executive Office of Environmental Affairs 1977). Estuaries, bays, coves, rivers, and marshes in this area provide spawning grounds for both fish and shellfish. Alewife fish runs occur on the Wild Harbor River and Herring Brook; the latter also supports a run of brook trout (Massachusetts Executive Office of Environmental Affairs, undated). In addition to the fish species listed above for Cape Cod, there are substantial harvests of lobsters, quahogs, and soft-shell clams from Buzzards Bay. Water quality problems, stemming from domestic and industrial wastewater, runoff from agricultural lands, and wastes dumped from vessels, have resulted in fishing and shell fishing closures in numerous areas (Massachusetts Executive Office of Environmental Affairs 1977 and 1985; Estrella 1984). On the northwest side of Cape Cod there are closures in portions of Phinney's, Red Brook, and Squeteague Harbors. The area of the closures is expanding: Buttermilk Bay was closed to shell fishing in 1984 because of high coliform count (Heuffelder 1987).

The South Cape Shore includes Great, Green, Bourne, and Eel ponds and Waquoit Bay, all of which are salt ponds, salt marshes, and river complexes that are highly valued for their fish and shellfish resources (Massachusetts Executive Office of Environmental Affairs 1977). Substantial development has occurred along the shoreline of each of these bodies of water except Waquoit Bay, which remains relatively pristine. A high diversity and abundance of fish occurs in the area, in part because cold water species from the north intermingle in this transitional area with warmer water species from the south

(Curley et al. 1971). Among the 46 species of fish identified on the South Cape Shore, important commercial and sport fishery species include striped bass, bluefish, winter flounder, quahog, white perch, Atlantic tomcod, and salt water trout. Several of the ponds, as well as the Coonamessett and Childs rivers, have runs of alewives, blueback herrings, and brook trout (Massachusetts Executive Office of Environmental Affairs undated; Bliven 1987; Curley et al. 1971). The warm waters of the ponds and bay also serve as nursery areas for juveniles of important commercial and sports fishery species. The ponds and bay support productive beds of shellfish, including quahogs, bay scallops, and soft-shell clams (Curley et al. 1971; Massachusetts Executive Office of Environmental Affairs 1977). The main threat to these marine resources is shoaling near the mouths of the ponds and bays, which restricts water circulation. Shell fishing closures resulting from pollution or bacteriological contamination have not been a problem in this area, although poor water quality has restricted shell fishing in Falmouth Inner Harbor (Massachusetts Executive Office of Environmental Affairs 1977).

3.8 ENDANGERED AND THREATENED SPECIES

A federally designated endangered plant species, the sandplain gerardia (*Agalinis acuta*) exists on the inner portion of the Cape. This annual plant requires disturbed sites for reproduction and is found most readily during September. The location of known populations is not available to the public.

Six species of plants and animals that occur near the Otis WWTP or some portion of the alternative effluent pipeline routes under consideration are of concern to the State of Massachusetts (Michaud 1987; White and Melvin 1985). These include one plant species, the reticulate nut-rush (*Scleria reticularis*), which is on the state's species watch list (Michaud 1987). The species occurs on damp, sandy soils and pine barrens in various locations along the Atlantic coast from Massachusetts to Florida (Gleason and Cronquist 1963). A population occurs along the alternative effluent pipeline route to the Falmouth WWTP, between State Rt. 151 and Landers Road.

Two species of noctuid moths listed by the state as threatened occur in the project area: Gerhard's underwing moth (*Catocala herodias gerhardi*) and decodon stem borer moth (*Papaipema sulphurata*). Noctuids are a large family of mostly nocturnal moths. Gerhard's underwing moth larvae feed on leaves and are often found wherever good pine barren habitat exists. A population has been observed along the proposed effluent pipeline route to the Cape Cod Canal. The decodon stem borer moth is more specialized in feeding habits and in habitat requirements. Larvae feed within the roots of a limited number of plant species (Brues 1972). The species is associated with wetlands and has been observed near a pond that occurs near State Rt. 151 along the alternative effluent pipeline route to the Falmouth WWTP.

Three state-listed bird species are on the Otis ANG Base: northern harrier (*Circus cyaneus*), threatened; upland sandpiper (*Bartramia longicauda*), endangered; and grasshopper sparrow (*Ammodramus savannarum*), a species of special concern. All three species are ground nesters and have been observed nesting at the MMR. All but the northern harrier winter south of Cape Cod.

The northern harrier uses marsh and grassland habitats. It feeds on small mammals, especially rodents. Nests are usually built on the ground in patches of low shrubs. One pair of northern harriers is known to use the Otis ANG area, as shown in Fig. 3.9 (White and Melvin 1985). Nesting northern harriers can be found in several other Massachusetts locations.

Grasshopper sparrows use dry, sandy grasslands, pastures, and hayfields to nest and to feed on insects and seeds. Unmowed fields, where scattered weeds and shrubs serve as song perches, are preferred. About 22 territorial grasshopper sparrows believed to represent breeding pairs, were located at the Otis ANG Base as shown in Fig. 3.10 (White and Melvin 1985). The species nests in numerous locations in Massachusetts.

Upland sandpipers use open grasslands, prairies, and hayfields. These birds often perch on fence posts and poles, nest in grass-lined depressions on the ground among dense vegetation, and feed on insects and seeds. Upland sandpipers nest in only seven locations in Massachusetts. The Otis ANG Base, with 14 known breeding pairs, has the largest breeding population in the state (White and Melvin 1985). Nesting sites and fields used by upland sandpipers at the base are shown in Fig. 3.11. A bird management program is currently in place at the Otis ANG Base to protect the three state-listed bird populations (White and Melvin 1985).

3.9 HAZARDOUS WASTE AND HAZARDOUS MATERIALS

Several hazardous wastes are routinely transferred from the Otis ANG Base to the Defense Logistics Agency (DLA). Small volumes of such items as nickel-cadmium batteries, lead-acid batteries, acids, paints, paint-strippers, hydraulic fluids, and photographic chemicals are routinely discarded. The largest volume consists of waste fuels, fuel oils, lubricating oils, and cleaning solvents. About 24,900 gal (182,000 lb) of such wastes were generated in 1988. Of this amount, 82.2 wt % constitute contaminated petroleum oils, JP-4 jet fuel, and fuel-oil-solid-water separation materials. These wastes are classified as being hazardous in the Commonwealth of Massachusetts. All hazardous wastes are treated, stored, and handled in accordance with the Resource Conservation and Recovery Act (RCRA) requirements.

Hazardous wastes are handled at the MMR in accordance with Commonwealth of Massachusetts regulations 310 CMR 30; EPA regulations in 40 CFR; and ANG regulations 19-1, 19-11, and Air Force Regulation (AFR) 19-14. Each organization that operates on the MMR handles hazardous wastes in accordance with regulations of the RCRA. The wastes are collected at a designated central collection points on the MMR. Storage of any waste at these areas awaiting pickup by the DLA is limited to 90 days. Hazardous wastes are not allowed to enter the waste streams sent to the Otis WWTP.

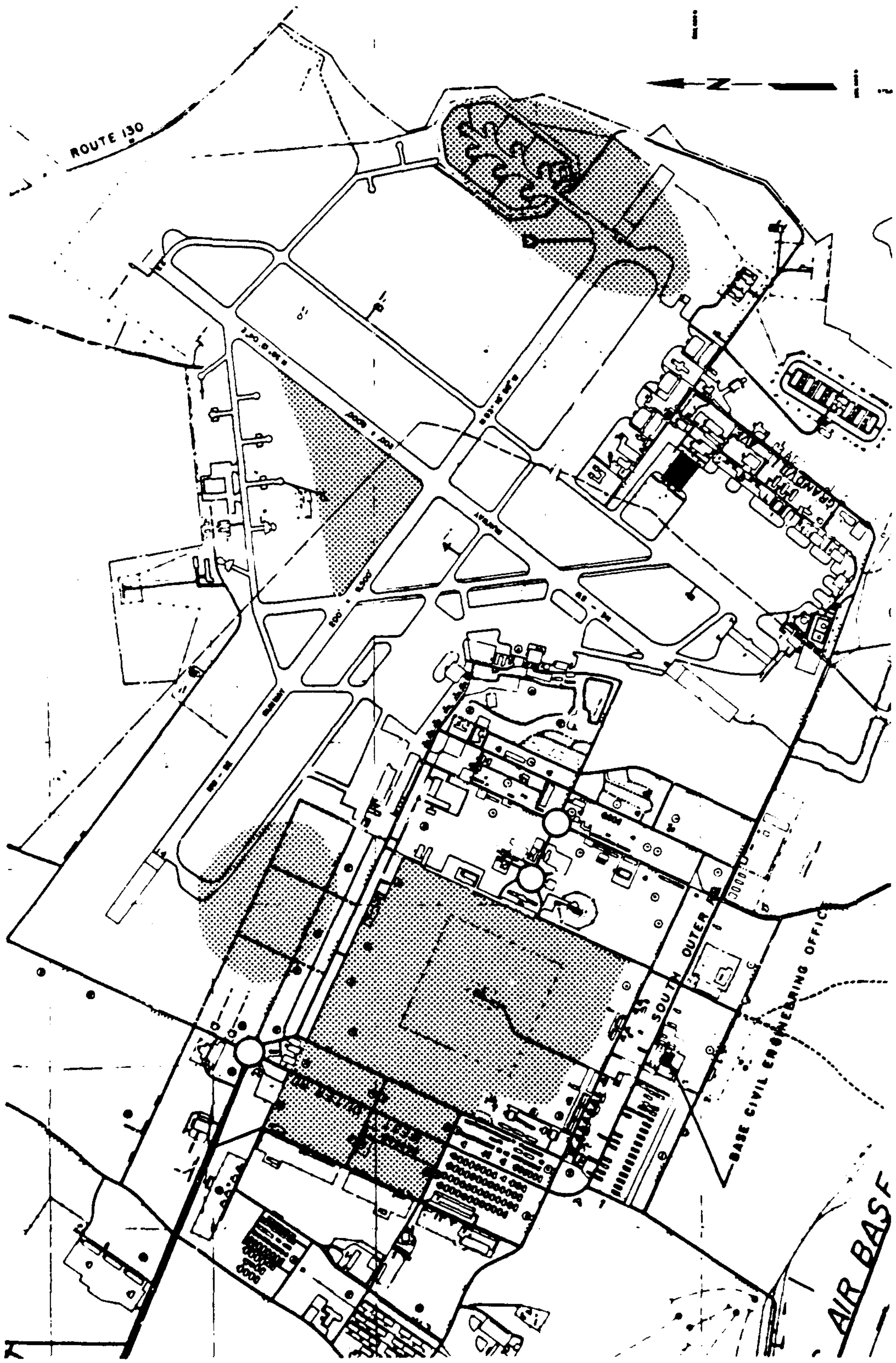

FIGURE 3.9 Northern Harriers at Otis ANG Base (nesting in shaded areas)

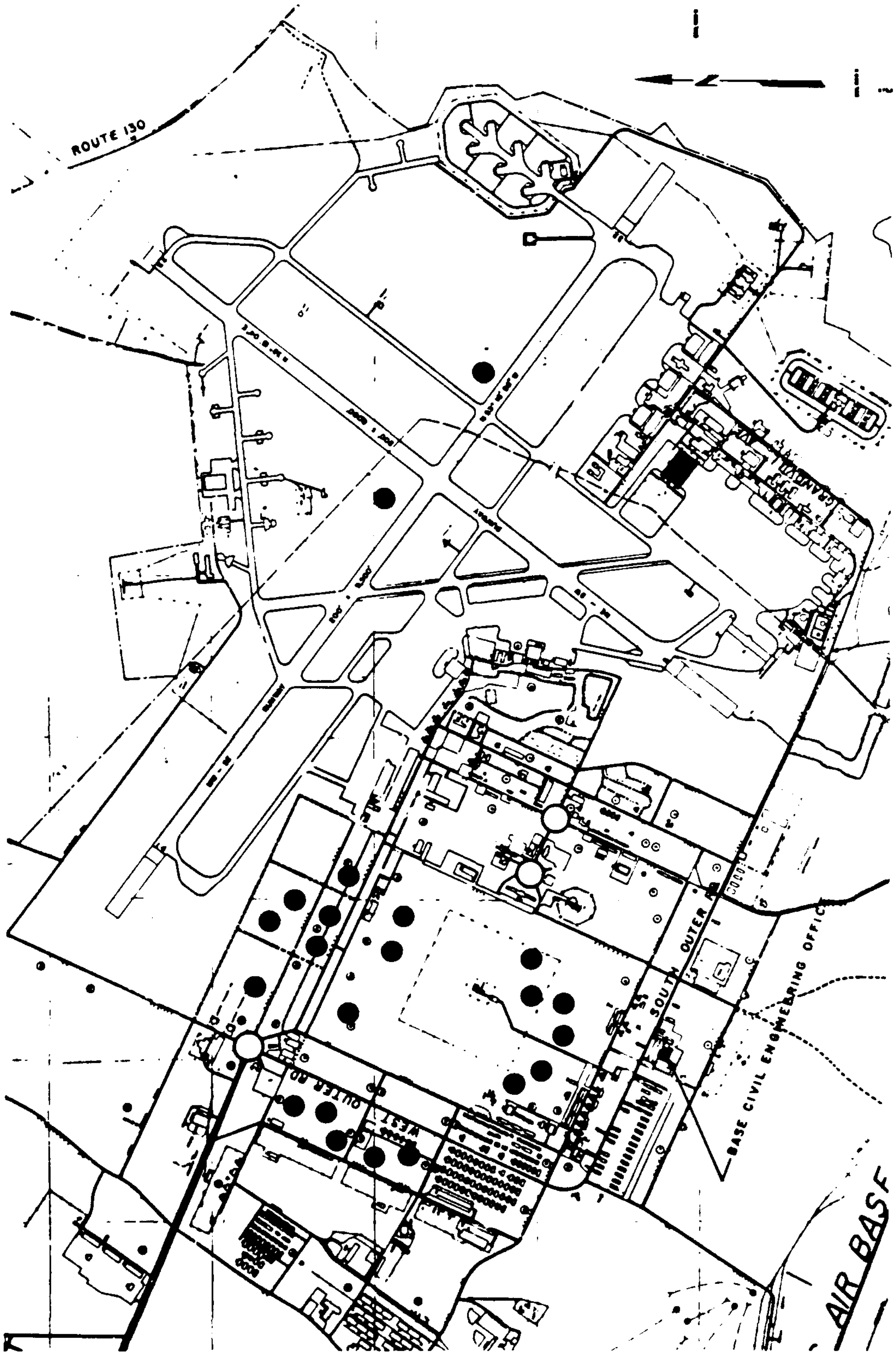

FIGURE 3.10 Grasshopper Sparrows at Otis ANG Base (nesting in circular black areas)

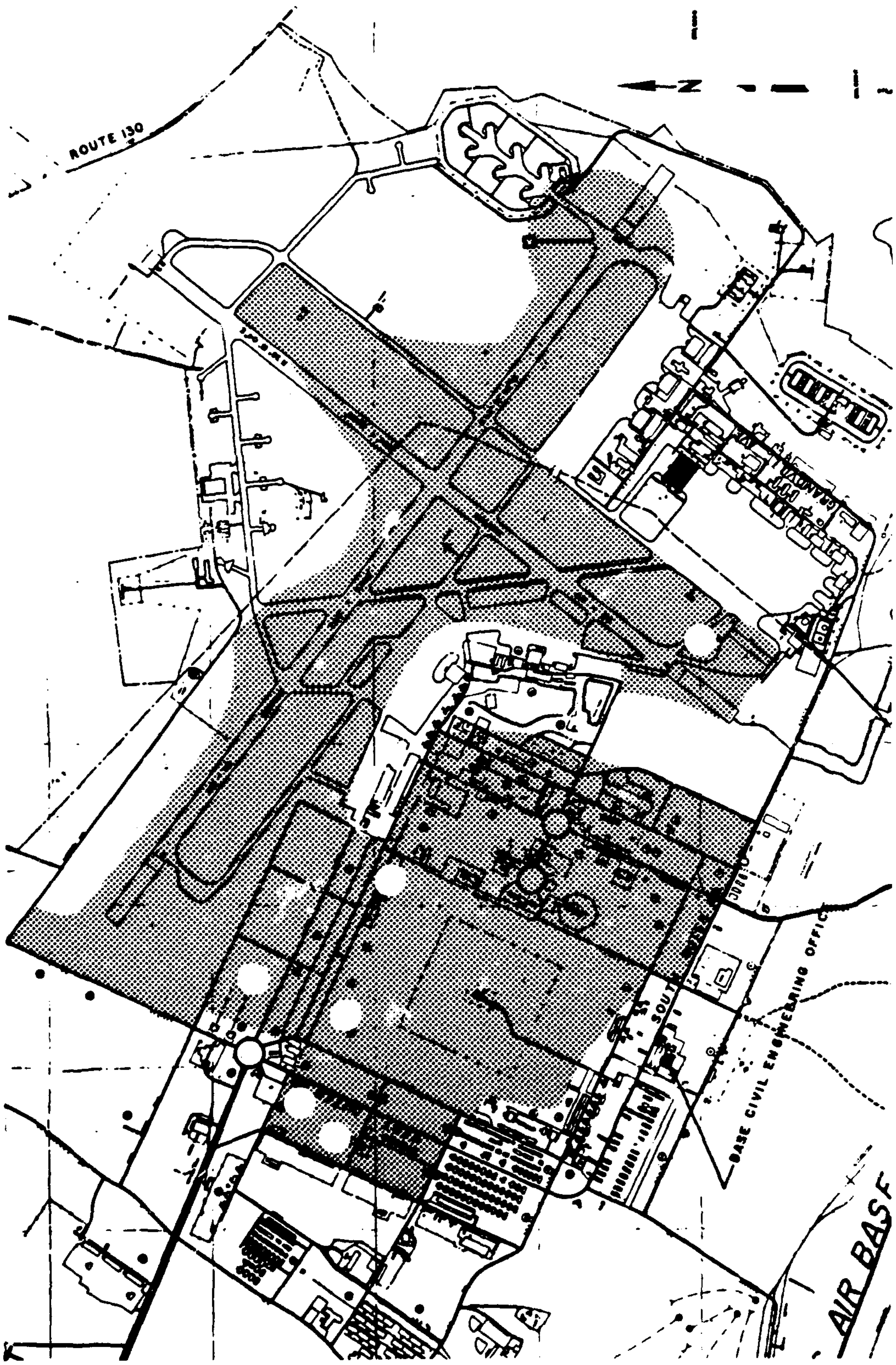

FIGURE 3.11 Upland Sandpipers at Otis ANG Base (nesting in shaded areas)

3.10 SOCIOECONOMIC RESOURCES

3.10.1 Demographic Factors

The towns of Sandwich, Falmouth, Bourne, and Mashpee comprise the inner Cape area of Barnstable County. According to the data in Table 3.2, Barnstable County had a total resident population of 170,600 in 1986, a 15.3% increase over its observed 1980 population. The towns of Sandwich, Mashpee, Falmouth, and Bourne grew in the same period, with Mashpee experiencing the most rapid population increase of all, at 60.5%. In spite of these increases in population, the population density per square mile for Sandwich, Mashpee, Falmouth, and Bourne were at the fairly low levels of 285, 258, 569, and 377, respectively, in 1986. The area of East Falmouth, defined as a census-designated place (CDP) by the U.S. Census Bureau, had a population density of 959 in 1980 (U.S. Bureau of the Census 1983).

While the permanent resident population of Barnstable County has been increasing rapidly during the last 20 years, the population of the inner Cape also increases during the summer months because of summer homes and seasonal accommodations. According to data provided by the CCPEDC (1982), both the permanent and seasonal resident population of Cape Cod increased substantially from 1970 to 1980, and these trends have continued in the 1980s. In addition, the number of tourists during the peak summer months can increase the daily population on the Cape by as much as 15%.

3.10.2 Land Use and Ownership

The MMR occupies 20,915 acres of land (see Table 3.3) in Cape Cod, representing about 10% of the Cape's surface area. The reservation is owned by the Commonwealth of Massachusetts. Camp Edwards occupies 14,705 acres of the reservation, and this land is leased by Massachusetts to the Department of the Army, which then licenses Camp Edwards back to the Massachusetts Army National Guard. The State also leases the Otis ANG Base, which occupies about 2,210 acres of land, to the Department of the Air Force, which then licenses the base back to the Massachusetts ANG. In addition, the ANG occupies 1,264 acres of land owned by the federal government and licensed back to the Massachusetts ANG. Finally, 1,407 acres of land are leased directly from Massachusetts to the U.S. Coast Guard. The Massachusetts Army National Guard operates Camp Edwards as a training facility for guard and other military units. Several other military and civilian organizations are also located on the reservation. The Otis ANG Base operates the airfield and the public utility system, including waste disposal.

Table 3.4 shows the land uses in four upper Cape towns and in Barnstable County as a whole. Although forestland and wetlands still dominate the area for each of the four towns (61-80%), the percentage of land being used for urban purposes (14-26%) has greatly increased over the past 30 yrs. The amount of land dedicated to urban use is expected to continue to increase as construction of permanent and second-home residences and commercial developments continue.

TABLE 3.2 Population Characteristics of Barnstable County and Towns in the Vicinity of the MMR

Political Unit	Land Area (mi²)	Population, 1986	Population % Change, 1980-1986	Total Housing Density (per mi²)	Total Housing Units, 1980
Barnstable County	400.0	170,600	+15.3	426.5	58,556
TOWNS					
Bourne CDP[a]	4.4	2,678[b]	c	608.6[b]	1,545
Bourne Town MCD[d]	41.7	15,730	+13.4	377.2	7,169
Buzzards Bay CDP	1.2	3,375[b]	c	2,812.5[b]	1,090
Falmouth Town MCD	44.7	25,440	+7.6	569.1	14,414
E. Falmouth CDP	5.4	5,181[b]	c	959.4[b]	3,330
Mashpee Town MCD	23.0	5,940	+60.5	258.3	3,582
Sandwich Town MCD	43.7	12,470	+42.9	285.4	4,358
Wareham Town MCD	34.3	20,340	+10.2	593.0	10,927

[a]CDP = census-designated place.

[b]Population estimates for 1986 are unavailable. The data provided are based on U.S. Census counts of the population in 1980.

[c]Data unavailable.

[d]MCD = minor civil division.

Source: U.S. Bureau of the Census 1983 and 1986.

All four towns have zoning regulations. In the Town of Bourne, zoning adjacent to the MMR includes residential to the north, and scenic development, business, and residential to the west. Along the southern boundary of the reservation, most of the land is zoned for public use, with a small portion zoned for agriculture. In the Town of Mashpee, the southern and eastern boundaries of the MMR are adjacent to residential development and recreational areas. Much of the boundary in the Town of Sandwich is bordered by land zoned for low- and medium-density residential use, with the remainder zoned for business and industrial purposes. Specific locations of the zoned parcels and the associated allowable uses are detailed in the zoning ordinances and maps of the respective towns.

New infiltration basins at the Cape Cod Canal site (one of the alternative facilities being considered) would be located about 800 ft southeast of Sandwich Road (State Rt. 6A) at the northwestern portion of the MMR. The land for this alternative is

TABLE 3.3 Land Use at the MMR

Managing Agency	Area (acres)	Major Use
Massachusetts Army National Guard	14,705	Training maneuvers and firing range (Camp Edwards)
U.S. Air Force and Massachusetts Air National Guard	3,540	Airfield (Otis ANG) and radar station
U.S. Coast Guard	1,407	Communications and air station
Veterans Administration	750	Cemetery
Other agencies	513	Miscellaneous activities
Total	20,915	

Source: Babij and Simmons (1985).

owned by the Commonwealth of Massachusetts; the land is leased to the federal government and then licensed to the Massachusetts Department of Military Affairs for operation. The Cape Cod Canal is located just north and west of Sandwich Road (Rt. 6). The majority of the northwestern portion of the Camp Edwards site is heavily wooded.

The Falmouth WWTP is owned and operated by the Town of Falmouth, and the plant site is zoned for public use. The adjacent Falmouth Industrial Park is zoned "light industrial B" and has been subdivided into 2- and 4-acre lots. The remaining land, adjacent to the site, is zoned "two-acre agricultural" (e.g., one dwelling unit per 2-acre parcel). The treatment plant is located in a sparsely populated, heavily wooded area just off State Rt. 28. The land located on the west side of the Falmouth WWTP and Rt. 28 is zoned "residential B" which allows one dwelling per half-acre.

3.10.3 Land Transportation

The two major transportation routes that traverse the length of the Cape are Rts. 6 and 28. All land traffic must enter and leave Cape Cod on the Bourne Bridge or the Sagamore Bridge. Traffic congestion is known to occur frequently on these bridges and on major transportation routes during the summer months when tourism is at its peak (Massachusetts Army National Guard 1985b).

The main entrance to the MMR is off State Rt. 28 just south of the Bourne Bridge; traffic must turn east on Cannery Road to pass through the main gate. Other entrances to the MMR are the Falmouth Gate at the intersection of Simpkins and

TABLE 3.4 Land Use (acres) in the Upper Cape Cod Area

Classification	Bourne		Falmouth		Mashpee		Sandwich		County Total	
	1951	1980	1951	1980	1951	1980	1951	1980	1951	1980
Agriculture	1,145	137	4,281	992	420	62	1,396	558	17,135	3,716
Cranberry bogs	232	247	288	308	392	269	192	170	3,530	2,500
Open land	927	1,275	1,200	1,625	182	253	1,572	1,162	21,592	15,393
Wetland	2,524	2,158	3,875	4,033	2,056	2,668	2,284	2,283	45,065	47,203
Forest land	21,326	18,735	19,391	15,061	13,128	10,646	20,940	17,459	173,895	141,832
Disposal	120	149	364	364	47	47	199	221	1,659	1,833
Recreation land	273	295	816	816	313	325	684	709	6,226	6,359
Urban land	1,897	4,955	2,469	8,305	502	2,410	2,100	5,922	19,090	61,471
Total acreage	27,951		31,504		16,680		28,484		280,307	

Source: Adapted from CCPEDC, undated.

Sandwich roads in the southern portion of the site, and the Sandwich Gate at the intersection of Dolan and Greenway roads in the eastern section of the site. All routes leading to the three MMR entrance gates are paved two-lane roads. The major roads between the existing treatment facility at Otis and the Falmouth WWTP include Sandwich, Landers, and Blacksmith roads, and State Rt. 151.

3.11 CULTURAL RESOURCES

3.11.1 Archaeological and Historical Conditions of the Inner Cape

The inner Cape has a lengthy record of both prehistoric and historic settlement, although much of the local prehistory is interpreted through the more extensive archaeological research conducted on the outer Cape and on Martha's Vineyard (e.g., Moffet 1957; Ritchie 1969; McManamon 1984). A statewide survey of archaeological sites, initiated by the Massachusetts Historical Commission in 1979, has recently provided a quantitative description of regional archeological and historic sites (Mahlstedt 1986); during the same year, the National Park Service began a large-scale survey (Cape Cod National Seashore Archeological Survey) and excavation program on the outer Cape.

Occupation of the region began at the end of the Pleistocene Epoch and the beginning of the Holocene Epoch (12,000-8,000 years ago), although the inventory of sites from this time period is limited to several localities on the Bass and Herring rivers in the middle Cape (Mahlstedt 1986). The paucity of sites from the earliest period has been attributed to rising sea levels and coastal erosion (Dincauze and Mulholland 1977; Mahlstedt 1986). By contrast, the middle Holocene is comparatively well represented; more than 50 middle Archaic sites (ca. 8,000-6,500 years ago) are known to have existed on the Cape and Martha's Vineyard. There is evidence from Martha's Vineyard of an increased emphasis on marine resources during the middle Archaic (Richardson 1985). This trend, along with continued growth in site numbers, intensified during the late Archaic (ca. 6,500-2,500 years ago) (McManamon 1984), and the Woodland (ceramic) period (2,500-400 years ago). Site numbers from the later Woodland period (ca. 1,000-400 years ago) exceed all previous periods on the Cape (Mahlstedt 1986).

The historic period began in the early seventeenth century with the arrival of Euro-American settlers. At this time, the inner Cape was occupied by members of the Wampanoag Federation tribes, part of the larger Algonquin Nation; the largest native American settlement in the area (Shaume) was located near Sandwich (Vuilleumier 1970). In 1637, Euro-Americans from Plymouth and Saugus moved into the region, establishing a church and town at Sandwich. Many historical sites, including houses, churches, cemeteries, ridges, and other structures, represent the lengthy history of the inner Cape. A number of sites are associated with the history of the Cape Cod Canal, which was first proposed by Myles Standish in 1623, and first surveyed in 1776 by order of General Washington (Corps of Engineers 1980).

3.11.2 Archaeological and Historical Resources of Affected Site Environments

3.11.2.1 Current Facility

Although the Otis ANG Base has not been subject to comprehensive archaeological or historic-structure surveys, Camp Edwards (which comprises 75% of the total area of the MMR) was surveyed in 1986 by the Corps of Engineers (Davin and Gallagher 1989). Approximately 40% (6,000 acres) of Camp Edwards was surveyed archaeologically (5% sample); areas of prior heavy disturbance were avoided. The sample was only partly random -- certain landscape features (e.g., wetlands, kettle holes) were specifically targeted for examination. Both surface reconnaissance and subsurface testing (pits approximately 20 in. x 20 in.) were performed. Local historic structures were also inventoried. Twenty percent of the survey units contained well-defined prehistoric sites, and another 20% produced isolated remains. A total of 12 sites (including 6 low-density loci) was discovered; the sites remain to be evaluated for potential eligibility for the *National Register of Historic Places*.

In addition to the Camp Edwards survey, the Massachusetts Historical Commission reports that four prehistoric sites (19-BN-608, 19-BN-609, 19-BN-610, and 19-BN-611) are located near Ashumet Pond (east of the Otis ANG Base) (Mills 1988).

The distribution of known archaeological sites in the surrounding area suggests that the MMR is likely to contain additional prehistoric sites. According to the Massachusetts Historical Commission, sites are likely to be found in the wooded areas in the vicinity of the existing treatment plant (Mills 1988). In addition, the Otis ANG Base itself is considered to be eligible for nomination to the *National Register* (Mills 1988), and many of the base facilities may be regarded as historic structures.

In October/November 1988, Argonne National Laboratory (ANL) conducted an archaeological survey of the proposed 50,000-ft force main route that would link the pumping station/wet well to the infiltration basins (Alternatives 4, 4a, and 4b) (Macomber 1990). Survey methods were developed in consultation with the Massachusetts Historical Commission and included a 100% pedestrian reconnaissance of the right-of-way (within 10 meters [m] of existing transmission line structures) and subsurface testing of 19 acres selected on the basis of their potential for containing buried prehistoric remains. Test pits (50 x 50 centimeters [cm]) were excavated in these areas at 10-m intervals along linear transects down to the level of sterile glacial deposits where feasible; test-pit sediment was sieved through quarter-inch screens. One hundred fifty-eight test pits were excavated on the right-of-way (Macomber 1990).

The survey produced a small quantity of isolated prehistoric and historic debris but failed to locate any potentially significant archaeological sites (Macomber 1990). Prehistoric stone artifacts included two bifaces and a preform (recovered from the surface), and a flake recovered from the uppermost 50 cm of a test pit. Historic artifacts included a brass bullet casing, five glass vessel fragments (recovered from shallow depths in test pits), and a variety of debris from modern military activities (observed on the surface).

3.11.2.2 Cape Cod Canal Site

Examination of the files of the Massachusetts Historical Commission indicates that two prehistoric sites (19-BN-224 and 19-BN-612) are located on the northwest side of the Cape Cod Canal, opposite the proposed infiltration basins (Mills 1988; Macomber 1990). In October/November 1989, ANL conducted an archaeological survey of the proposed infiltration basins area (Macomber 1990). The survey employed the same methods used for the force-main right-of-way (see Sec. 3.11.2.1); in addition to a 100% surface reconnaissance, 203 test pits were excavated in six selected areas. The survey produced a small quantity of isolated prehistoric debris but failed to identify any potentially significant archaeological sites (Macomber 1990). Prehistoric stone artifacts included a proiectile point base and angular waste fragment recovered from shallow depths in test pits, and a projectile point fragment and flake recovered from the surface.

3.11.2.3 Falmouth Treatment Plant

No archaeological sites or historic structures are known to exist in or near the site of the Falmouth WWTP, and, according to the Massachusetts Historical Commission, the area is unlikely to contain previously undiscovered sites or structures (Mills 1988).

4 ENVIRONMENTAL CONSEQUENCES

4.1 ENVIRONMENTAL CONSEQUENCES COMMON TO ALL OF THE ALTERNATIVES

Because of their commonality, the impacts associated with air, floodplains, coastal zone management, human health, and hazardous waste are generically analyzed below, without specific reference to any of the alternatives.

4.1.1 Air Quality Analysis

The Otis WWTP lies in an ozone nonattainment area according to standards promulgated under the Clean Air Act. Actually, the entire state of Massachusetts is classified as nonattainment for ozone. The VOC sources contribute to the formation of ozone in the presence of sunlight.

Since 1984, there has been significant disagreement concerning whether WWTPs are large or small VOC sources. Depending on the calculation method, the quality of the input data, and the assumptions made, one can find large and small emission rate estimates even for the same plant. The VOCs originate primarily from the industrial component of the total wastewater flow as distinct from the domestic component. The VOCs can follow several pathways:

1. The compounds can volatilize while traveling in the sewers from the industrial facility to the WWTP.

2. VOCs can volatilize at the plant.

3. VOCs can be biodegraded at the plant and changed into nonvolatile or other volatile compounds.

4. They can be adsorbed on the sludge, grit, or bioactive material.

5. They can be created in the chemical interactions of chlorine.

6. VOCs can exit the plant in the effluent. This pathway is unlikely at the Otis WWTP.

The following sections present methods of quantifying the generation of VOCs at wastewater treatment plants and analyzes how VOC generation at the Otis WWTP is affected by each disposal alternative.

4.1.1.1 VOC Calculation Methods

There are at least four methods, some of them with subvariations, of calculating VOC emissions. They are as follows.

Method 1: Input/Output Measurements

In this method, the input and output concentration data of a WWTP are measured and any difference between them is attributed to volatilization. The technique ignores biodegradation and adsorption and will *not* work if VOCs are formed during the treatment process. However, it has merit as a worst-case screening approach for air quality analysis. Corsi et al. (1987a) provide a good discussion of this method, as well as results of application to California treatment plants.

Method 2: Input Measurements/Volatilization Assumptions

Frequently, only input measurements are provided; in these cases, a percentage of volatilization is assumed. This assumption can take several forms: (1) 100% volatilization is sometimes used to provide a worst-case analysis (this is the absolute worst case possible since the effluent VOC concentration is assumed to be zero); (2) a single average percentage for all VOCs is simply estimated or taken from input/output measurements at other facilities; or (3) individual percentages are used for each VOC at a facility, as determined from speciated input/output measurements at other facilities (Corsi et al. 1987a; Greene 1985). Like Method 1, this method ignores adsorption and biodegradation and attributes all removal to volatilization.

Method 3: First-Order Kinetic Modeling

Simple first-order mathematical kinetic models attempt to account not only for volatilization but also for adsorption and biodegradation on a compound-specific basis (Pincince and Carvitti 1988; Corsi et al. 1987b; Namkung and Rittman 1985; Noll 1987). The rate of these mechanisms with respect to the residence time in the process is also considered. A subvariation of this method incorporates a saturation factor in the volatilization equation; this factor accounts for aeration gas not being in contact with the wastewater long enough for complete saturation. These models generally require much input data, including such notable variables as measured input VOC concentrations, the Henry's law constant, the water/octanol partition coefficient, and the biodegradation-rate constant, to name a few. Unfortunately, there are no measured data for the biodegradation-rate constant, and the model is extremely sensitive to this value. Thus, depending on which value one selects, the mechanism for VOC loss can be shifted from nearly all volatilization to nearly all biodegradation. Most results presented in the literature conclude that adsorption is negligible.

Method 4: Use of Single-Value Average Emission Factors

When no input or output concentrations are available, the procedure of estimating emission rate involves scaling it at another plant to the plant of concern using a flow rate in millions of gallons per day as the scaling factor (Misenheimer 1988; Baamonde and Martinovich 1987; Greene 1987). Of course, there is a great range of possible single values, depending on which of the above methods (Methods 1, 2, or 3) is used to estimate the VOC emissions at a reference plant and on the measured influent concentrations at the reference plant.

4.1.1.2 Discussion and Selection of Method

All four methods use measured data either directly or, in the case of Method 4, indirectly. Because VOC concentrations vary diurnally and seasonally, the timing of these samples is important. Also, the compounds actually analyzed are important since most analyses include only the 31 purgeable organic priority pollutants for which the Clean Water Act sets standards. However, there are many other VOCs in wastewater in addition to these 31, and four of the 31 are not technically VOCs since they are not photochemically reactive. VOC concentrations also vary depending on where the samples are collected (i.e., immediately entering the WWTP or far upstream in the sewer lines). Finally, VOC concentrations depend on just what industries are connected to the treatment plant at which the measurements occur and the relative amount of industrial wastewater as compared to domestic wastewater. Consequently, not only is the quality of the sampling and analysis plan important, but also, even when the original data are high quality, there is concern regarding the validity of transferring such data from a reference plant to another plant. As a result, the analysis was performed using a worst-case scenario.

Methods 1 and 2 are good as screening methods; however, for large municipal treatment plants, they yield very high VOC emissions, which is why this nontraditional source of VOCs (municipal wastewater) is now being thoroughly scrutinized. However, for very small treatment facilities like the Otis plant, the worst-case screening model establishes that the emissions are small. It is concluded by ANL that these methods are acceptable as worst-case screening models for small treatment plants where measured input or input/output data exist, but that for larger plants the models of method 3 should be applied.

The major controversy about Method 3 is twofold: (1) the selection of a biodegradation-rate constant and (2) whether or not the system is acclimated. As mentioned above, there are presently no good quantitative data on the biodegradation constant, due in part to the uncertainty regarding the degree of acclimation at actual treatment plants. Most laboratory studies have quantified the rate constant in an acclimated setting where the VOC influent concentration is carefully controlled. However, industrial wastewater enters an actual plant in such widely varying quantities that the bacteria may not bioacclimate. Because the model is so sensitive to this variable, and since most applications of the Method 3 model would use data from acclimated laboratory studies, the results of this model have generally shown biodegradation to be the primary VOC-removal mechanism.

Where no measured data exist, there is little choice but to use Method 4. The best approach when applying this method is to find the broadest range of emission factors listed in the literature and multiply the daily capacity of the plant under study by each extreme of that range. Unfortunately, the resulting emission rate range often spans two orders of magnitude.

Because a small amount of input concentration data exist for the Otis WWTP, and since the proposed flow rate is so small (300,000 or 500,000 gal/day), the analysis using the screening method (Method 2) yields a worst-case estimate of VOC generation. The results will be compared with the range obtained from a Method 4 analysis and should fall within that range.

4.1.1.3 Calculation of the Emission Rate at the Otis Wastewater Treatment Plant

Table 4.1 summarizes the alternatives and changes in VOC air emission sources. Rather than estimate the net change in the VOC emission rate for each of the sources, it will suffice to estimate the worst possible net change, that is, going from no plant to a plant with a capacity of 300,000 gal/day. Clearly, any of the alternatives being considered in this FEIS must be less than this worst case.

Table 4.2 summarizes the influent measurement data provided by Oak Ridge National Laboratory (1987). Effluent measurements derived from plant operations are also summarized in Table 4.2. (EPA-certified laboratories analyzed the samples.) The measurements were taken on April 1-8, 1986, with samples analyzed for VOCs collected manually every 4 hr and analyzed individually, and samples analyzed for semivolatile organic compounds collected automatically every 20 min and analyzed daily. Thus, the range of data reported in Table 4.2 for the VOCs represents the minimum and maximum *4-hr* average, while the range for semivolatile compounds represents the minimum and maximum *daily* average.

If it is assumed that all the VOC in the influent volatilizes (a worst case), and if it is further assumed that the maximum measured concentration prevails year-round, then the annual total VOC concentration would be 1,281 μg/L. This value excludes methylene chloride, which is nonphotochemically reactive. Given a 300,000 gal/day annual average operation, the highest possible estimate for total VOC loss using method 2 is 0.59 ton/yr. Similarly, for the 500,000 gal/day average flow, the maximum VOC loss using Method 2 is 0.99 ton/yr.

To provide a comparison for the Method 2 results, Method 4 is evaluated using the 300,000 gal/day flow rate. The data available to perform a Method 4 analysis are shown in Table 4.3. The range of emissions available from the three literature references cited is 0.21 to 12.5 ton/yr per million gal/day. Given a 300,000 gal/day operation, the total VOC emission rate at the Otis WWTP should fall between 0.063 and 3.75 ton/yr. (Applying the Massachusetts average annual emission factor of 1.8 ton/yr per million gal/day to Table 4.3 indicates that the Otis emission rate should be 0.54 ton/yr.) Thus, there is good agreement between Method 2 and Method 4 estimates.

In conclusion, the total VOC emission rate for any of the action alternatives is much less than 0.59 ton/yr. Even at the worst-case upper limits of 0.59 ton/yr (for the 300,000 gal/day flow) and 0.99 ton/yr (for the 500,000 gal/day flow), this is a very small source of VOC input to the atmosphere; it will have no significant impact on air quality.

4.1.2 Floodplains

Floodplains are low-lying areas that periodically flood because of a rise in a bordering waterway or water body. They are considered within the category of inland wetlands and are treated as a specific resource area with values related to flood control and storm damage protection (Massachusetts Division of Wetlands and Waterways 1984).

TABLE 4.1 Basis for Air Quality Analysis of Otis WWTP Alternatives

Alternative	Added VOC Sources	Eliminated VOC Sources
1, 1a	Air venting from wet well and pump station through carbon column at Otis WWTP 3 infiltration basins at site near Cape Cod Canal, or direct discharge to the canal	
2	Air venting from wet well and pump station through carbon column at Otis WWTP 2 aerated ponds at Falmouth WWTP 3 infiltration basins at Falmouth WWTP	Otis WWTP deactivated (except emergency generators)
3	Air venting from wet well and pump station through carbon column at Otis WWTP 3 infiltration basins at Falmouth WWTP	
4, 4a, 4b	11.1 acres of storage lagoons at Otis WWTP 60 acres of irrigation fields at Otis WWTP	Otis infiltration basins deactivated
5	Existing clarifiers to 2 aeration stations converted, and 2 anoxic stages for Bardenpho process at Otis WWTP Existing Imhoff tanks to activated sludge storage converted at Otis WWTP New secondary clarifiers built at Otis WWTP	Existing secondary clarifiers no longer used as final settling chambers at Otis WWTP Existing Imhoff tanks no longer used as solids digesters at Otis WWTP Trickling filters deactivated at Otis WWTP

TABLE 4.2 Influent and Effluent VOC Measurements at Otis WWTP

Chemical Compound	Measured Influent VOC Concentration[a] (µg/L)	Measured Effluent VOC Concentration[b] (µg/L)
Methylene chloride[a]	6.7-140	ND[d]
Acetone	19-360	NA[e]
1, 2-dichloropropane	19	ND
Benzene	5.8-49	ND
Toluene	5-210	ND
Ethyl benzene	15-57	ND
Total xylenes	6.2-400	NA
Semivolatile:		
1, 4-dichlorobenzene	15	ND
1, 2-dichlorobenzene	19	ND
4-methylphenol	24-37	NA
Benzoic acid	63	NA
Diethylphthalate	17	NA
Bis(2-ethylhexyl)phthalate	22-35	NA
Total excluding methylene chloride	230-1281	NA

[a]Methylene chloride is nonphotochemically reactive and is not considered a VOC from an air pollution viewpoint.

[b]Source: Oak Ridge National Laboratory (1987).

[c]Source: Plant records (1986).

[d]Not detected.

[e]Not analyzed.

A review was made of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps for the towns of Bourne, Falmouth, and Sandwich (FEMA 1985a, 1985b, and 1986). These are the towns in which existing, proposed, or alternative WWTP facilities or effluent pipelines occur or would occur.

None of the existing or proposed facilities or pipelines would occupy 100-yr or 500-yr floodplains. Furthermore, the proposed action would not result in, or encourage, further development in floodplains. Consequently, the proposed action would not affect Cape Cod floodplains.

TABLE 4.3 Single-Value Emissions of VOCs (ton/yr per million gal/day) Reported in Three Treatment-Plant Studies

Study	Reported Emission Values[a]
Misenheimer (1988)	3.29[b]
Nationwide	
Baamonde and Martinovich (1987)	
New Jersey (w/o Middlesex)	2.51-12.5
New York	0.21-1.09
Greene (1987)	
Massachusetts[c]	1.8

[a]For total wastewater flows (both domestic and industrial).

[b]Assumes 16% of total flow is industrial. (Value was reported incorrectly in paper, but is corrected here.)

[c]Boston Harbor plant measurement data extrapolated to state.

4.1.3 Coastal Zone Impacts

The Massachusetts CZMP allows for the selection and protection of Areas for Preservation or Restoration (APR) and Areas of Critical Environmental Concern (ACEC). One area designated as an ACEC that could potentially be affected by the alternatives is Waquoit Bay, south of the Otis ANG Base. This 2,522-acre ACEC is the most extensive, largely unaltered estuarine system on the south shore of Cape Cod (Bliven 1987). The area is known for high water quality and productivity, good shellfish crops, and a high diversity of finfish, as well as upland, shore, and aquatic birds. Located at Waquoit Bay are the South Cape State Park and the Waquoit Bay National Estuarine Research Reserve. The area was recently evaluated for potential designation as a national estuarine sanctuary because of its high values and uniqueness (U.S. Department of Commerce 1984).

The alternatives would remediate existing impacts on water quality in a CZM area. Consequently, any of the alternatives would be consistent with CZM policies if it resulted in (1) no construction or direct discharge in coastal waters, (2) no increased future development in CZM areas, and (3) no deterioration in coastal waters or coastal resources. Except for Alternative 4a, direct discharge into Cape Cod Canal, the alternatives would be consistent with the first two items. The potential impacts to water quality and coastal resources are evaluated for the first alternative in Sec. 4.2 and for other alternatives in Secs. 4.3-4.5. Those sections conclude that none of the alternatives would have a significant effect on coastal waters or coastal resources.

The Massachusetts ANG will comply with all regulations pertaining to the Coastal Zone Management Act of 1972.

4.1.4 Human Health

In response to concerns expressed by residents of the upper Cape, the Massachusetts Department of Public Health (MDPH) conducted a study of trends in mortality rates in the towns near the MMR (Massachusetts Department of Public Health 1988). Other studies on cancer incidence and mortality have also been conducted in recent years for the upper Cape (Massachusetts Department of Public Health 1985a and 1985b). In addition, the MDPH has recently contracted with epidemiologists at Boston University to conduct a two-year study of cancer incidence in the upper Cape. Results of the latter study will be available in 1990.

The latest MDPH study of mortality rates in the upper Cape was designed to evaluate the relationship between the proximity of long-term residents in the area to the MMR and the risk of death from lung cancer and all leukemias. Age-adjusted mortality rates were compared with comparable mortality rates from these causes for the total population of Massachusetts. Mortality data from two time periods were evaluated, 1969 and 1985. The results of this study indicated that, while age-adjusted mortality rates from some causes of death were significantly higher among all long-term residents of the upper Cape than those observed for residents of the entire state of Massachusetts, there were no statistically significant differences in the risk of cancer mortality as a function of distance from the MMR (Massachusetts Department of Public Health 1988). No causal relationship has been established between any environmental agents that originated at the MMR and the elevated cancer mortality rates observed for long-term residents of the upper Cape.

These results make it impossible to determine whether the elevated cancer mortality risks for upper Cape residents are attributable to something unique in their particular environment, or whether all Cape Cod residents face elevated risks of cancer mortality. It should be emphasized that a major problem with studies such as those conducted by the MDPH involves the relatively small numbers of deaths that are available for analysis. For example, there were a total of 27 leukemia deaths observed in the upper Cape area for the five-year period from 1979 through 1983 (Massachusetts Department of Public Health 1988), and in 1984 the total number of new cases (incidence) of lung cancer and leukemia for the combined areas of Bourne, Mashpee, Sandwich, and Falmouth, were 54 and 14, respectively (Massachusetts Department of Public Health 1984). From such small numbers of both incidence and deaths from these particular diseases, it is not possible to arrive at statistically significant results that may be used for comparison purposes across either time or geographic boundaries within a given community, or between different communities. Also, previous research on cancer incidence and mortality conducted by the MDPH resulted in an overestimate of mortality rates due to methodological problems which were resolved in subsequent studies. Finally, no evidence exists indicating that long-term residents of the upper Cape face an elevated risk of mortality from heart disease or other types of respiratory illnesses relative to other Cape Cod residents or the entire Massachusetts population.

4.1.5 Hazardous Waste

Hazardous wastes are handled at the MMR in accordance with Commonwealth of Massachusetts regulations 310 CMR 30; EPA regulations in 40 CFR, and ANG regulations 19-1, 19-11, and AR 19-14. Each organization that operates on the MMR handles hazardous waste in accordance with regulations of the RCRA. The wastes are collected at designated central collection points on the MMR. Storage of wastes at these areas while awaiting pickup by the DLA is limited to 90 days. Hazardous waste is not allowed to enter the waste streams sent to the Otis WWTP. Thus, there will be no impact from hazardous waste under any of the alternatives.

4.2 ENVIRONMENTAL CONSEQUENCES FOR THE FALMOUTH AREA DUE TO ALTERNATIVES 1 AND 1a

The impacts on the Falmouth area environment associated with Alternatives 1 and 1a are described in this section. The impacts, again, are divided into six groups: effects on archaeological and historical conditions, socioeconomic conditions, land transportation, natural resources, endangered and threatened species, and land use. This section also describes in detail the results of groundwater-flow and contaminant-transport modeling associated with sending untreated effluent (Alternative 1) or treated effluent (Alternative 1a) to the Falmouth facility.

4.2.1 Archaeological and Historical

The Massachusetts Historical Commission has determined that these two alternatives would have no adverse effects on significant archaeological sites or historic structures (Mills 1988).

4.2.2 Socioeconomic Conditions

The socioeconomic impact associated with Alternatives 1 and 1a would be minimal. There would be no population changes associated with these alternatives. Construction costs and work force requirements are well within the range of available contractors located on Cape Cod or other nearby areas. In addition, the Town of Falmouth is committed to putting all groundwater users on municipal water supplies.

4.2.3 Land Transportation

Alternative 1 would require that untreated effluent be pumped via a new force main that would be built adjacent to several existing two-lane roads between the Otis WWTP and the Falmouth WWTP. Alternative 1a would require pumping the treated effluent via a new force main to the Falmouth WWTP. During construction associated with these alternatives, minor traffic congestion would be expected to occur along Sandwich, Landers, and Blacksmith roads, and State Rt. 151. Such traffic congestion would be considerably worse if the construction phase of the project occurred during the summer months when these roads are heavily used by tourists; winter construction, however, would not affect this traffic congestion.

4.2.4 Natural Resources

4.2.4.1 Terrestrial Resources

These alternatives would disturb existing vegetation and soil surfaces along the pipeline route and convert habitat from forest cover to open, low-growing vegetation cover at the potential locations of the infiltration basins and aeration ponds at the potential infiltration beds. The total acreage disturbed would depend on the exact pipeline route selected (Table 2.1). The potential total area disturbed by Alternative 1 or 1a varies from 4.8 to 11.8 acres. This is a relatively small area and involves the loss of less than 5 acres, since either of the alternatives would use existing cleared easements. The impact is not considered significant. The area of the Falmouth WWTP is predominately forest cover. Consequently, forest cover would not become a limiting habitat type if a small amount were converted to other cover types.

4.2.4.2 Fresh Water Resources

There are no notable surficial fresh water resources between the site and West Falmouth Harbor. A small pond (less than 5 acres), Crocker Pond, is located just east of Rt. 28, at the intersection with Thomas Landers Road. Consequently, the groundwater plume from the new infiltration basins at the Falmouth WWTP could not affect lakes, ponds, or streams. Hence, these alternatives would have less of an effect on fresh water resources compared to the present situation. There is a concern, however, that the WWTP groundwater plume may deflect the landfill (located approximately one mi east of the WWTP) groundwater plume towards Long Pond (Witt 1987; CDM 1983). If this occurred, the water of Long Pond, derived primarily from groundwater inflow, could be degraded in quality. Recreational use of this municipal water supply source is not allowed; therefore, recreation would not be affected. The groundwater-flow and contaminant-transport modeling completed for the Falmouth WWTP (see Sec. 4.5.7) projects that Long Pond would not be affected by Alternatives 1 and 1a.

4.2.4.3 Marine Resources

Under maximum disposal conditions (800,000 gal/day from the Town of Falmouth and 500,000 from the MMR), groundwater nitrogen in amounts of 1 to 6 mg/L (with an average of approximately 2.5 mg/L) is projected to occur in the area of West Falmouth Harbor. Levels of 4 to 6 mg/L are projected to occur in the vicinity of the inner part of the harbor. Nitrogen is a limiting nutrient for plant growth in coastal water (Ryther and Dunstan 1971; Thomas et al. 1974), and concentrations of nitrogen in seawater at 25 to 75 μg/L enhance algal cell production and chlorophyll a levels (Vince and Valiela 1973). Thus, even with the dilution of the groundwater nitrogen levels in the harbor, primary production will most likely be enhanced in the inner part of West Falmouth Harbor. In addition, fertilization of salt marshes has been shown to decrease the diversity of diatom species, but has little effect on the function of the algal component of the marsh ecosystem (Van Raalte et al. 1976). Some mitigation of this nutrient enrichment of Buzzards Bay would occur because the physical structure of the harbor restricts tidal exchanges with Buzzards Bay and results in nitrogen uptake by phyotoplankton occurring within the harbor waters (Valiela and Costa 1989; Gilbert et al. 1982).

4.2.5 Endangered and Threatened Species

There are no known populations of *Agalinis acuta* in the construction areas for Alternative 1 or 1a (Sorrie 1988). To determine whether this species may be affected, the U.S. Fish and Wildlife Service, under Sec. 7 of the Threatened and Endangered Species Act (amended in 1988), would require a survey of the pipeline route before construction.

The potential for Alternative 1 or 1a to affect state-listed species depends on which of the two pipeline routes is selected. The southern option, following Sandwich and Landers roads, would not affect any known populations of state-listed species.

The northern routing option which follows State Rt. 151 and a transmission-line corridor would pass very near populations of two state-listed species: the reticulate nut-rush and the Decodon stem borer moth. Exact locations of these populations are not shown at the request of the Massachusetts National Heritage Program. Consequently, the Falmouth WWTP alternative potentially affects state-listed species depending on the pipeline route selected. A site-specific survey of the exact route would have to be performed to determine whether either of these species occurs along the narrow strip of ground that would be disturbed for the pipeline. If populations were found, the pipeline would be moved to avoid disturbing these populations.

4.2.6 Land Use

Under Alternatives 1 or 1a, three new infiltration basins would need to be built at the Falmouth WWTP. However, the current proposed location for the infiltration basins is approximately 100 ft away from the boundaries of Maple Swamp. The siting of the infiltration basins could be changed under Alternative 1a to several hundred feet farther away from Maple Swamp. It is not known whether Maple Swamp is hydrologically connected to the groundwater flow in a manner similar to the flow dynamics that occur at Ashumet Pond or other kettle ponds on Cape Cod. Most likely, this area represents a perched water table condition, and thus the effluent from the proposed sand filter beds would not be available to the vegetation in Maple Swamp. However, if wells in this vicinity showed that flow from the sand filter beds was available to the vegetation in Maple Swamp, altered groundwater with nitrogen levels ranging from 5 to 10 mg/L would occur in the vicinity of Maple Swamp. Under this scenario, both nitrogen and phosphorus would enhance primary production, and this impact could alter long-term successional patterns of the vegetation community. Those plants that respond most favorably, especially tree species, to the increased nutrients would be at a competitive advantage and could, over a period of 10 to 30 years, dominate the vegetation community at this location. In addition, the Town of Falmouth recently voted to establish "the wildlife corridor," which encompasses, among other areas, the entire Falmouth WWTP area (Town of Falmouth 1988). This corridor represents a unique deer migration and foraging area protected by local ordinances to restrict the use of land in the area. All proposed land use within the corridor requires the submission of plans to the state's Natural Resources Department, and the department's subsequent approval.

4.2.7 Groundwater-Flow and Contaminant-Transport Modeling

Three-dimensional groundwater-flow and contaminant-transport models for each site were developed to evaluate the effects on ground and surface water of each alternative. The CFEST computer code (Gupta et al. 1986) was used in the modeling effort. A detailed description of CFEST is included in Appendix F. The general steps followed in the modeling process were: (1) the development of a conceptual model (a mental picture of significant hydrological processes occurring at the site): (2) the inputting of the groundwater flow data (based on the conceptual model) and the performance of the steady-state flow calculations; (3) the calibration of the groundwater-flow model with existing field data; and (4) the inputting of contaminant-transport data (based on the conceptual model) and the performance of the steady-state contaminant-transport calculations. These steps will be discussed for each alternative in the following sections.

The conceptual model for each site was developed based on the geological, hydrological, and chemical data discussed in the previous sections. Using these data, model areas were selected for each alternative. The areas were selected to incorporate hydrogeologic boundaries of the groundwater systems and to include the areas where the altered groundwater plumes are most likely to migrate. Using the boundaries of the study area and other surface features (i.e., lakes, ponds, infiltration basins, and spray-irrigation areas), finite-element grids were developed for each site. Constant-head (Dirichlet) boundaries were specified along the rivers, lakes, and the ocean. Other constant-head boundary values were selected using water-level data. In addition, no-flow (Neumann) boundaries were specified in areas parallel to the groundwater-flow direction (LeBlanc and Guswa 1977; Weston Geophysical 1987). In cross section, a no-flow boundary was specified at the bottom of each model (assuming the top of bedrock and the salt-water/fresh-water interface are impermeable). In cross section, a constant-flux boundary (Cauchy) was assigned to the top of the model to represent recharge from precipitation and wastewater application rates at source locations.

The goals of the modeling effort were to define the extent of groundwater alteration for each of the alternatives and identify regions in which the nitrogen concentration in the groundwater exceeded the requirements of a Class III area ($\geq$ 10 mg/L). Steady-state contaminant-transport simulations were used for each calculation; the steady-state condition provides the most conservative projection for the Class III area. For conservative results, the contaminant-transport figures show projected maximum concentrations. In all simulations, the maximum nitrogen concentrations occurred in the upper part of the aquifer.

The Falmouth models are discussed in detail below. The Ashumet Valley models are discussed in Sec. 4.3.7 and the Cape Cod Canal model is discussed in Sec. 4.4.7.

4.2.7.1 Model Development for the Falmouth Site

Geologic Characterization

The primary geologic formations in the Falmouth area are the Mashpee Pitted Plain deposits, the Buzzards Bay moraine deposits, and the Buzzards Bay outwash (Fig. 4.1). The Falmouth WWTP is located on the Buzzards Bay moraine, which consists mostly of sand and gravel, with some fine sand and clay (Oldale and Barlow 1986). The Buzzards Bay moraine extends along a ridgeline forming the Elizabeth Islands, through Woods Hole, and northward to approximately the Bourne Bridge (CDM 1987). The Buzzards Bay outwash parallels the east coastline of Cape Cod. These deposits are similar to the composition of the Buzzards Bay moraine except that layers of silt and clays have been identified (CDM 1987). The Town of Falmouth is located primarily on deposits of the Mashpee Pitted Plain, whose surficial deposits consist of a gravelly sand layer overlying a layer of fine sand and silt. The unconsolidated deposits are underlain by bedrock at a depth of 100 to 250 ft (CDM 1987).

Hydrology

The major surface water features in the Falmouth area are Long, Jenkins, and Coonamessett ponds; the Coonamessett River; and several other small ponds -- see Fig. 4.2. As discussed in Sec. 3, most of these ponds are connected to the groundwater.

Groundwater at the Falmouth site is unconfined, like most of the groundwater on the Cape. The water-table surface ranges from 0 to 40 ft above MSL. The potentiometric surface, derived from average water levels measured by the USGS (LeBlanc and Guswa 1977) and E.C. Jordan (1987), is shown in Fig. 4.3. The principal groundwater flow direction is south towards South Cape Shore and southeast towards Buzzards Bay (CDM 1983; LeBlanc 1984b). The hydraulic gradients measured from the water-table map range from 0.001 ft/ft to 0.004 ft/ft, with the steeper gradients in the north-northwest part of the Falmouth site.

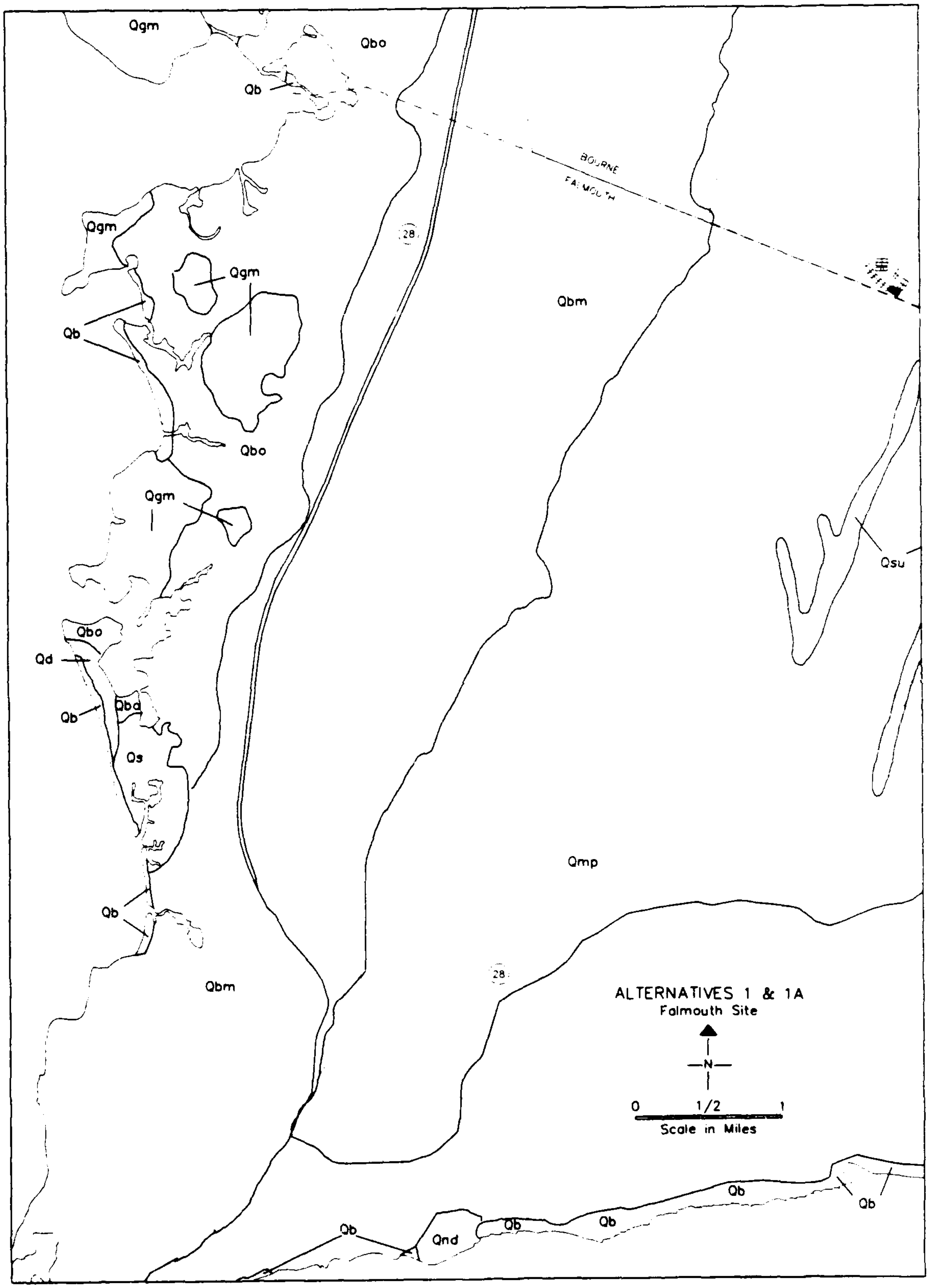

FIGURE 4.1 Geology of Falmouth Area, Site of Alternatives 1 and 1a (see legend, Fig. 3.4)

1

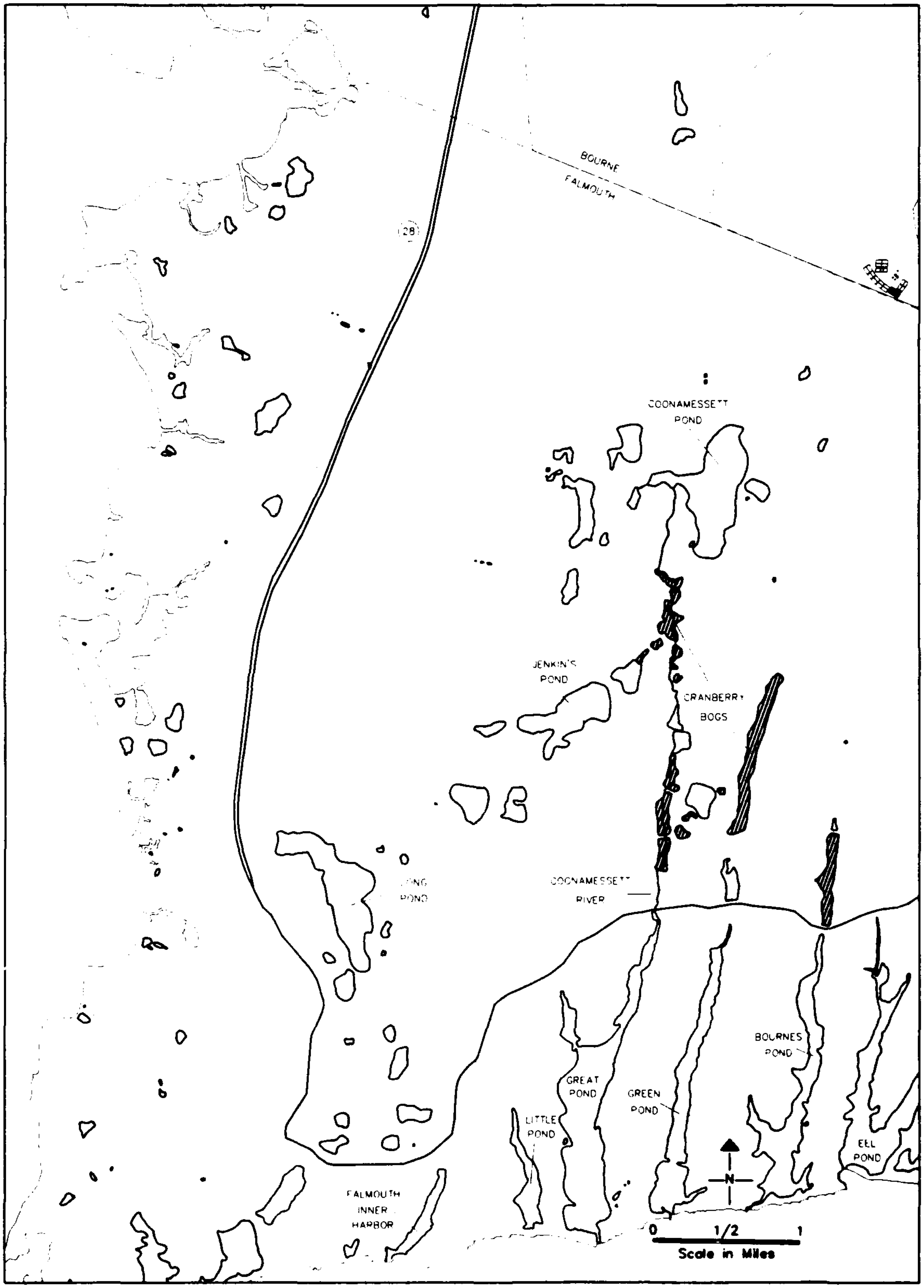

FIGURE 4.2 Surface Water in the Falmouth Area, Site of Alternatives 1 and 1a

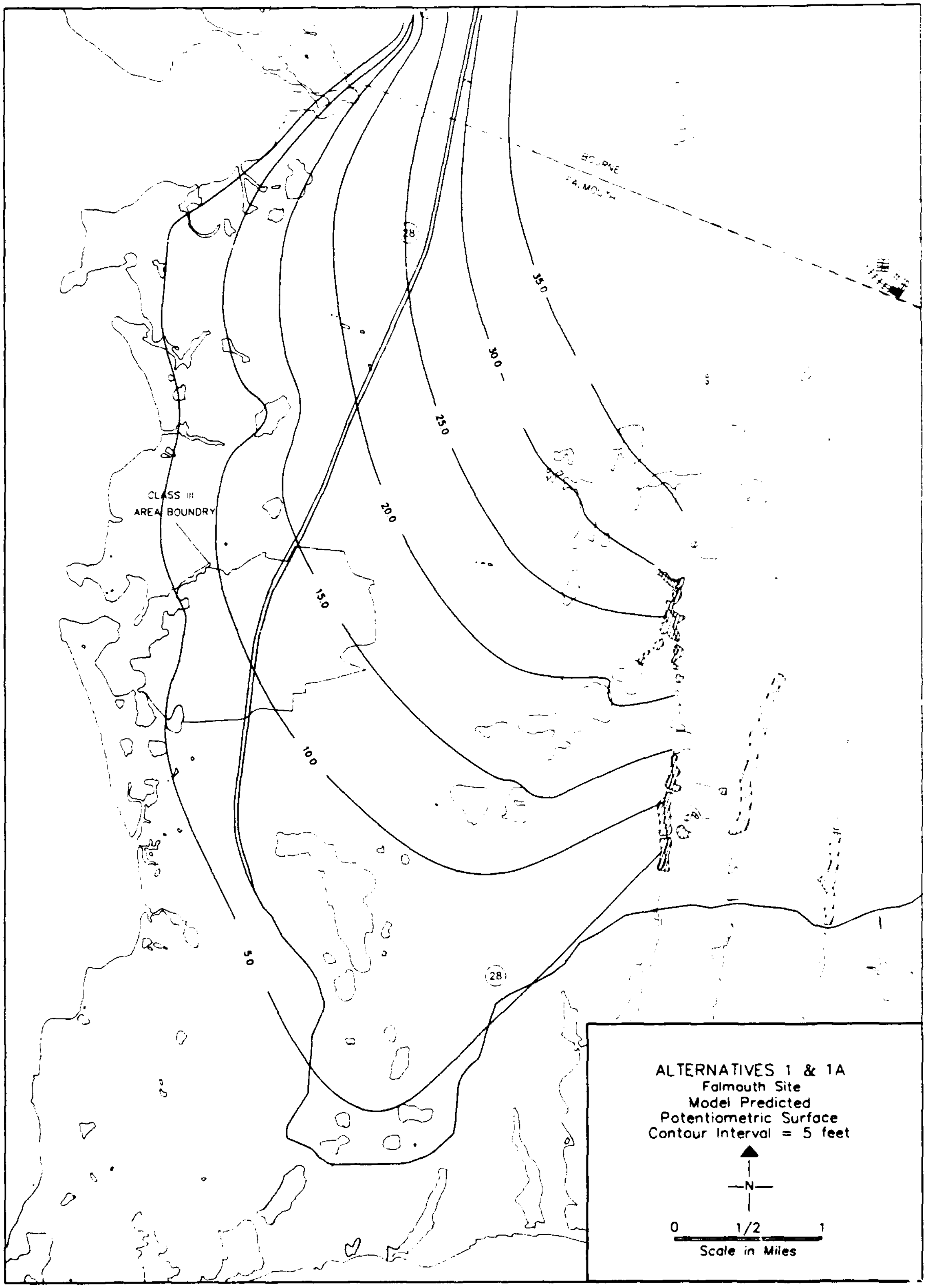

FIGURE 4.3 Observed Groundwater Elevations in the Falmouth Area, Site of Alternatives 1 and 1a (contours in ft relative to MSL)

The area east of Falmouth (Ashumet Valley) receives approximately 48 in. of precipitation on average annually; this is estimated to recharge the groundwater system with between 12 and 24 in./yr (CDM 1987). A rate of 21 in./yr of areal recharge from precipitation was estimated by the USGS (LeBlanc 1984b) using the Thornthwaite and Mather (1957) method.

Long Pond is currently the major drinking water source for the Town of Falmouth. The average monthly withdrawal of Long Pond, measured from June 1985 through May 1986, was 2,400,000 gal/day. This average discharge is also equivalent to the average annual withdrawal rate measured from 1980 to 1985 (CDM 1987). Because of an increase in Falmouth's population during the summer months, there is an increase in the summer pumping rate. For example, in July 1985 the withdrawal from Long Pond increased to a rate of 4,140,000 gal/day (CDM 1987).

Site Definition

For modeling the Falmouth site, an aquifer system encompassing an area of approximately 13,900 acres was selected. The area extends along the northern border of Falmouth south toward South Cape Shore, east to Buzzards Bay, and west to Coonamessett Pond and Coonamessett River (Fig. 4.2).

The study area was subdivided into an assemblage of 591 quadrilateral elements, with 643 nodal points. The two-dimensional surface representation of the grid is shown in Fig. 4.4.

Surface-water features were incorporated in the finite-element grid by placing specific nodes of the grid along the boundaries of the major lakes and ponds in the area. The nodes were assigned constant-head values based on average lake-elevation data from LeBlanc and Guswa (1977) and CDM (1987). The actual elevation values are shown in Table 4.4. The constant-head boundaries allow groundwater to flow into and out of the lakes.

The pumping from Long Pond was simulated by a single node positioned in the center of the pond. The flow model was calibrated using the mean pumping rate (2,400,000 gal/day) from Long Pond. To predict the aquifer response of maximum seasonal withdrawal from Long Pond, the July pumping rate -- 4,140,000 gal/day (CDM 1987) -- was also simulated. The results are discussed for two scenarios: (1) an average annual withdrawal from Long Pond, and (2) the maximum withdrawal that would be expected during the summer months.

The elements of the grid are of similar size except in the area of the Falmouth WWTP. In this area, the elements are smaller in order to approximate the actual size and locations of (1) the Falmouth WWTP current sand filter beds, (2) the proposed sand filter beds for Alternatives 1 and 1a, and (3) the Falmouth WWTP spray-irrigation area.

To simulate hydrologic conditions at the site, four sets of hydraulic properties were used to represent the different geologic formations. The formations are the Buzzards Bay moraine deposits, the Buzzards Bay outwash, and two stratigraphic layers

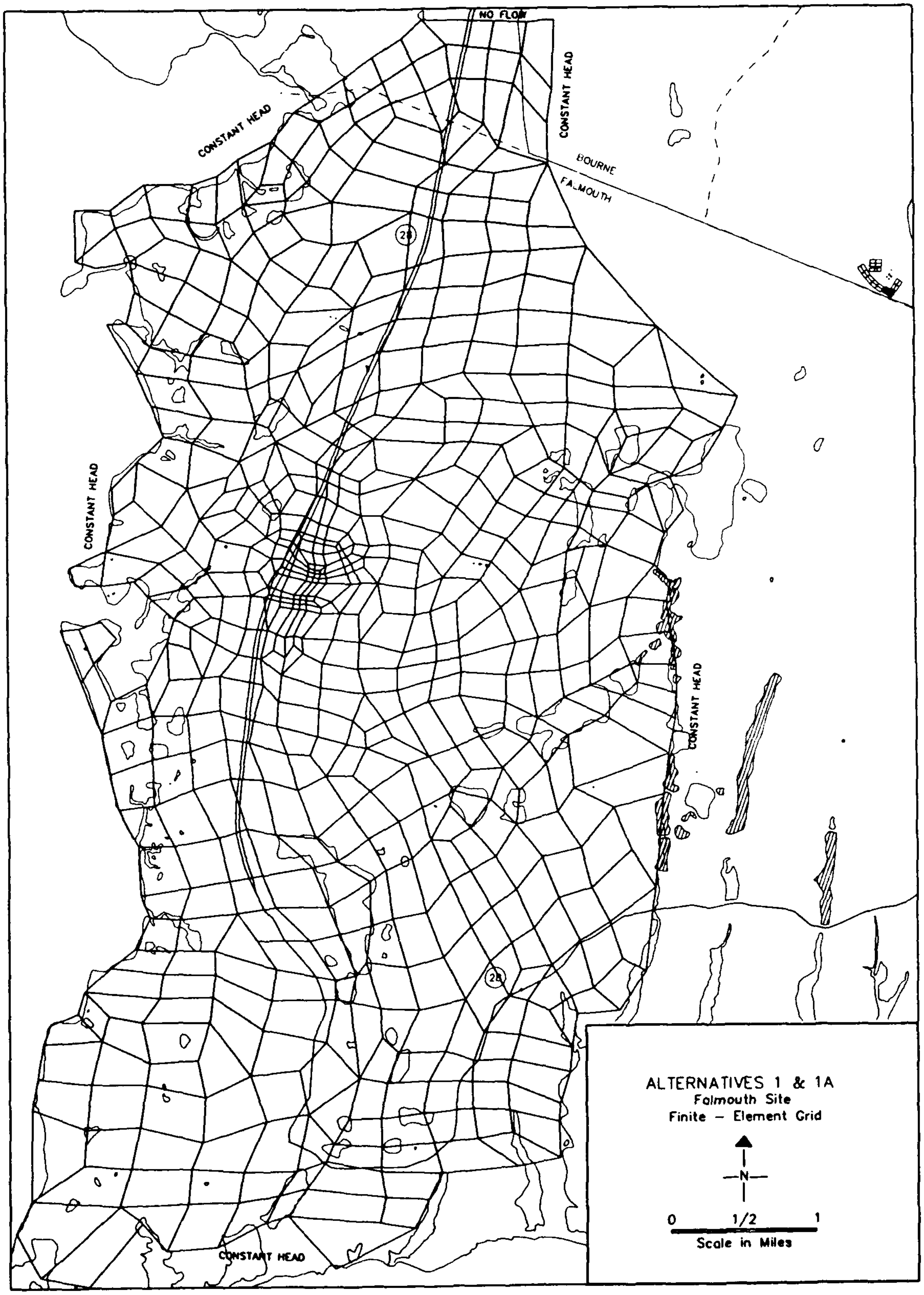

FIGURE 4.4 Surface Representation of the Finite-Element Grid and Boundary Conditions for the Falmouth Area, Site for Alternatives 1 and 1a

TABLE 4.4 Fixed-Head Elevations Assigned to Major Ponds Located within the Falmouth Site

Ponds	Elevation (ft above MSL)	Reference
Siders	2.0	USGS 1979[a]
Morse	5.0	USGS 1979[a]
Jones	6.0	USGS 1979[a]
Nye	5.0	USGS 1979[a]
Shivericks	5.0	USGS 1979[a]
Wings	9.0	USGS 1967[b]
Coonamessett	35.26	E.C. Jordan 1987
Jenkins	19.0	USGS 1979
Round	21.0	USGS 1979
Deer	17.0	USGS 1979
Mares	13.0	USGS 1979
Spectacle	13.0	USGS 1979
Shallow	27.0	USGS 1979
Crooked	30.0	USGS 1979
Spectacle (north of Crooked Pond)	31.0	USGS 1979
Deep	35.0	USGS 1979
Long/Grews	6.0	CDM 1987

[a]Topographic map of the Falmouth area.

[b]Topographic map of the Falmouth area.

of the Mashpee Pitted Plain deposits. There is an absence of definable stratigraphic layers in the vicinity of the Buzzards Bay moraine and the Buzzards Bay outwash. Therefore, the geology was assumed to remain constant with depth. However, the Mashpee Pitted Plain was simulated with two distinct stratigraphic layers: a sand and gravel material (Layer 1) overlying a fine sand and silt material (Layer 2). Underlying the sands is the bedrock, which is assumed to be impermeable (Fig. 4.5).

In the contaminant-transport simulations, additional vertical layering was added to evaluate groundwater mounding and the vertical extent of altered groundwater. Layer 1 and the upper areas of the Buzzards Bay moraine and Buzzards Bay outwash were subdivided into 9 layers, each approximately 20 ft thick. Layer 2 and the lower area of Buzzards Bay moraine and Buzzards Bay outwash were subdivided into three layers of equal thickness.

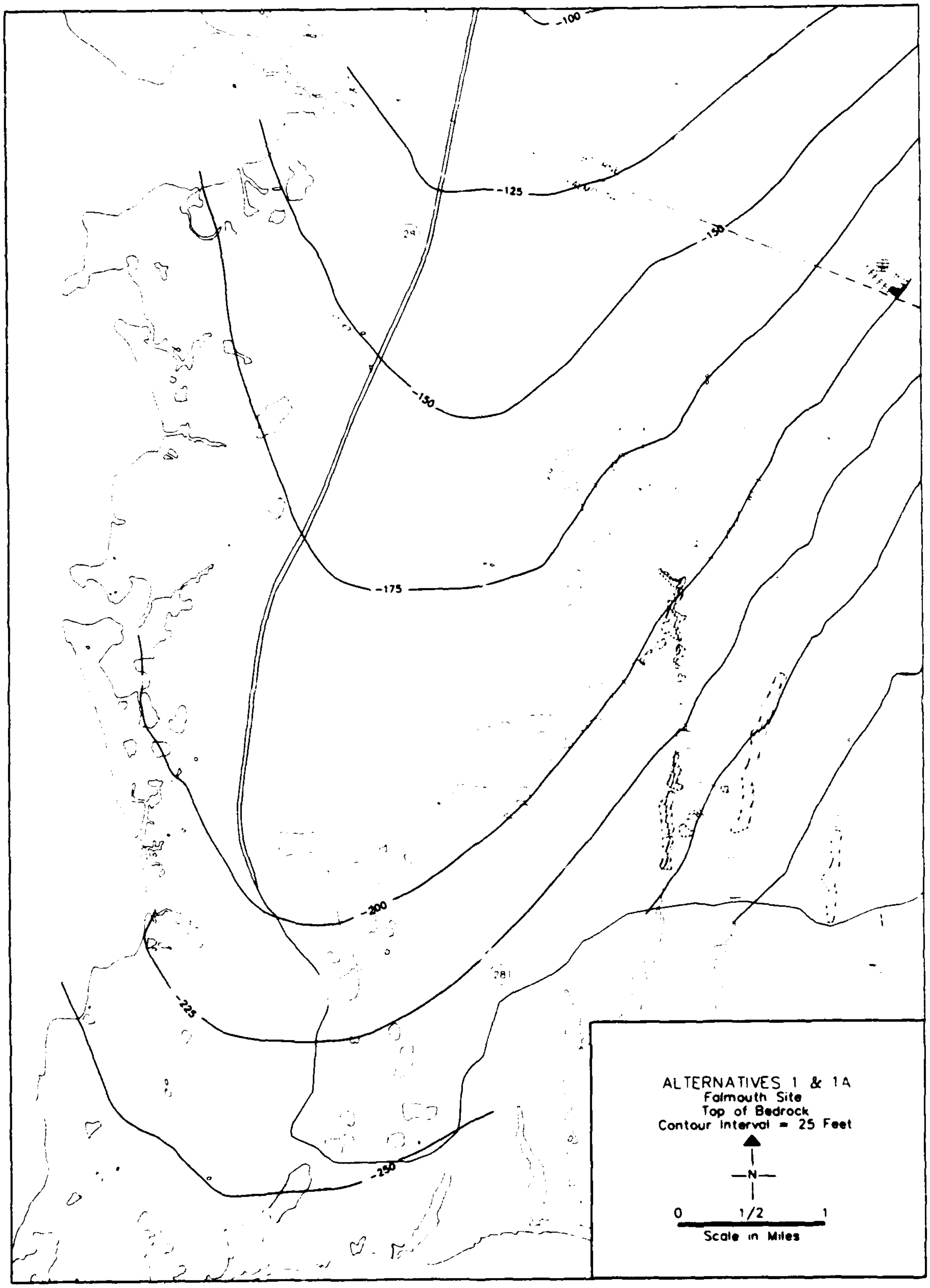

FIGURE 4.5 Top of Bedrock in the Falmouth Area, Site for Alternatives 1 and 1a (contours in ft relative to MSL)

Input Parameters

Figure 4.4 shows the boundary conditions for the Falmouth model. The east boundary that parallels the Coonamessett River and Coonamessett Pond was modeled as a constant-head boundary. The constant-head boundary along the Coonamessett River was based on the gradient from the Coonamessett Pond to the ocean. The northeast boundary parallels a line of equal head (LeBlanc and Guswa 1977) and was modeled as a constant-head condition (elevation = 35 ft); a segment of the north boundary parallels a stream line and was assigned a no-flow condition. A constant-head condition was selected for the west, south, and north boundaries that parallel the ocean.

In cross section, the model was assumed to be bounded on the bottom by impermeable bedrock. For the area (nodes) along the ocean, the location of the salt-water/fresh-water interface was estimated (Appendix G). Layers above the interface itself were assumed to have a constant-head condition of 0 ft, and the interface was modeled as a no-flow boundary. Moving inland from the ocean boundaries, the interface was estimated to be below the impermeable bedrock. The top boundary, which represents the water-table surface, was simulated as a constant-flux boundary due to recharge from precipitation.

The horizontal hydraulic conductivity values for the sediments were estimated from the aquifer testing by the USGS (LeBlanc 1984b). Initial values of hydraulic conductivity for the sand and gravel (Layer 1) and the fine sand and silt (Layer 2) of the Mashpee Pitted Plain were 380 ft/day and 38 ft/day, respectively. The values resulted in higher projected groundwater levels than the ones measured. During the calibration process, the hydraulic conductivity for the fine sand and silt (Layer 2) was increased to 100 ft/day. Hydraulic conductivity values of 120 ft/day for the Buzzards Bay outwash and 300 ft/day for the Buzzards Bay Moraine were entered in the model. Because of the absence of definable stratigraphic layers in the vicinity of the Buzzards Bay outwash and Buzzards Bay Moraine, hydraulic properties were assumed to remain constant with depth. The ratio of vertical-to-horizontal hydraulic conductivity was adjusted in the calibration process. The best results were obtained with a 10:1 ratio for Layer 1 of the Mashpee Pitted Plain deposits and a 100:1 ratio for Layer 2 of the Mashpee Pitted Plain deposits. The anisotropic values that resulted in a best fit between the projected and observed water-level values came from a ratio of 10:1 for the Buzzards Bay outwash and Buzzards Bay Moraine.

The porosity on Cape Cod is reported to range from 0.32 to 0.42 (LeBlanc 1984b). An estimated porosity value of 0.32 was used to obtain the most conservative modeling results during the contaminant-transport simulations.

The aquifer recharge was assumed to be from infiltration by precipitation (runoff was assumed negligible). An estimated recharge of 21 in./yr was the value used in the modeling (LeBlanc 1984b). Dispersivity values used in the simulations were 40 ft and 13 ft for longitudinal and transverse, respectively. A retardation value of 1, which corresponds to a distribution coefficient of 0, was used for nitrogen. Total nitrogen was the solute used to determine the extent of the altered groundwater plume.

Aquifer porosity and recharge, and dispersivity and retardation values are discussed in greater detail in Sec. 4.4.7.1 (Model Development for the Cape Cod Canal Site).

Disposal Conditions

Two different disposal rates at the Town of Falmouth's WWTP were simulated in conjunction with Alternatives 1 and 1a. These two disposal rates are in addition to the proposed effluent flow from the Otis WWTP. The two disposal rates include (1) the current disposal conditions, measured from September 1987 through October 1988; and (2) the maximum disposal capacity, as restricted by the Falmouth Class III permit. For the current conditions, the average wastewater discharge, measured from September 1987 through October 1988, was approximately 300,000 gal/day. During this period, 80,000 gal/day (28%) of the total effluent was disposed of in infiltration basins and 220,000 (72%) was disposed of by spray irrigation (Witt 1988).

The maximum design capacity of Falmouth's WWTP is 800,000 gal/day. There are no exact specifications for the percentage of wastewater that would be disposed of via infiltration basins and spray irrigation. Therefore, in the simulations, the current disposal percentages of 28% for infiltration basins and 72% for spray irrigation were used, resulting in 224,000 gal/day disposed of into infiltration basins and 576,000 gal/day of wastewater spray-irrigated.

The average nitrogen concentration measured in the treated wastewater from the Town of Falmouth's WWTP from September 1987 through October 1988 was 19.7 mg/L (Witt 1988). This nitrogen concentration was used for the wastewater disposed of into infiltration basins for both the current and maximum loading rates at the Falmouth WWTP. It was assumed that the nitrogen concentration of the spray-irrigated wastewater would be reduced by a conservative estimate of 25%, before it infiltrated to the unconfined aquifer. The 25% represents typical nitrogen removals for wooded, rather than grassy areas. This would be the result of nutrient removal by vegetation and soil. (The Falmouth WWTP uses natural forest vegetation in its spray-irrigation area.) As a result, the Falmouth WWTP spray-irrigated effluent was estimated to have an initial nitrogen concentration of 15 mg/L.

In the model simulations, disposal of current and maximum quantities of the Town of Falmouth's treated wastewater were simulated separately for Alternative 1 and 1a. The effluent discharge into infiltration basins was entered into five elements of the finite-element grid representing the five existing infiltration basins used at the Falmouth WWTP. The effluent disposed of by spray irrigation was entered into 10 elements of the grid representing the 65-acre acre designated at the Town of Falmouth's WWTP for spray irrigation.

In Alternative 1, the Otis wastewater would be pumped to the Falmouth WWTP for treatment and disposal in new infiltration basins approximately 500 ft north of the current basins (Fig. 4.6). Two loading rates from the Otis WWTP (300,000 gal/day and 500,000 gal/day) would be over and above the flow from the Falmouth WWTP. These conditions were simulated for an initial total nitrogen concentration of 19.7 mg/L. For

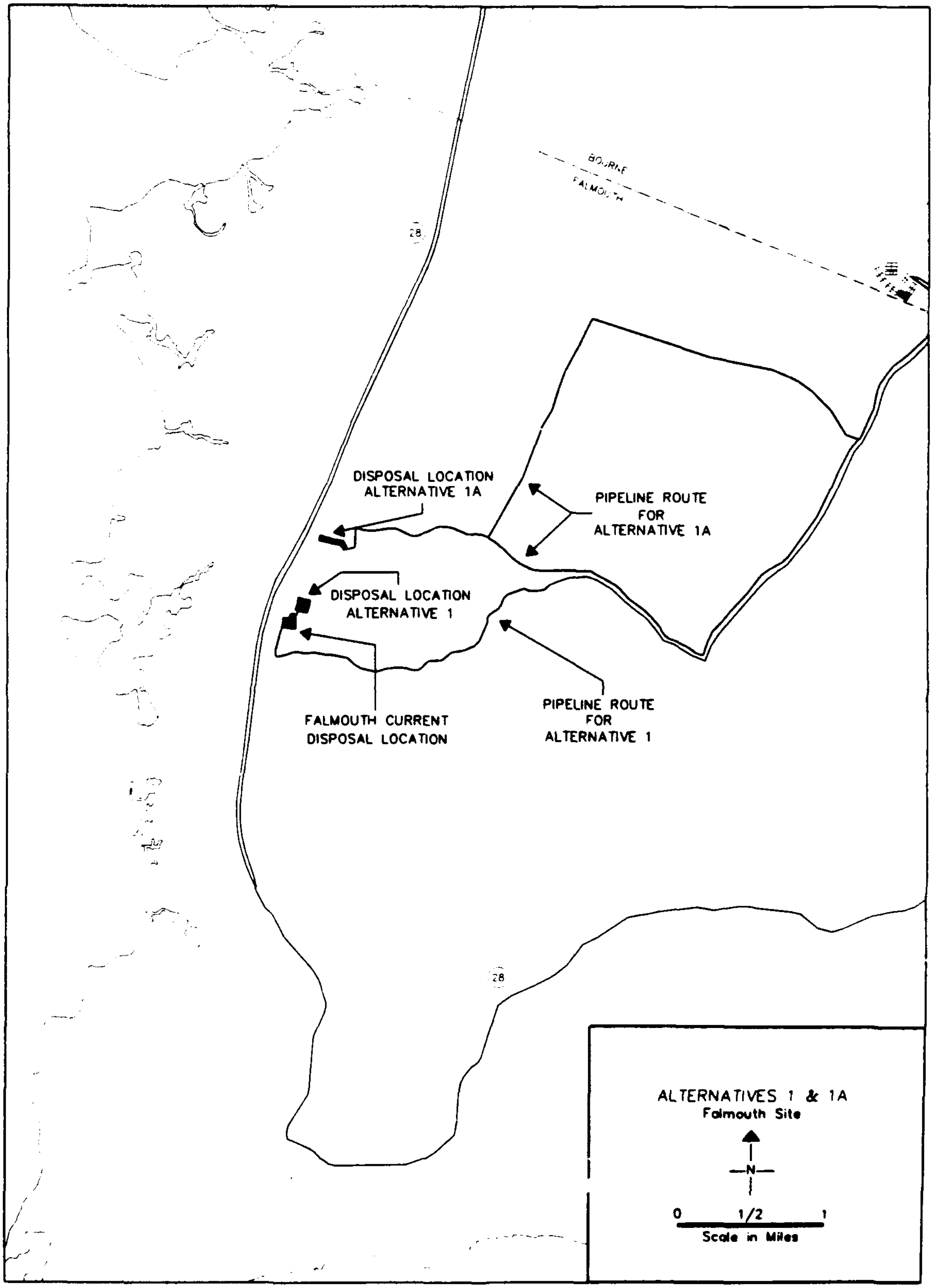

FIGURE 4.6 Location of Sand Filter Beds (black areas) in Falmouth Area, Site for Alternatives 1 and 1a

these simulations, the wastewater was entered into the two elements of the grid representing the proposed location of the infiltration basins. Table 4.5 summarizes the discussion that follows.

In Alternative 1a, the Otis treatment facility would be fully operational and the treated effluent would be pumped to the Falmouth WWTP for disposal. The Otis effluent should be disposed of in new infiltration basins south of Landers Road and approximately 18,000 ft north of the current basins (Fig. 4.6). The same two loading rates, 300,000 and 500,000 gal/day, were simulated, but the initial nitrogen concentration of the effluent treated at the Otis WWTP was reduced to 15 mg/L. The loading rates from the Falmouth WWTP remained the same as for Alternative 1, and had a concentration of 19.7 mg/L for the infiltration basins and 15 mg/L for the spray-irrigated wastewater. In these simulations, the Otis wastewater was entered into the two particular elements representing the proposed locations of the infiltration basins for this alternative.

After the flow model was calibrated (Fig. 4.7), the wastewater disposed of by infiltration basins was entered in the model with the assumption that it would pond at the surface and induce a slight downward gradient. Because of the nature of the CFEST code (fully saturated conditions), it was not possible to simulate the unsaturated zone. Therefore, the wastewater was applied directly to the water table. Based on the assumption that there was no unsaturated zone, the spray-irrigated wastewater was also applied directly to the water table in the model simulations. However, because the spray-irrigated water was distributed over a large area, it was assumed that no ponding would occur at the land surface for this disposal method.

CDM (1983) conducted a study to determine the destination of the groundwater plume extending from the Falmouth landfill area. The simulation models that were developed projected that the landfill plume would travel southwest from the landfill and pass to the north of Long Pond. The area within the path of the landfill plume in Figs. 4.8 through 4.19 represent the expected area through which 98% of the constituents would travel.

4.2.7.2 Modeling Results for Alternative 1

The observed water-table elevations (Fig. 4.3) were used for the flow model calibration. The input parameters, such as recharge, hydraulic conductivity, and anisotropy, were adjusted (within reasonable limits) until a best match was obtained between the predicted and observed water-level elevations. Figure 4.7 shows the calibrated model-projected water-level elevations.

The modeling results for Alternative 1, pumping untreated effluent to the Falmouth WWTP for treatment and disposal, coupled with the current disposal conditions at the Town of Falmouth's WWTP, are shown in Figs. 4.8 (300,000 gal/day) and 4.9 (500,000 gal/day), and listed in Table 4.5. The two loading rates, 300,000 gal/day and 500,000 gal/day, each with an initial nitrogen concentration of 19.7 mg/L, were simulated in conjunction with the current disposal conditions (described previously) at the Falmouth WWTP.

TABLE 4.5 Comparison of Alternatives 1 and 1a

	Otis Disposal		Falmouth Disposal[a]			Results		
Alternative	Loading Rate (gal/day)	Nitrogen Conc. (mg/L)	Loading Rate (gal/day)	Nitrogen Conc. (mg/L)	Area[b] (acres)	Maximum Water-level (ft)	Maximum Conc. of Nitrogen (mg/L)	See Also Fig. No.
1	300,000	19.7	80,000 224,000	19.7 15.0	7	1.1	17.7	4.8
1	500,000	19.7	80,000 224,000	19.7 15.0	23	1.6	19.2	4.9
1	300,000	19.7	224,000 576,000	19.7 15.0	29	1.5	18.0	4.10
1	500,000	19.7	224,000 576,000	19.7 15.0	60	2.0	19.3	4.11
1a	300,000	15.0	80,000 224,000	19.7 15.0	3	1.0	13.2	4.12
1a	500,000	15.0	80,000 224,000	19.7 15.0	6	1.5	14.2	4.13
1a	300,000	15.0	224,000 576,000	19.7 15.0	9	1.3	15.1	4.14
1a	500,000	15.0	224,000 576,000	19.7 15.0	11	1.8	15.1	4.15
1a[c]	300,000	15.0	80,000 224,000	19.7 15.0	3	1.1	13.5	4.16

TABLE 4.5 (Cont'd)

	Otis Disposal		Falmouth Disposal[a]			Results		
Alternative	Loading Rate (gal/day)	Nitrogen Conc. (mg/L)	Loading Rate (gal/day)	Nitrogen Conc. (mg/L)	Area[b] (acres)	Maximum Water-level (ft)	Maximum Conc. of Nitrogen (mg/L)	See Also Fig. No.
1a[c]	500,000	15.0	80,000 224,000	19.7 15.0	8	1.6	14.6	4.17
1a[c]	300,000	15.0	224,000 576,000	19.7 15.0	23	1.5	15.1	4.18
1a[c]	500,000	15.0	224,000 576,000	19.7 15.0	31	2.0	15.1	4.19

[a]The *current* disposal quantity of the Town of Falmouth's WWTP is 300,000 gal/day, with 80,000 gal/day (28%) disposed of in infiltration basins and 220,000 gal/day disposed of by spray irrigation. The *maximum* disposal quantity of the Falmouth WWTP is 800,000 gal/day, with 224,000 gal/day (28%) disposed of in infiltration basins and 576,000 gal/day disposed of by spray irrigation.

[b]Extent where groundwater contains 10 mg/L or greater nitrogen concentrations.

[c]Alternative 1a, treating the wastewater at the Otis WWTP, but disposing of it in the location of the Alternative 1 infiltration basins.

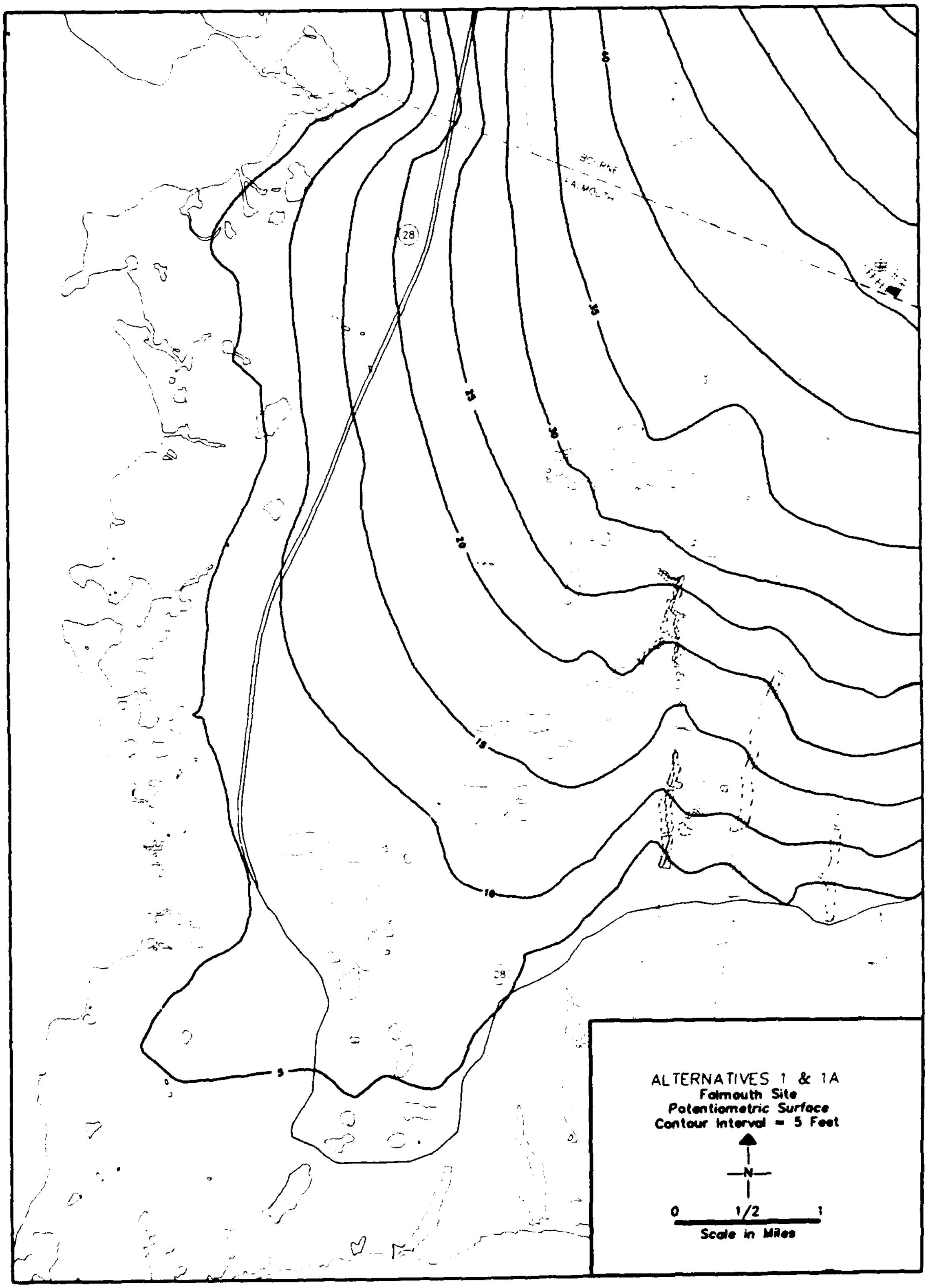

FIGURE 4.7 Projected Groundwater-Level Elevations for the Falmouth Area, Site for Alternatives 1 and 1a (contours in ft relative to MSL)

The results of the modeling projected that the areas with nitrogen concentrations of 10 mg/L or more would remain within the current Class III area, with the additional disposal of 300,000 gal/day or 500,000 gal/day of wastewater into two infiltration basins at the Falmouth WWTP (Fig. 4.6). The 300,000 gal/day and 500,000 loading rates predicted areas of approximately 7 acres (Fig 4.8) and 23 acres (Fig. 4.9), respectively, with nitrogen concentrations of 10 mg/L or greater in the groundwater. A maximum nitrogen concentration of 17.7 mg/L resulted from the 300,000 gal/day loading rate, and a maximum nitrogen concentration of 19.2 mg/L resulted from the 500,000 gal/day loading rate.

Groundwater mounding was observed in the simulations as a result of the additional wastewater added to the aquifer system. In the 300,000-gal/day simulation, there was a maximum increase of 1.1 ft in the water-level elevations; for 500,000 gal/day, there was a maximum water-level elevation increase of 1.6 ft. The projected groundwater mounding was observed primarily in the vicinity of the Falmouth WWTP.

The modeling results for the Alternative 1 disposal conditions of 300,000 gal/day and 500,000 gal/day, along with the maximum disposal capacity of the Falmouth WWTP, are shown in Figs. 4.10 and 4.11, respectively. (See also Table 4.5.)

Like the previous simulations, the results of the modeling projected the areas with 10 mg/L or more of nitrogen to remain within the current Class III area, with the additional disposal of 300,000 gal/day or 500,000 gal/day of wastewater into two new infiltration basins at the Falmouth WWTP (Fig. 4.6). The 300,000 gal/day loading rate projected an area of approximately 29 acres (Fig. 4.10) in the groundwater, with 10 mg/L or greater nitrogen concentrations; the 500,000 gal/day loading rate projected an area of 60 acres (Fig. 4.11). A maximum nitrogen concentration of 17.0 mg/L resulted from the 300,000 gal/day loading rate, and, for the 500,000 gal/day loading rate, the highest nitrogen concentration in the groundwater was 19.3 mg/L.

Once again, groundwater mounding, primarily in the vicinity of the Falmouth WWTP, was observed in the simulations as a result of the additional wastewater added to the aquifer system. However, simulating the Falmouth WWTP at maximum capacity projected the groundwater elevations to be higher than the previous simulations with Falmouth's current loading conditions. In the 300,000 gal/day simulation, there was a maximum increase of 1.5 ft in the water-level elevations; for 500,000 gal/day, the water elevations increased a maximum of 2.0 ft. Water elevations outside the designated Class III area showed minimal increase, with the additional wastewater added to the groundwater system. Therefore, the current migration direction of the plume from the Falmouth landfill area should not be altered by the wastewater added to the groundwater at the Falmouth WWTP.

An additional simulation was run to determine the effect on the unconfined aquifer using the 500,000 gal/day loading rate and the maximum disposal capacity of the Falmouth WWTP -- except that the pumping from Long Pond was increased from an average rate of 2.12 million gal/day to a summer rate of 4.14 million gal/day (CDM 1987). The modeling results projected the increased pumping to have a minimal effect on the groundwater elevations at the Town of Falmouth's WWTP. Therefore, the projected

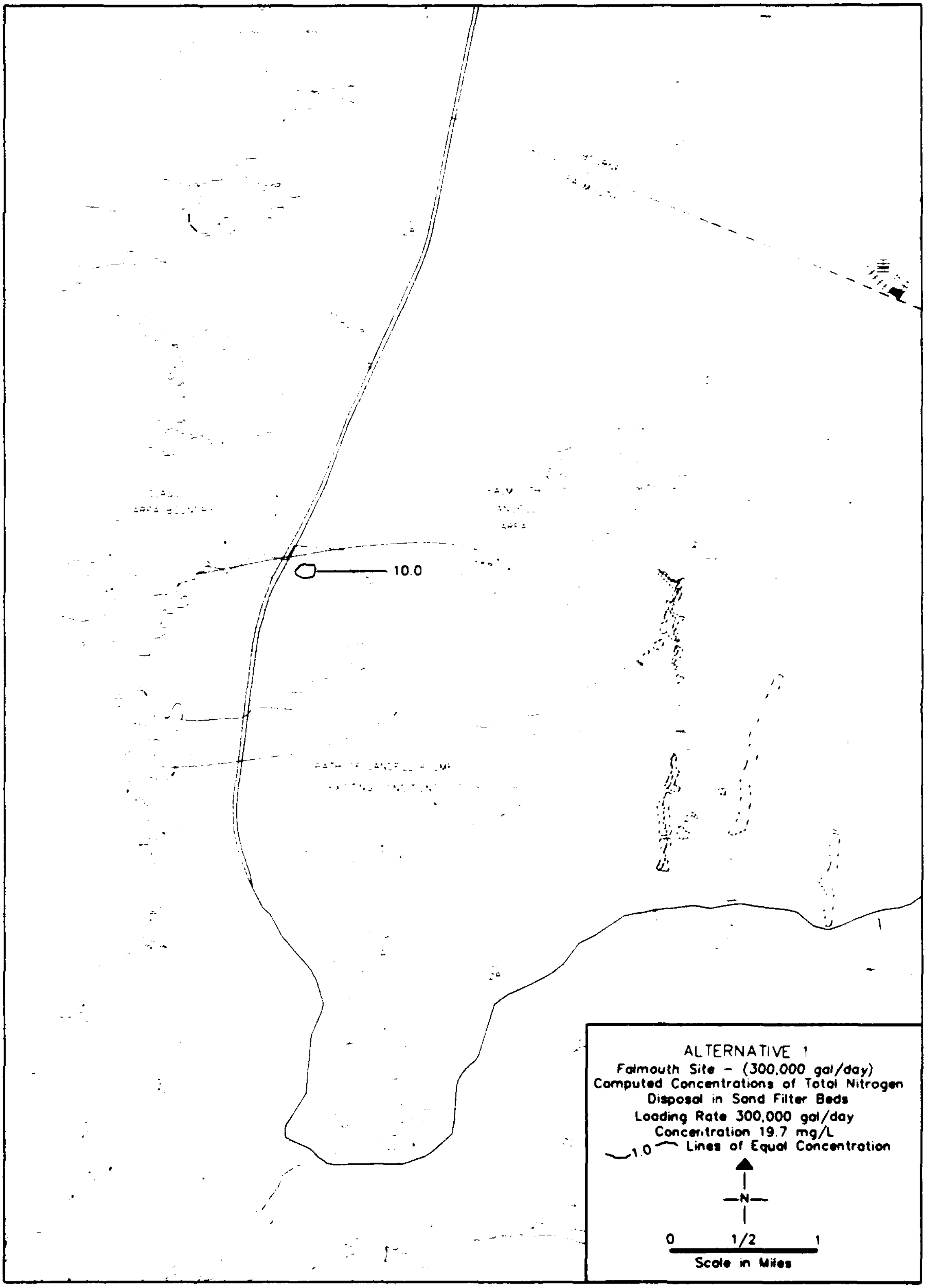

FIGURE 4.8 The 7-Acre Area Projected to Have a Nitrogen Concentration of ≥ 10 mg/L, at Loading Rate of *300,000 gal/day* and an *Initial Nitrogen Concentration of 19.7 mg/L* — Alternative 1 Site

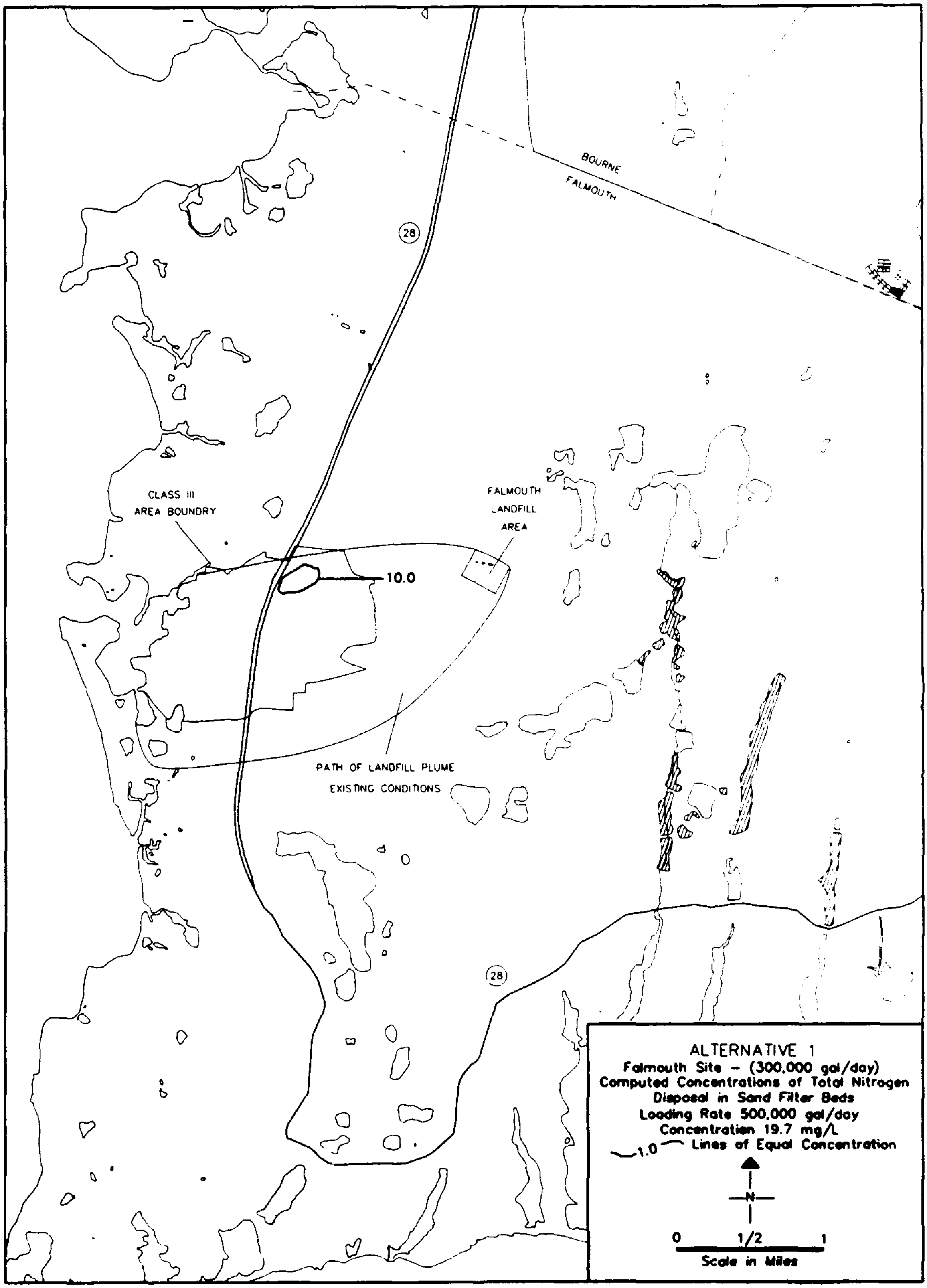

FIGURE 4.9 The 23-Acre Area Projected to Have a Nitrogen Concentration of ≥ 10 mg/L, at Loading Rate of *500,000 gal/day* and an *Initial Nitrogen Concentration of 19.7 mg/L* — Alternative 1 Site

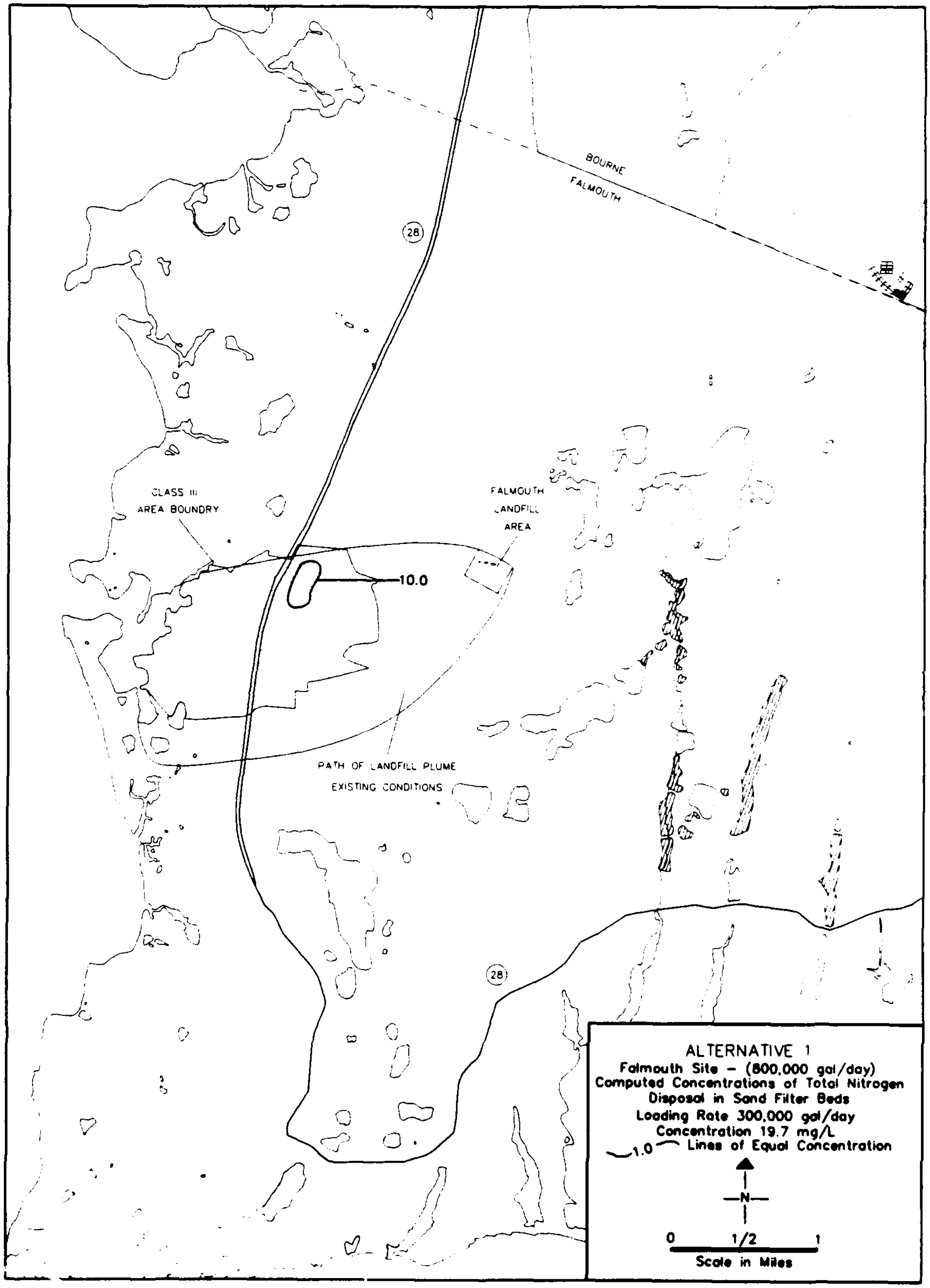

FIGURE 4.10 The 29-Acre Area Projected to Have a Nitrogen Concentration of ≥ 10 mg/L, at Loading Rate of *300,000 gal/day* and an *Initial Nitrogen Concentration of 19.7 mg/L* — Alternative 1 Site

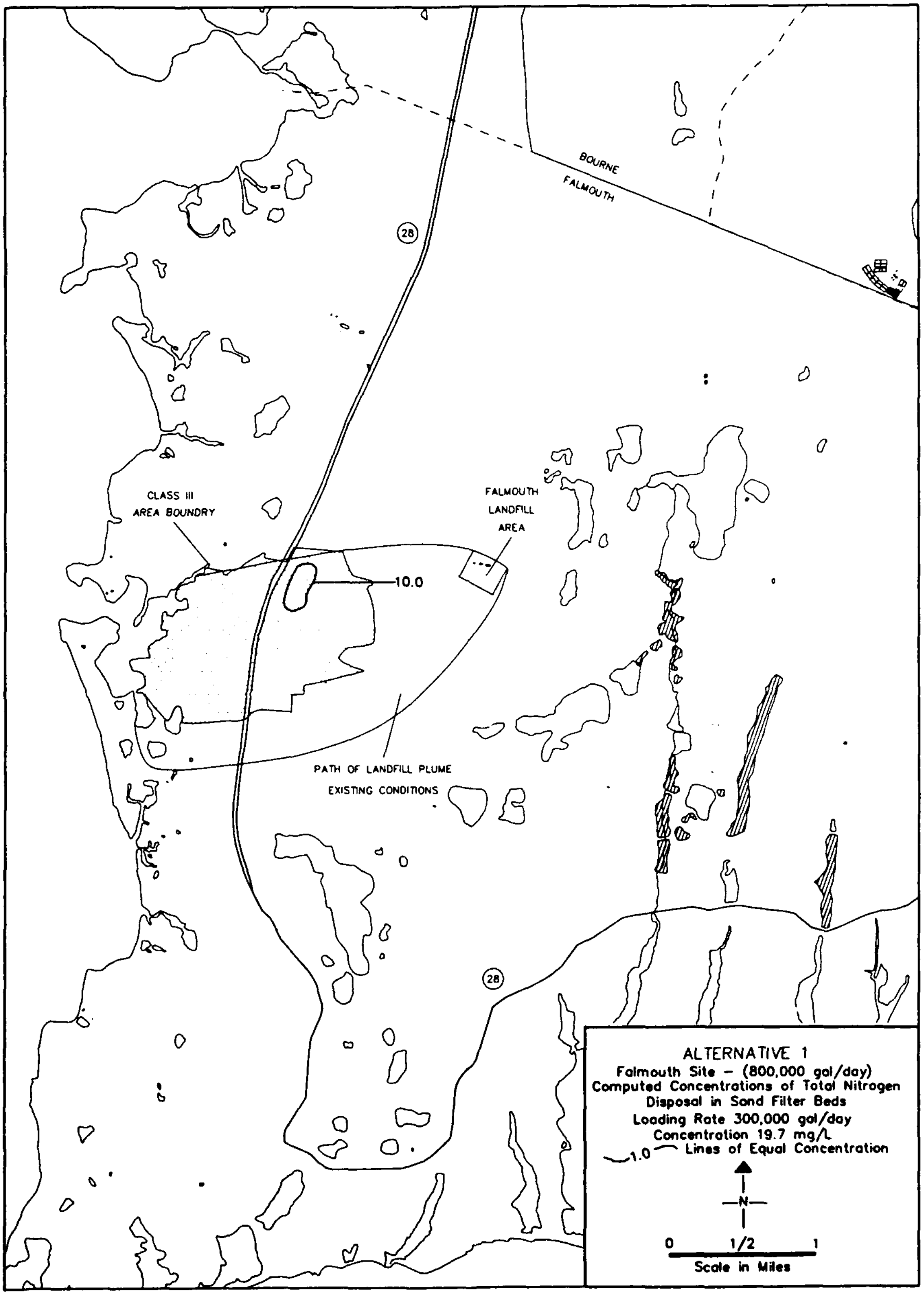

FIGURE 4.11 The 60-Acre Area Projected to Have a Nitrogen Concentration of ≥ 10 mg/L, at *Loading Rate of 500,000 gal/day* and an *Initial Nitrogen Concentration of 19.7 mg/L* — Alternative 1 Site

extent of the sewage plume, as shown in Fig. 4.11, did not change. CDM (1987) also observed in its previous modeling effort that seasonal pumping conditions at Long Pond have a minimal impact on water-surface elevations in the area of the Falmouth WWTP.

4.2.7.3 Modeling Results for Alternative 1a

The modeling results for Alternative 1a, pumping treated effluent to the Town of Falmouth's WWTP for disposal into two new infiltrations basins in conjunction with the current disposal conditions at Falmouth's WWTP are shown in Figs. 4.12 (300,000 gal/day loading rate) and 4.13 (500,000 gal/day loading rate), and listed in Table 4.5. The two loading rates, each with an initial nitrogen concentration of 15.0 mg/L, were simulated in conjunction with the current disposal conditions at the Falmouth WWTP, as described in Section 4.2.7.1.

The results of the modeling projected that the current Class III area would have to be extended to the north with the additional wastewater added to the sand filter beds north of the treatment plant. The 300,000 gal/day and 500,000 gal/day loading rates projected areas of approximately 3 acres (Fig. 4.12) and 6 acres (Fig 4.13), respectively, with 10 mg/L or greater nitrogen concentrations in the groundwater. A maximum nitrogen concentration of 13.1 mg/L total nitrogen was projected for the 300,000 gal/day loading rate; for the 500,000 gal/day rate, the highest projected concentration of total nitrogen in the groundwater was 14.2 mg/L. These maximum nitrogen concentrations occur in the area of the proposed location of the new infiltration basins.

Groundwater mounding was again projected from the simulations as a result of the additional wastewater added to the unconfined aquifer system. The maximum groundwater mounding was in the area of the proposed infiltration basins, with a 1-ft projected increase in water-level elevations for the 300,000 gal/day loading rate. For the 500,000 gal/day loading rate, water-level elevations are projected to increase 1.5 ft in the area of the basins. These maximum projected water-level elevations were in the area of the basins because the Otis WWTP loading rates were distributed over a much smaller area compared to the wastewater disposal at the Falmouth WWTP.

The modeling results for this alternative, coupled with the maximum disposal capacity of the Falmouth WWTP are shown in Figs. 4.14 and 4.15, respectively, and listed in Table 4.5.

The results of the modeling again projected that the current Class III area would have to be extended to the north, with the additional wastewater from the Otis WWTP added to new infiltration basins. The projected areas of 10 mg/L or greater nitrogen concentrations in the groundwater were approximately 9 acres (Fig. 4.14) and 11 acres (Fig. 4.15), respectively, for the 300,000 and 500,000 gal/day loading rates. A maximum nitrogen concentration of 15.1 mg/L resulted from both the 300,000 gal/day and 500,000 gal/day loading rates. The maximum projected nitrogen concentration (15.1 mg/L) for these two simulations occurred in the immediate vicinity of the Falmouth WWTP, as a result of simulating the maximum disposal capacity of the WWTP. In addition, the maximum nitrogen concentration is slightly greater than the initial nitrogen concentration of the Otis wastewater. This is due to the addition of the Otis

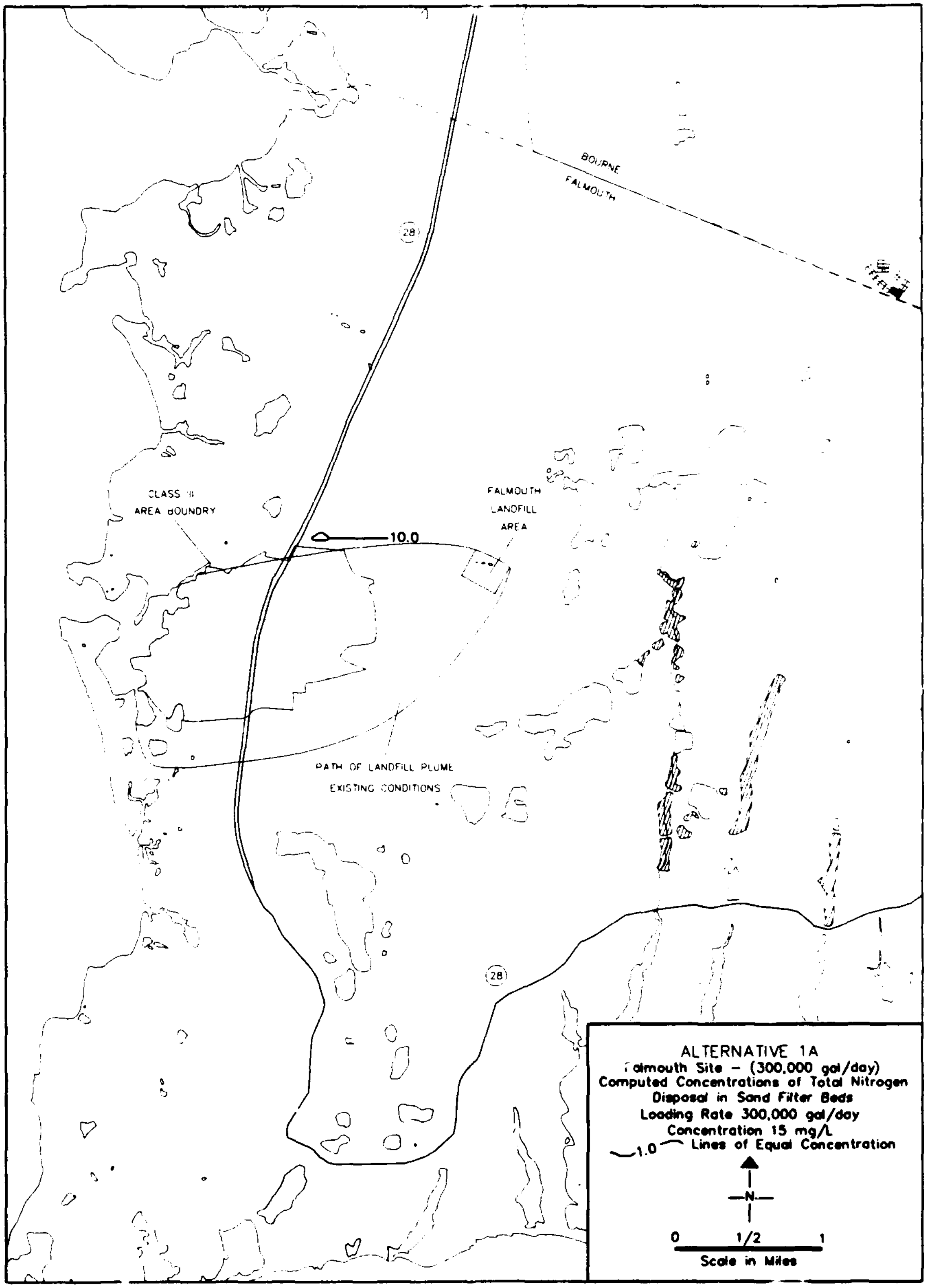

FIGURE 4.12 The 3-Acre Area Projected to Have a Nitrogen Concentration of ≥ 10 mg/L, at Loading Rate of *300,000 gal/day* and an *Initial Nitrogen Concentration of 15 mg/L* — Alternative 1a Site

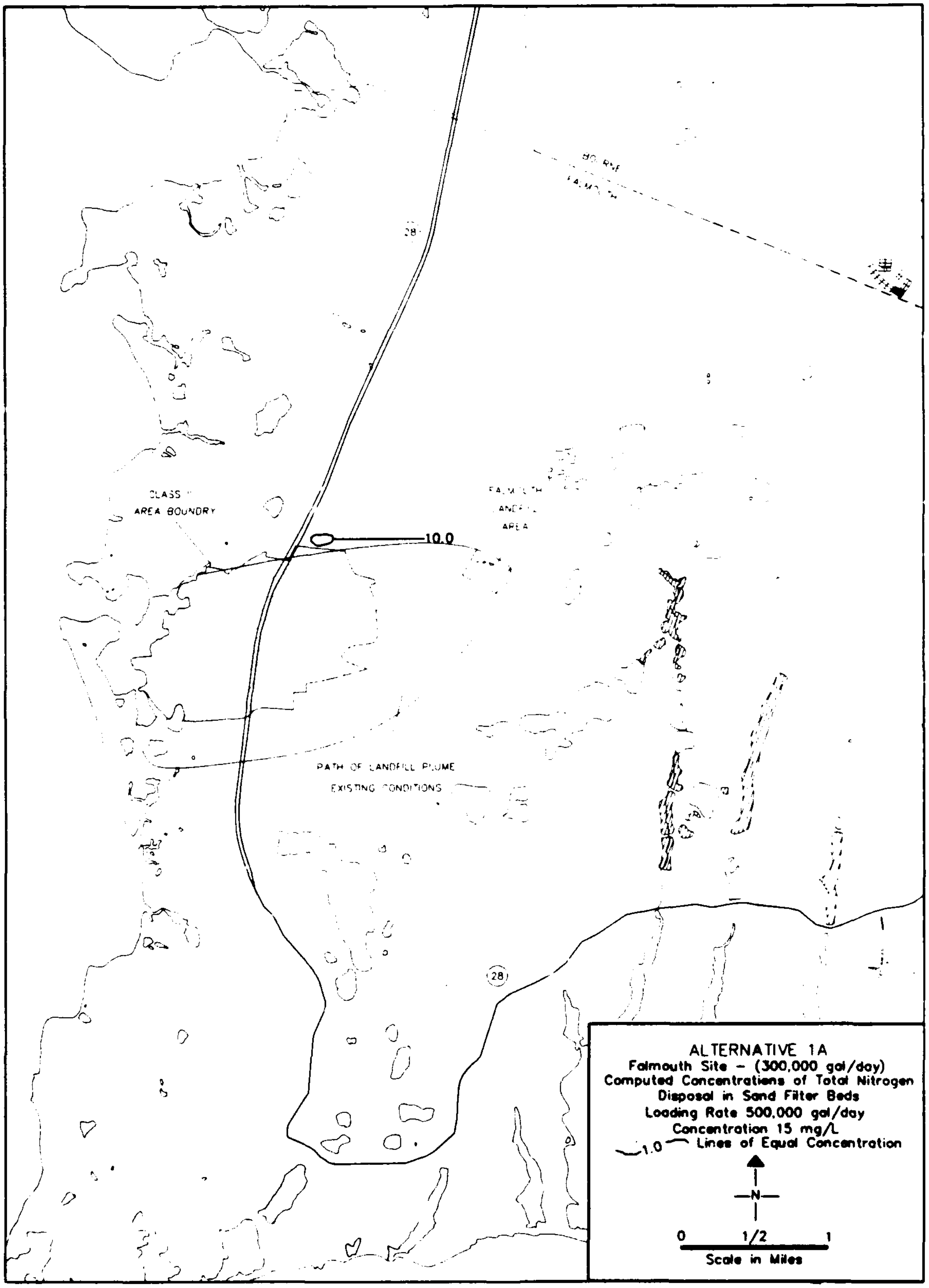

FIGURE 4.13 The 6-Acre Area Projected to Have a Nitrogen Concentration of ≥ 10 mg/L, at Loading Rate of *500,000 gal/day and an Initial Nitrogen Concentration of 15 mg/L* — Alternative 1a Site

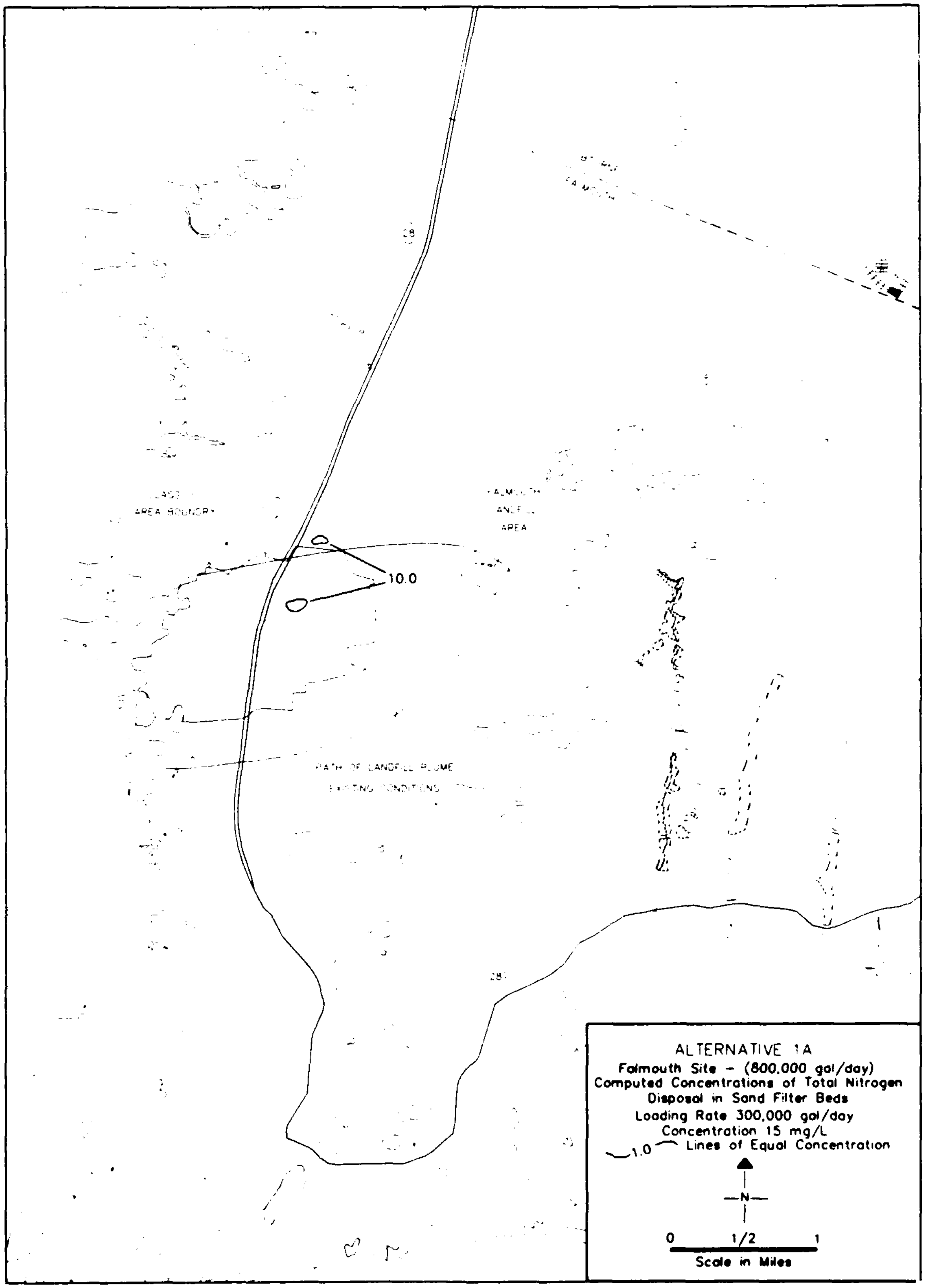

FIGURE 4.14 The 9-Acre Area Projected to Have a Nitrogen Concentration of ≥ 10 mg/L, at Loading Rate of *300,000 gal/day* and an *Initial Nitrogen Concentration of 15 mg/L* — Alternative 1a Site

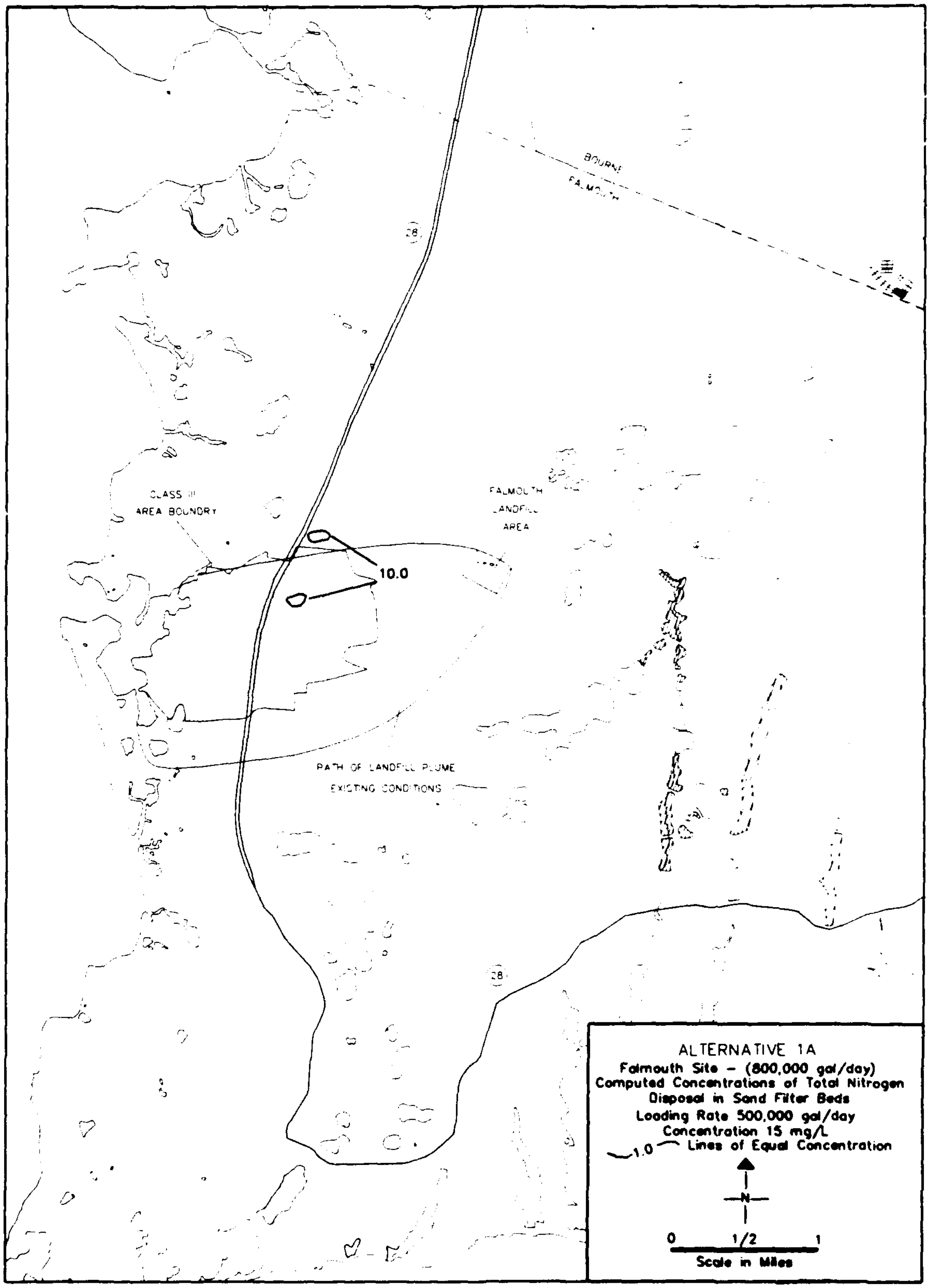

FIGURE 4.15 The 11-Acre Area Projected to Have a Nitrogen Concentration of ≥ 10 mg/L, at Loading Rate of *500,000 gal/day* and an *Initial Nitrogen Concentration of 15 mg/L* — Alternative 1a Site

wasterwater to the wastewater disposal by the Falmouth WWTP (which had a nitrogen concentration of 19.7 mg/L).

The projected groundwater mounding is again observed in the vicinity of the infiltration basins and in the area of the Falmouth WWTP. For the 300,000 gal/day loading rate, the groundwater levels increased 1.3 ft in the area of the new basins and 1.3 ft in the vicinity of the Falmouth WWTP. However, for the 500,000 gal/day loading rate, the maximum projected increase in water-level elevations was in the area of the new infiltration basins, at 1.8 ft. Again, the increase in the water-level elevations in this area is attributed to the Otis WWTP effluent being distributed over a smaller area relative to the disposal area and rates at the Falmouth WWTP. The groundwater elevations south of the WWTP changed a minimal amount, as projected in the other simulations.

The increase in the Class III area, as defined by the 10 mg/L or greater nitrogen-concentration boundaries, is more a factor of the proposed location of the new infiltration basins than of loading rates or initial concentration. Therefore these results led to another modeling scenario in which the infiltration basins to be used in Alternative 1 (located closer to basins currently being used by the Town of Falmouth), were used for disposing of the effluent treated at the Otis WWTP. Four simulations were run for the two loading rates of 300,000 and 500,000 gal/day with both the current and maximum disposal capacity at the Falmouth WWTP. The results of these simulations are shown in Figs. 4.16-4.19 and listed in Table 4.5.

The modeling results for all four of these simulations projected the area of 10 mg/L or greater nitrogen concentration in the groundwater to remain within the Class III area. Simulating the current disposal conditions at the Falmouth WWTP with the two loading rates, 300,000 gal/day and 500,000 gal/day, the 10 mg/L or greater nitrogen-concentration areas included approximately 3 acres (Fig. 4.16) and 8 acres (Fig. 4.17) respectively. A maximum nitrogen concentration of 13.5 mg/L resulted from the 300,000 gal/day loading rate, and a maximum nitrogen concentration of 14.6 mg/L in the groundwater resulted from the 500,000 gal/day loading rate.

Entering the maximum disposal capacity of the Falmouth WWTP, the projected areas in the groundwater with a nitrogen concentration of 10 mg/L or more were 23 acres (Fig. 4.18) and 31 acres (Fig. 4.19), respectively, for the 300,000 and 500,000 gal/day loading rates. The maximum nitrogen concentration was 15.1 mg/L for both the 300,000 gal/day and 500,000 gal/day loading rates. These projected maximum nitrogen concentrations, like the previous simulations, occur in the immediate vicinity of the Falmouth WWTP, as a result of simulating the maximum disposal capacity of the WWTP. As previously stated, the projected maximum nitrogen concentration is slightly greater than the initial nitrogen concentration of the Otis wastewater. This is due to the addition of the Otis wastewater to the simulated wastewater disposal by the Falmouth WWTP.

The projected increase in groundwater elevation for the four additional simulations was the same as described for Alternative 1 since the same loading rates were used and only the initial nitrogen concentrations were different.

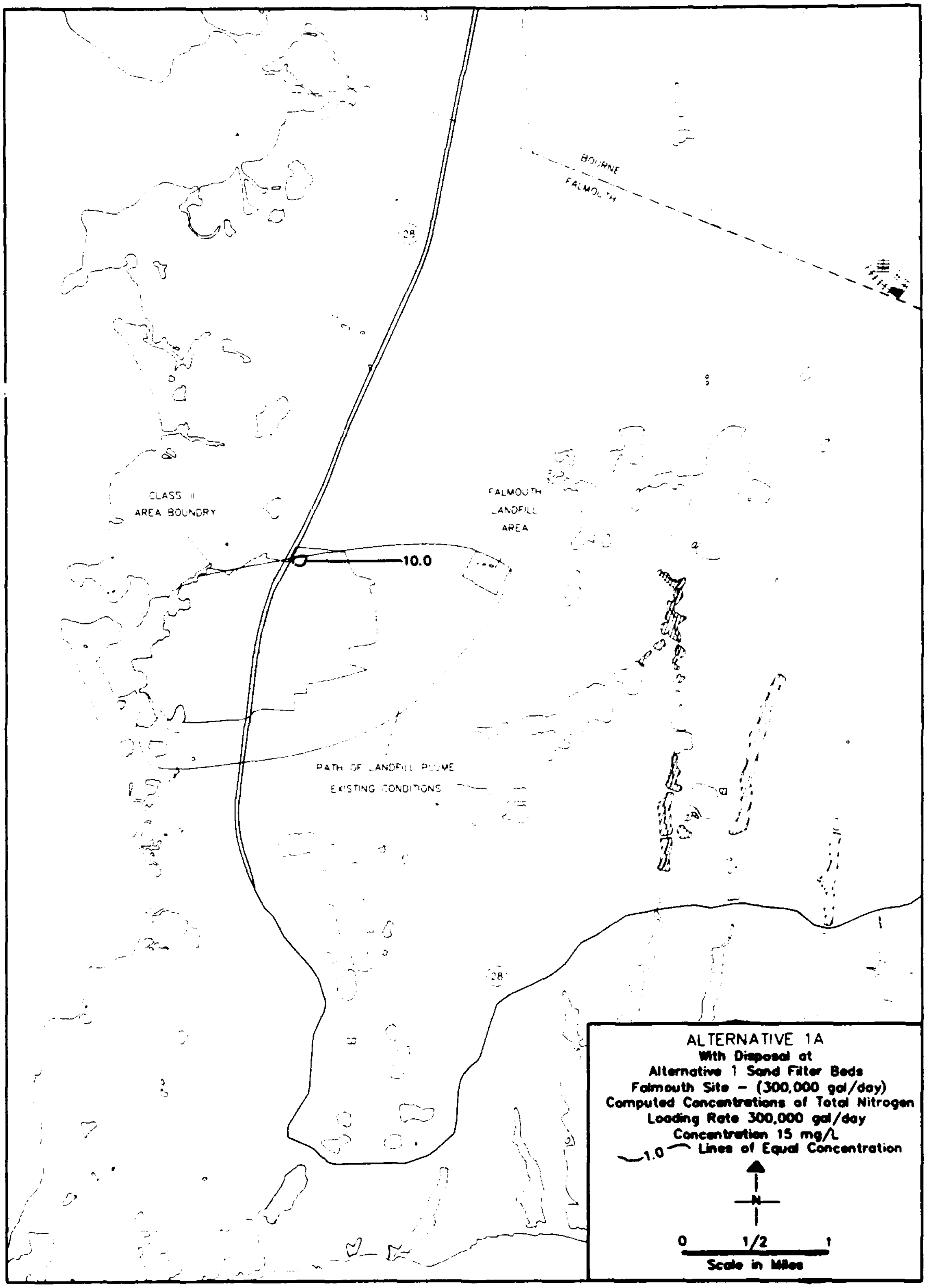

FIGURE 4.16 The 3-Acre Area Projected to Have a Nitrogen Concentration of ≥ 10 mg/L, at Loading Rate of *300,000 gal/day* and an *Initial Nitrogen Concentration of 15 mg/L* — Alternative 1a Site, but with Infiltration Basins at Alternative 1 Site

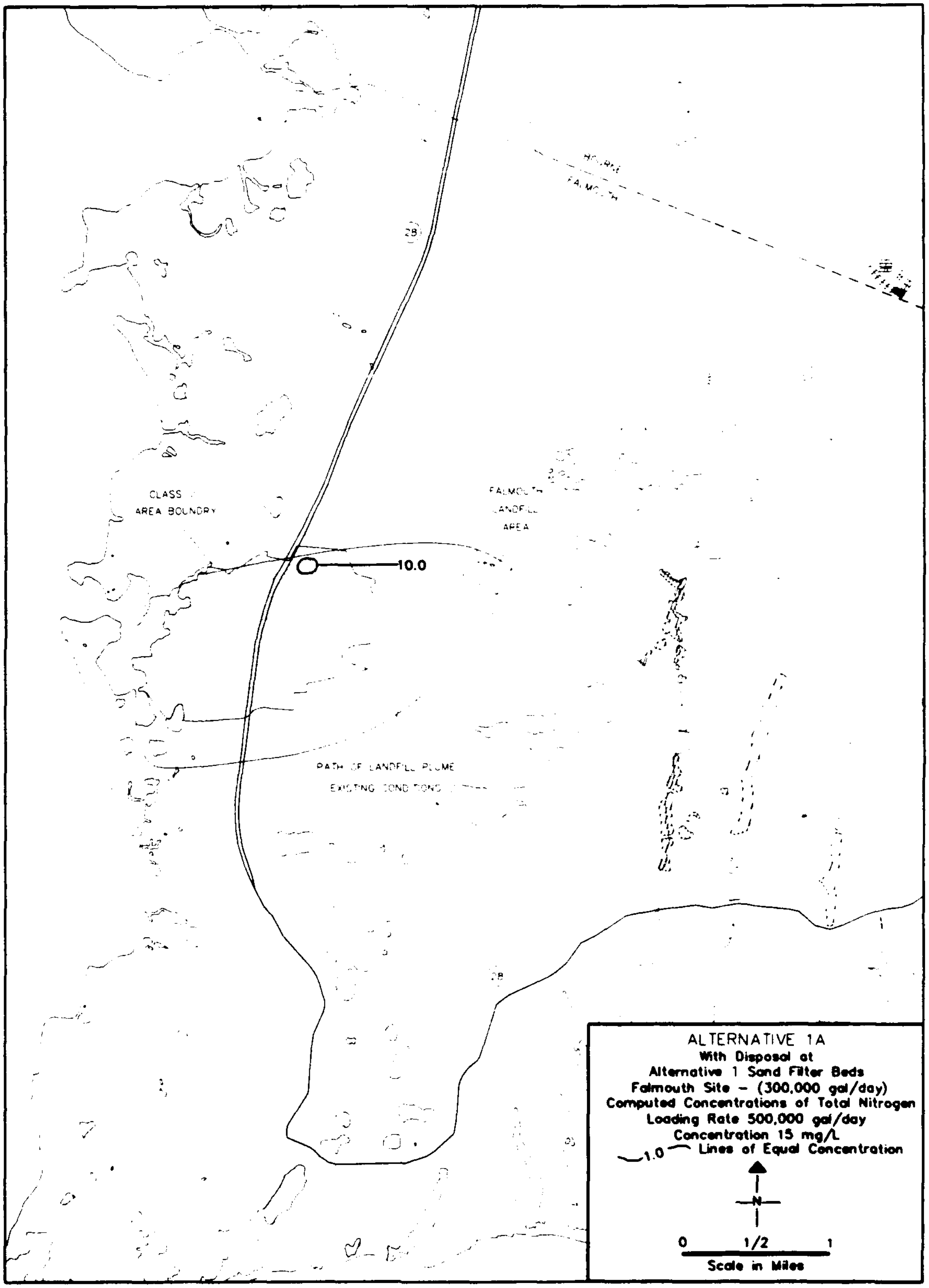

FIGURE 4.17 The 8-Acre Area Projected to Have a Nitrogen Concentration of ≥ 10 mg/L, at Loading Rate of *500,000 gal/day* and an *Initial Nitrogen Concentration of 15 mg/L* — Alternative 1a Site, but with Infiltration Basins at Alternative 1 Site

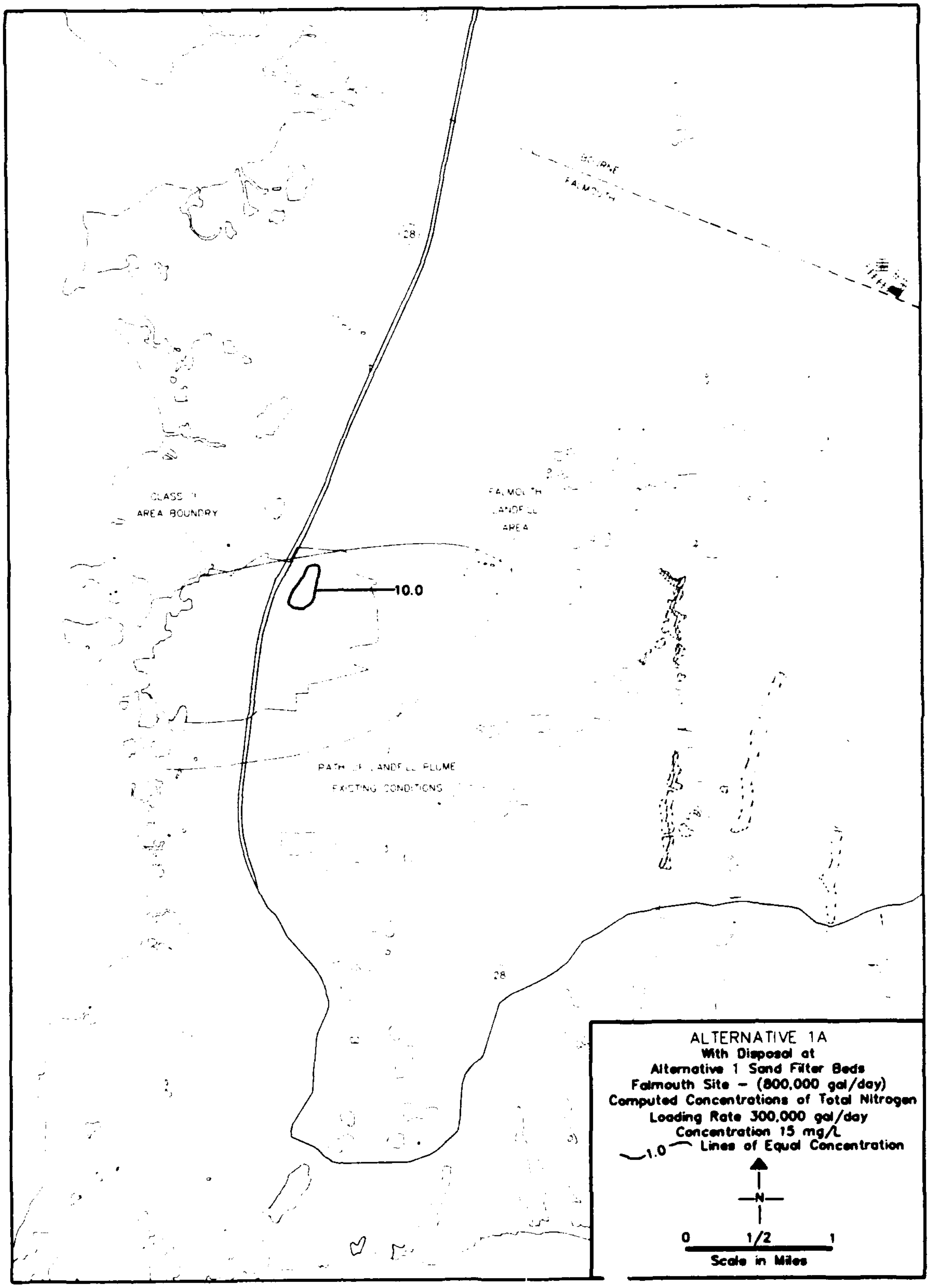

FIGURE 4.18 The 23-Acre Area Projected to Have a Nitrogen Concentration of ≥ 10 mg/L, *at Loading Rate of 300,000 gal/day, an Initial Nitrogen Concentration of 15 mg/L,* and Assuming *Maximum Disposal Capacity Being Used at Falmouth WWTP* — Alternative 1 Site

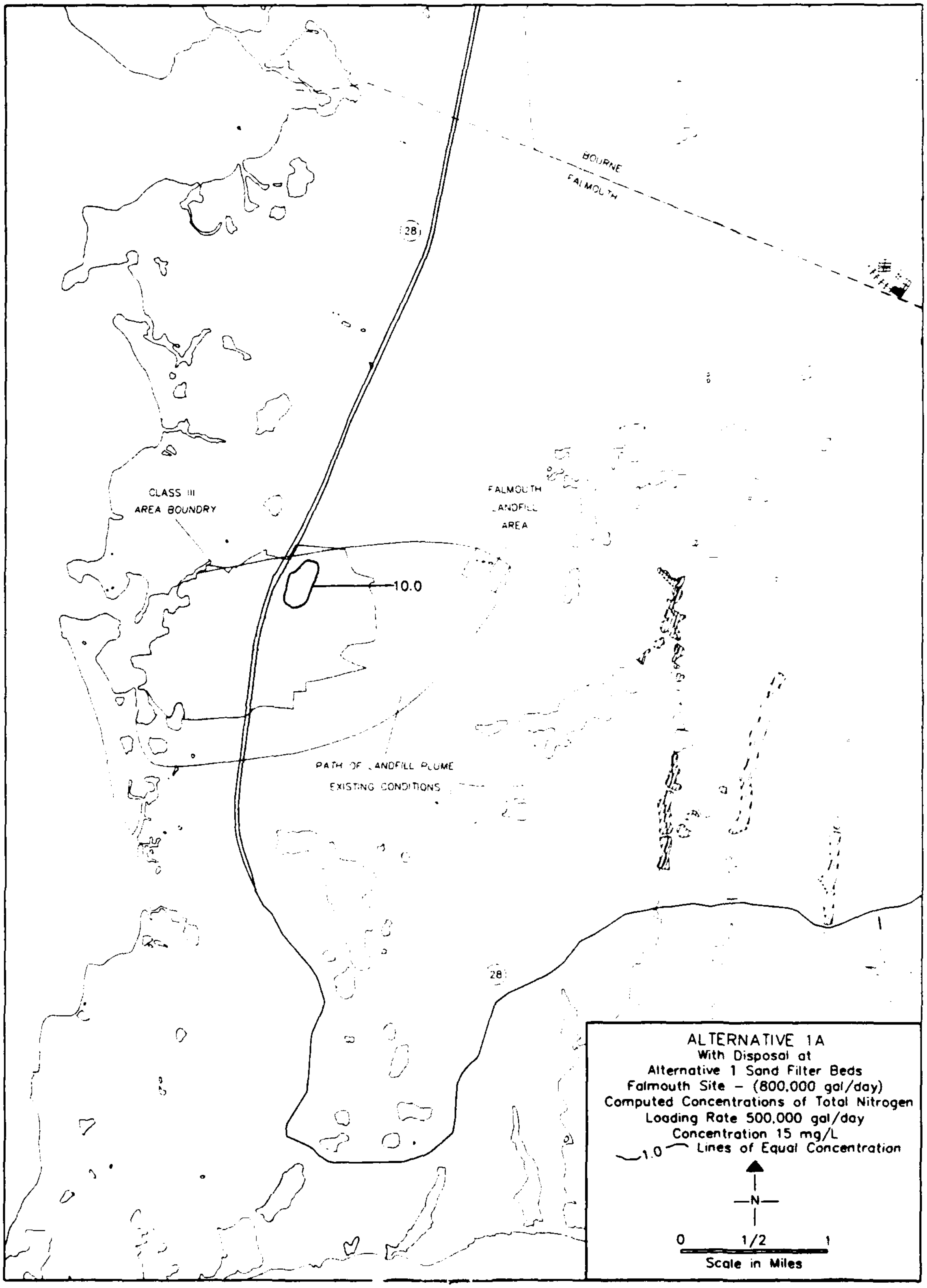

FIGURE 4.19 The 31-Acre Area Projected to Have a Nitrogen Concentration of ≥ 10 mg/L, at *Loading Rate of 500,000 gal/day, an Initial Nitrogen Concentration of 15 mg/L,* and Assuming *Maximum Disposal Capacity Being Used at Falmouth WWTP* — Alternative 1a Site, but with Infiltration Basins at Alternative 1 Site

4.3 ENVIRONMENTAL CONSEQUENCES FOR THE MMR DUE TO ALTERNATIVES 2 AND 3

Impacts on the MMR's environment associated with Alternatives 2 and 3 follow. These, too, are divided into six groups: archaeological and historical conditions, socioeconomic conditions, land transportation, natural resources, endangered and threatened species, and land use. In this section the results from the groundwater-flow and contaminant-transport modeling, associated with disposing of the effluent via spray irrigation (Alternative 2) and upgrading the existing wastewater treatment facility (Alternative 3) are also described in detail. (Appendix H describes in greater detail the background and assumptions of nitrogen removal using the spray-irrigation alternative.)

4.3.1 Archaeological and Historical

Alternatives 2 and 3 could have adverse effects on currently unrecorded archaeological sites (surficial and buried), based on the known distribution of sites in the area (see Sec. 3.11.2). It would be necessary for the Massachusetts Historical Commission to review detailed design plans for these alternatives; a survey of affected areas may be required, particularly for previously undisturbed ground (Mills 1988).

4.3.2 Socioeconomic Conditions

The socioeconomic impact associated with Alternatives 2 and 3 would be minimal. There are no population changes associated with these alternatives. Construction costs and work force requirements are well within the range of available contractors located on Cape Cod or other nearby areas.

4.3.3 Land Transportation

4.3.3.1 Alternative 2

The construction of new storage lagoons would cause minor increases in traffic at the entrance gates to the MMR during the construction phase of the project.

4.3.3.2 Alternative 3

The additional use of land at the Otis WWTP associated with this alternative is consistent with existing land use in the area. Adverse impacts associated with traffic flow are not anticipated under this alternative.

4.3.4 Natural Resources

4.3.4.1 Alternative 2

Terrestrial Resources

The potential impacts of spray irrigation, Alternative 2, on terrestrial resources involve the disturbance of a relatively large area; the conversion of forest habitats to low-growing vegetation or crop cover; and increased exposure of soil, plants, and animals to minimal-level nutrients and heavy metals.

Alternative 2 would disturb a little more than 71 acres (Table 2.1). Most of the disturbance (about 60 acres) would involve the replacement of forest vegetation with grass/legume mixtures in the spray-irrigation areas. A smaller area (about 11.1 acres) would be used for lagoons and storage of treated effluent. These changes would alter the immediate area of the Otis WWTP from one that is predominately forested to a predominately open area of low-growing vegetation (see Sec. 3.7). This conversion would probably have adverse effects on some populations of forest-dwelling wildlife such as ruffed grouse, great crested flycatchers, woodpeckers, tree squirrels, and gray foxes (DeGraaf and Rudis 1980). On the other hand, species that utilize open areas or agricultural lands would probably benefit (e.g., bobwhite quail, pheasants, sparrows, rabbits, red fox, and white-tailed deer) (DeGraaf and Rudis 1980). Adverse impacts would be moderated and to a large extent offset by beneficial effects of four kinds: (1) most species use both forested and open areas, and the increased forest-edge areas would benefit these populations (DeGraaf and Rudis 1980); (2) there would be buffer strips of forest between irrigated areas and other openings; (3) abundant forest cover exists to the east, south, and west of the Otis WWTP area; and (4) the increased nutritional quality of irrigated vegetation would, in general, support higher densities of wildlife (Nagy and Haufler 1980).

When treated effluent is used for spray irrigation, a number of processes are at work to alter the physical and chemical composition of the effluent waters: chemical precipitation, volatilization, ion exchange, microbial action, biological transformation, and biological absorption through root systems (Sopper 1986; Jordan 1987; Zirschky and Abernathy 1987). It has been demonstrated in numerous field tests that spray irrigation of actively growing vegetation with treated effluent waters will result in (1) substantial removal of chemicals from the water, (2) increased nutritional quality of soils and vegetation, and (3) increased yields (production) of vegetation (Jordan 1987; Zirschky and Abernathy 1987; Vaccaro et al. 1979; Sopper 1971, 1986). Achievement of these favorable results requires that (1) application rates (i.e., nutrient loading) be kept low enough for soils and vegetation to be able to retain and/or absorb nutrients, (2) effluent be reasonably free of toxic materials or toxic concentrations of normally benign or even essential elements, and (3) vegetation be kept in an actively growing stage (usually by periodic harvest) (Jordan 1987; Sopper 1986; Hook and Kardos 1978; Hansen and Chaney 1984). The low concentrations of nutrients and heavy metals in MMR effluent would meet these requirements (Vaccaro et al. 1979; Reish 1984; LeBlanc 1984c; CDM 1985).

The poor-quality soils of the Cape are low in nitrogen and, even with the addition of wastewater, nitrogen remains a limiting nutrient (Vaccaro et al. 1979). Plants require much more nitrogen than phosphorus, but the wastewater has almost as much phosphorus (by weight) as nitrogen; consequently, phosphorus is underutilized and tends to accumulate in the upper layer (top 1 ft) of soil (Vaccaro et al. 1979). The uptake of phosphorus by plants can be increased if a nitrogen-fixing plant species such as alfalfa is planted along with the other crop species used on the spray-irrigation plots (Vaccaro et al. 1979). In addition to nitrogen and phosphorus, plants may accumulate numerous other elements from wastewater: manganese, potassium, zinc, magnesium, cadmium, lead, selenium, boron, and molybdenum (Vaccaro et al. 1979; Hansen and Chaney 1984).

Several researchers have noted that phosphorus and other elements such as iron, manganese, copper, cadmium, chromium, nickel, and lead often accumulate in the top layers of the soil when wastewaters are applied to vegetated areas (Meade and Vaccaro 1971; Red and Nutter 1986; Woodwell et al. 1976; Hansen and Chaney 1984). Elements that were entering the groundwater in test applications at Otis included sodium, potassium, and boron (Vaccaro et al. 1979).

At certain concentrations, some elements can be harmful to plants: aluminum, iron, manganese, zinc, copper, nickel, arsenic, boron, lead, mercury (Hansen and Chaney 1984; Daubenmire 1974). Most of these would be toxic to plants before reaching concentrations that would be harmful to animals (Hansen and Chaney 1984). Heavy metals may accumulate in some wildlife species when wastewater or sewage sludge are applied to forests or croplands, but the amounts have not resulted in measurable or observed harm to small mammals in general (Woodyard et al. 1986), earthworms and birds (Hansen and Chaney 1984), or rabbits (Dressler et al. 1986). Dressler et al. (1986) found that rabbits feeding on sludge-treated vegetation in Pennsylvania accumulated zinc, but that all other heavy metals in the sample rabbit tissue were not significantly different from tissue in the control group. In addition, the low concentrations of heavy metals in the treated effluent (e.g., cadmium, 0.00024 mg/L; lead, 0.00054 mg/L; zinc, 0.047 mg/L) would not pose a hazard to wildlife.

Irrigation of food crops with treated wastewater is a common practice in the state of California (Pettygrove and Asano 1985). There have been no confirmed disease outbreaks in California as a result of the use of treated wastewater in irrigation systems (Cook 1985). Treatment with chlorine removes in excess of 90% of the pathogenic bacteria in wastewater (Cook 1985). In addition, storage of treated water in lagoons prior to irrigation has been found to reduce bacteria and virus levels by four orders of magnitude (Kott et al. 1978). While aerosols from spray irrigation can be carried as far as 1,000 m under strong wind conditions (Sepp 1971), the forested conditions around the Otis WWTP would result in deposition occurring at distances of less than 1,000 meters. In summary, the forested conditions around the Otis WWTP, the relative isolation of this area from inhabited areas, and the irrigation of nonfood crops reduces human exposure to bacteria, viruses, and heavy metals to negligible levels.

Aquatic Resources

The conversion from the use of infiltration basins to spray irrigation is essentially a type of upgrading of the existing facilities; more components of the effluent (in particular, phosphorus and nitrogen compounds) would be removed before reaching groundwater because of increases in volatilization, microbial action, and absorption by plants and soil. Consequently, fewer nutrients capable of causing algal blooms and other adverse consequences would reach Ashumet Pond.

To lessen the potential for impacts on Ashumet Pond from spray irrigation, one modification to this alternative proposed by CDM (1985) should be made. CDM identified five potential areas for spray irrigation; the area to the east of the existing WWTP facilities should probably *not* be used because of its relative nearness (about 1,000 ft) to Ashumet Pond and because it occurs over the probable groundwater recharge area of Ashumet Pond (K-V Associates and IEP 1987). Consequently, the opportunity for nutrients and their compounds to reach Ashumet Pond via storm runoff or groundwater would be lessened by only using areas for spray-irrigation plots that are north and west of the existing Otis WWTP (see Sec. 4.3.7).

4.3.4.2 Alternative 3

Terrestrial Resources

Upgrading the existing WWTP at the ANG Base would result in very minor impacts on terrestrial resources. A very small area (<0.5 acre) would be disturbed for new facilities at the existing plant, the immediate area of which is already dominated by roads, buildings, and other WWTP apparatus such as trickling filters and clarifiers. Therefore, impacts on terrestrial resources would not be significant.

Aquatic Resources

Ashumet Pond is moderately productive and supports good recreational fishing, but is exhibiting stresses from anthropogenic sources. The pond is currently being affected by four primary nutrient inputs: (1) the plume from the Otis WWTP, (2) septic systems adjacent to the pond, (3) an abandoned cranberry bog, and (4) runoff from lawn fertilizer (K-V Associates and IEP 1987; E.C. Jordan 1987). These inputs increase natural eutrophication processes because enhanced nitrogen and phosphorous levels promote primary productivity. Phosphorus levels of 0.02 mg/L can promote algal growth in kettle ponds on Cape Cod. Thus, primary productivity in Ashumet Pond is phosphorus-limited -- the pond retains about 70% of the phosphorus it receives.

To determine areas that were receiving nutrients, groundwater was sampled at Fisherman's Cove from monitoring wells and lysimeters by K-V Associates, Inc., and IEP, Inc. (1987). Phosphorus levels in the plume from the Otis WWTP had concentrations ranging from 0.11 to 1.7 mg/L. In addition, two septic leachate detectors were placed in the pond and moved horizontally along the shoreline. The shoreline regions with elevated levels of phosphorus and nitrogen (ammonia) were Fisherman's Cove (discharge point of the Otis plume) and a northern inlet (which drains the abandoned cranberry bog). K-V Associates, Inc., and IEP, Inc., (1987) determined that, in the groundwater that enters the pond at Fisherman's Cove, the sewage plume contains concentrations of 0.035 to 0.2 mg/L of phosphorus. These values reflect disposal in the northeast infiltration basins. Effluent disposal was moved to rehabilitated infiltration basins located southwest of these infiltration basins in 1984.

4.3.5 Endangered and Threatened Species

No known populations of the federally listed endangered species *Agalinis acuta* are found in the vicinity of the Otis WWTP. In addition, this alternative would not affect state-listed threatened or endangered species because none are found at the Otis WWTP (Michaud 1987).

4.3.6 Land Use

The additional use of land at the Otis WWTP associated with Alternative 2 or 3 is consistent with existing land use in the area. Adverse impacts associated with land use are therefore not anticipated under either alternative.

4.3.7 Groundwater-Flow and Contaminant-Transport Modeling

4.3.7.1 Model Development for the Ashumet Valley Spray-Irrigation Site

Appendix H supplements the following discussion of the spray-irrigation model used and its parameters.

Geologic Characterization

The Ashumet Valley is situated in the Mashpee Pitted Outwash Plain, which was formed during the last glacial advance. The outwash deposits consist of 130 to 200 ft of medium-to-coarse brown sands overlying fine to very fine sands and silt (E.C. Jordan 1987). South of State Rt. 151 (Fig 3.2), the sand and gravel outwash overlies fine to very-fine sand, sandy silt, and dense sandy till. The till contains lenses of clay, silt, sand, and gravel (LeBlanc 1984c). The glacial deposits overlie crystalline bedrock, which probably slopes from west to east in this area.

Hydrology

The major surface water features in the Ashumet Valley are the Ashumet, Coonamessett, and Johns ponds; the Coonamessett and Childs rivers; and several other small ponds, as shown in Fig. 4.20.

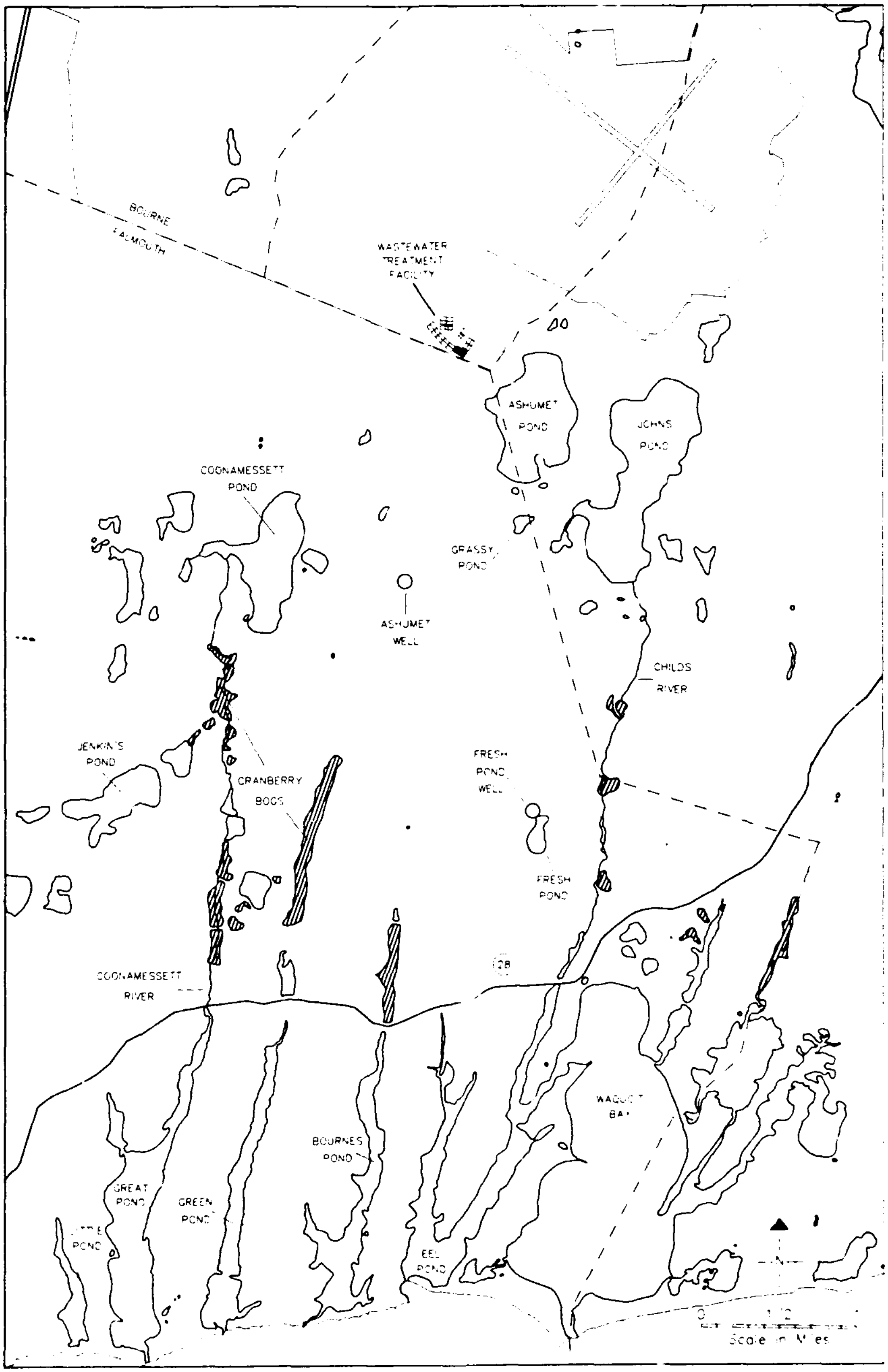

FIGURE 4.20 Surface Water in the Ashumet Valley, Site for Alternatives 2, 3, and 5

Groundwater in the Ashumet Valley is unconfined, with groundwater elevations ranging from 0 to 60 ft above MSL. The groundwater elevations averaged from USGS and E.C. Jordan data are shown in Fig. 4.21. Basically, the groundwater in the Ashumet Valley flows from north to south, discharging at the ponds and the ocean (LeBlanc 1984b).

Groundwater recharge occurs primarily from precipitation and is estimated to be 21 in./yr, or 45% of the average annual precipitation of 48 in./yr (LeBlanc 1984a and 1984c).

There is one municipal well in the southern portion of the study area that supplies water to the Town of Falmouth. The well is located adjacent to Fresh Pond (Fig. 4.20) and pumps on average 670,000 gal/day (CDM 1987).

Site Definition

For the Ashumet Valley modeling study, an aquifer system encompassing an area of approximately 10,000 acres was selected (Fig. 4.20). The area extends from north of the Otis WWTP to the ocean, with the Coonamessett and Childs rivers forming the west and east boundaries, respectively, of the modeled portion of the valley.

The finite-element grid developed for the Ashumet Valley area consists of 635 nodes and 573 quadrilateral elements. The two-dimensional representation (plan view) of the grid is shown in Fig. 4.22.

The lakes and ponds were incorporated into the finite-element grid as specific nodes and were represented by specifying the lake or pond elevation as a constant-head boundary. This type of specification allows groundwater to flow into and out of the lakes. The surface-water elevations, listed in Table 4.6, were obtained from a USGS topographic map (1979) and E.C. Jordan (1987) data.

The municipal pumping well, located adjacent to Fresh Pond (Fig. 4.20), was simulated by a single node of the finite-element grid. The node was positioned in the approximate location of the pumping well, and an average pumping rate of 670,000 gal/day was simulated (CDM 1987). The elements of the finite-element grid are all of similar size except in the area of the WWTP. In this area, elements were reduced in size to simulate the actual size and locations of the sand filter beds and the spray-irrigation area.

For the third dimension of the model, the geology of the area was represented as two layers: the upper sand and gravel layer (Layer 1), and the lower fine sand and silt layer (Layer 2). Underlying the sands is bedrock, which is assumed to be impermeable. The elevation of the top of Layer 2 ranges from 20 to -110 ft and is shown in Fig. 4.23. The top of the bedrock ranges from -130 to -350 ft and is shown in Fig. 4.24. For modeling purposes, the top of Layer 1 is the same as the water table (Fig. 4.21). The data used to develop these contours were obtained from USGS well logs and previous modeling of the Falmouth area performed by CDM (1987). In the transport modeling, Layer 1 was subdivided into a maximum of nine layers, each approximately 20 ft thick;

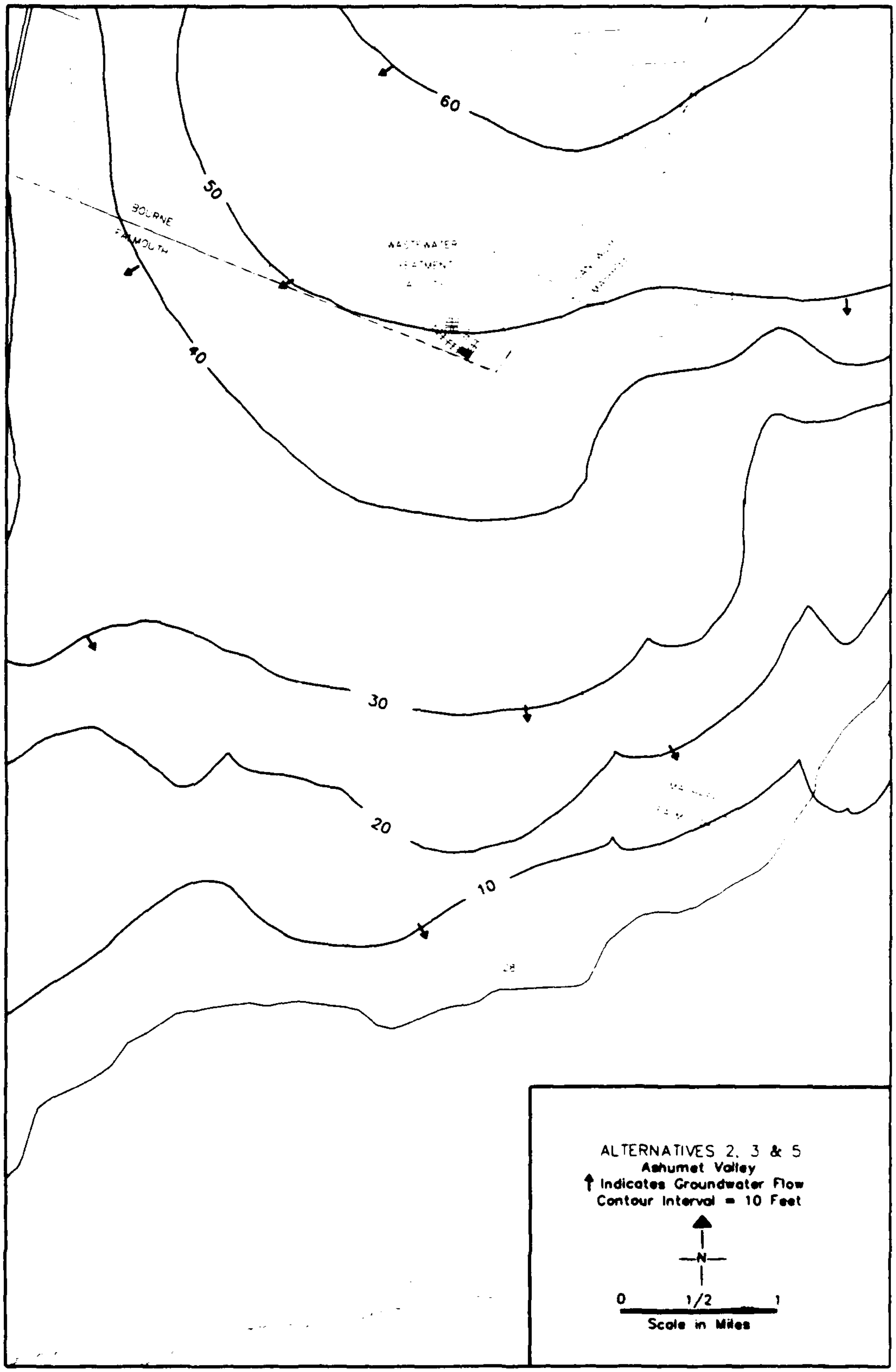

FIGURE 4.21 Observed Groundwater Elevations in the Ashumet Valley, Site for Alternatives 2, 3, and 5 (contours in ft relative to MSL)

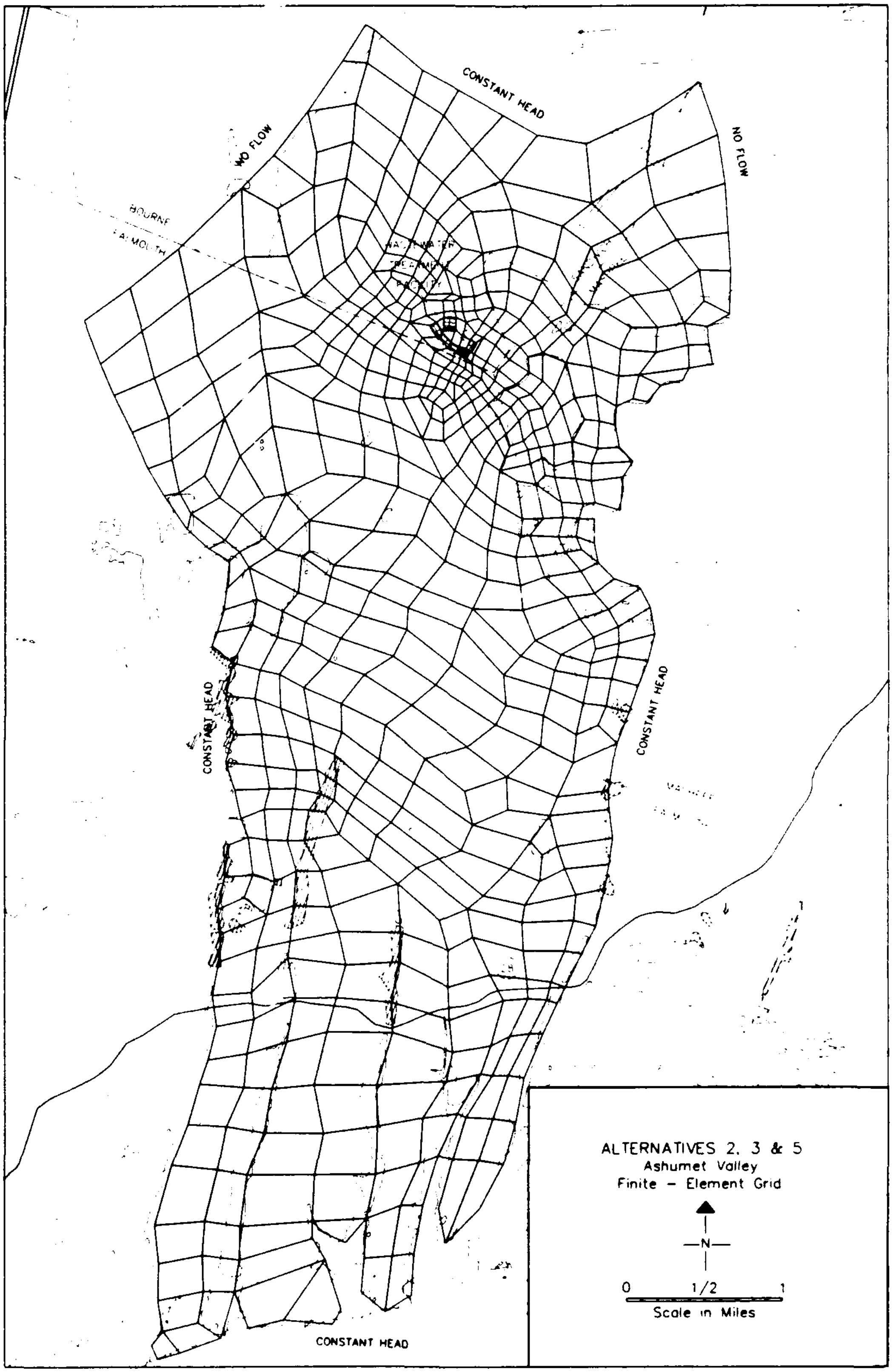

FIGURE 4.22 Surface Representation of the Finite-Element Grid and Boundary Conditions for the Ashumet Valley, Site for Alternatives 2, 3, and 5

TABLE 4.6 Constant-Head Elevations Assigned to Major Ponds Located within the Ashumet Valley

Pond	Head Elevation (ft above MSL)	Reference
Johns	38.67	E.C. Jordan 1987
Ashumet	45.34	E.C. Jordan 1987
Coonamessett	35.26	E.C. Jordan 1987
Flax	12.0	USGS 1979
Flashy	35.0	USGS 1979
Edmund's	52.0	USGS 1979
Grassy	40.01	E.C. Jordan 1987
Round	35.26	E.C. Jordan 1987

Layer 2 was subdivided into three layers of equal thickness. These layers were added to assess groundwater mounding and to better delineate the vertical extent of altered groundwater.

Input Parameters

The model area is bounded by the Coonamessett River to the west (a constant-head boundary based on the gradient from Coonamessett Pond to the ocean); the Childs River to the east (a constant-head boundary based on the gradient from Johns Pond to the ocean); the ocean to the south (a constant-head boundary with an elevation of 0 ft above MSL); Johns Pond along the eastern boundary (a constant-head boundary with an elevation of 38.31 ft (E.C. Jordan 1987); and constant-head and no-flow boundaries in the northern portion of the model (these boundaries based on published water-level elevations [LeBlanc and Guswa 1977]). In cross section, the model was assumed to be bounded by impermeable bedrock on the bottom, resulting in a no-flow boundary except for the area (nodes) near the ocean. Because of the location of the ocean relative to the model area, it was necessary to calculate the depth to the interface between salt and fresh water. This depth was calculated using the method described in Appendix E. The location of the interface was entered because it acts as a no-flow boundary -- there is some mixing of fresh and salt water along the boundary, but, basically, no flow occurs across the interface. Where the salt-water/fresh-water interface was calculated to be above the bedrock, the interface was specified as the bottom of the model to simulate the no-flow condition. The top boundary, which represents the water-table surface, was assigned as a constant-flux boundary due to recharge from precipitation.

The hydraulic conductivity of the sand and gravel is estimated to range from 100 to 500 ft/day. A large-scale pump test and a natural gradient tracer test were performed by the USGS, and a hydraulic conductivity of 380 ft/day was calculated for

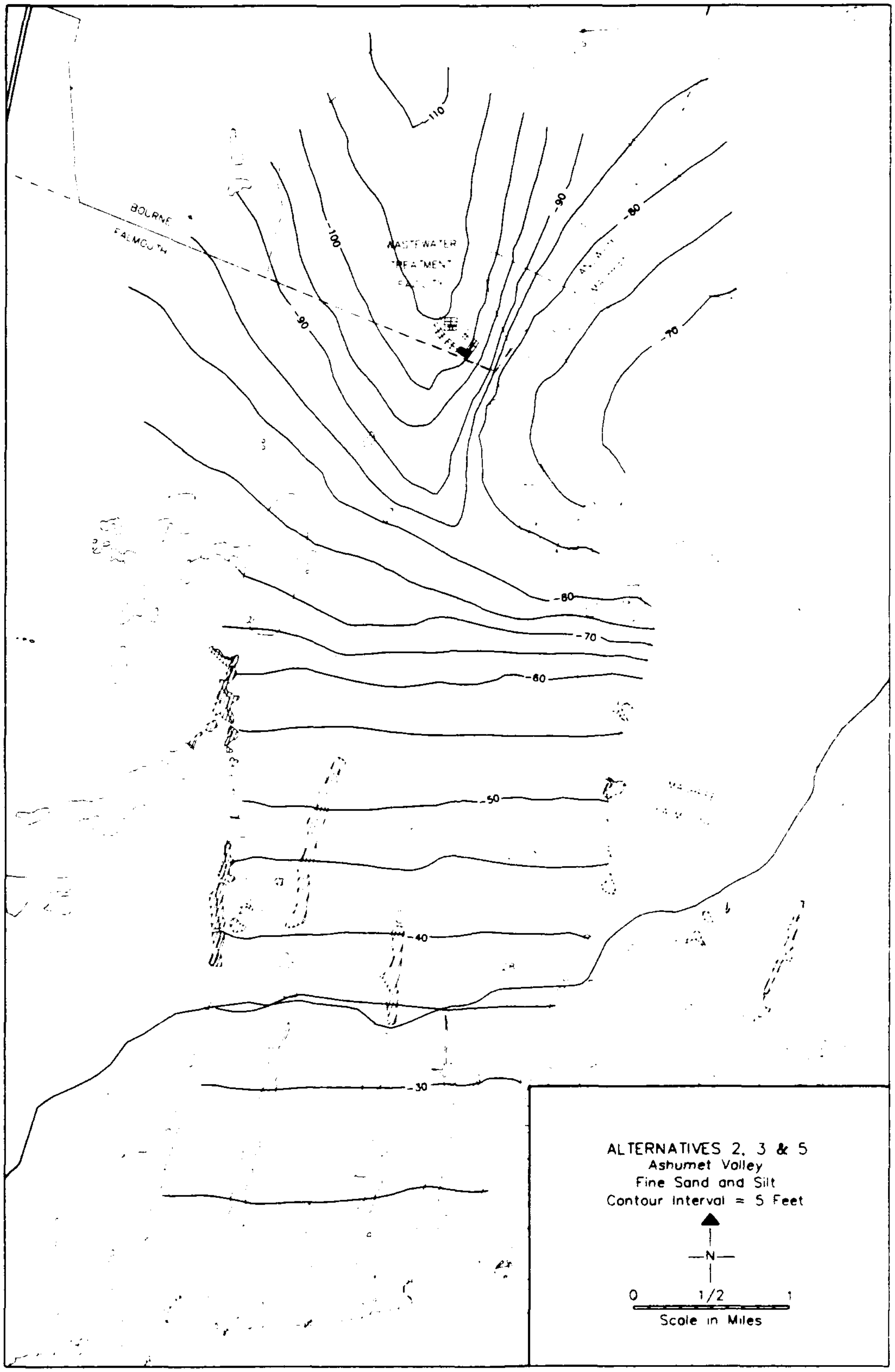

FIGURE 4.23 Elevations of Top of Fine Sand and Silt in the Ashumet Valley, Site for Alternatives 2, 3, and 5 (contours in ft relative to MSL)

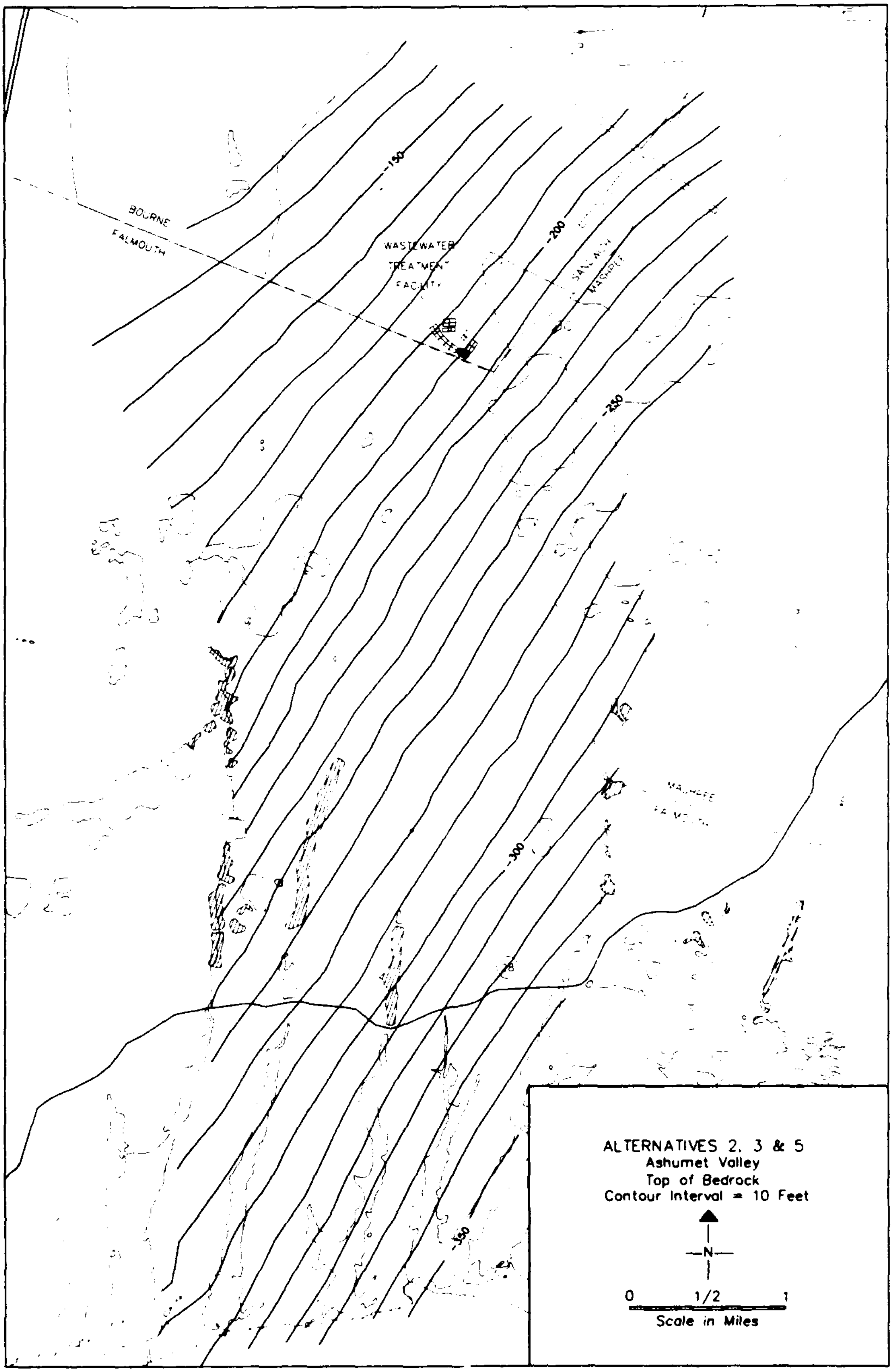

FIGURE 4.24 Top-of-Bedrock Elevations in the Ashumet Valley, Site for Alternatives 2, 3, and 5 (contours in ft relative to MSL)

both tests (E.C. Jordan 1987). This value was not adjusted in the model calibration process because it was obtained from a long-term pump test which should produce a hydraulic conductivity representing a large part of the aquifer. Conversely, the hydraulic conductivity of the fine sand and silt (Layer 2) was adjusted in the calibration process because it is not as well-defined as the sand and gravel (Layer 1). The hydraulic conductivity of this finer grained material is estimated to be less than that of the sand and gravel (LeBlanc et al. 1986). Initially, the hydraulic conductivity of the fine sand and silt was entered as 38 ft/day (10% of the conductivity of Layer 1). This resulted in the projected groundwater elevations being higher than the observed values. The best match between projected and observed values was obtained with a hydraulic conductivity of 100 ft/day for the fine sand and silt (Layer 2). The ratio of vertical to horizontal hydraulic conductivity was also adjusted in the calibration process. The anisotropic values that resulted in a best fit between the projected and the observed water-level values was a ratio of 10:1 for Layer 1 and 100:1 for Layer 2. The calibrated water-table surface projected by the model is shown in Fig. 4.25.

Porosity in the Ashumet Valley is reported to range from 0.32 to 0.42 (LeBlanc 1984b). To obtain the most conservative contaminant-transport modeling results, the lowest porosity (0.32) was used for all model simulations.

The amount of precipitation that recharges the aquifer represents a constant-flux boundary. The Thornthwaite and Mather (1957) method was used by the USGS (LeBlanc 1984c) to calculate an average recharge value of 21 in./yr.

As discussed in Sec. 4.4.7 ("Input Parameters") dispersion values have been reported by LeBlanc (1984b) to range from 40 to 100 ft for longitudinal dispersivity and from 13 to 30 ft for transverse dispersivity. Initial runs were performed to determine which dispersivities provided the most conservative results (the highest concentrations). The lower dispersions resulted in higher concentrations; therefore, dispersivities of 40 ft and 13 ft for longitudinal and transverse, respectively, were used in all simulations.

Nitrogen was the solute used to determine the extent of the plume. To provide the most conservative results, a retardation value of 1, which corresponds to a distribution coefficient of 0, was used in the contaminant-transport model for nitrogen.

Disposal Conditions

The Ashumet Valley model was developed to assess spray irrigation near the existing Otis WWTP and the continued disposal of wastewater in the infiltration basins at that plant. The groundwater-flow models for the two alternatives are identical. The spray-irrigation alternative is discussed here, and the infiltration basin alternative in Sec. 4.3.7.3, below.

Loading rates of 300,000 and 500,000 gal/day of spray irrigation were simulated. Approximately 60 acres were used for the irrigation area. Although irrigation would only occur during 8 mo of the year, for modeling purposes it was assumed to occur throughout the year. This assumption provides conservative results (higher concentrations) and greatly simplifies model input. The wastewater was

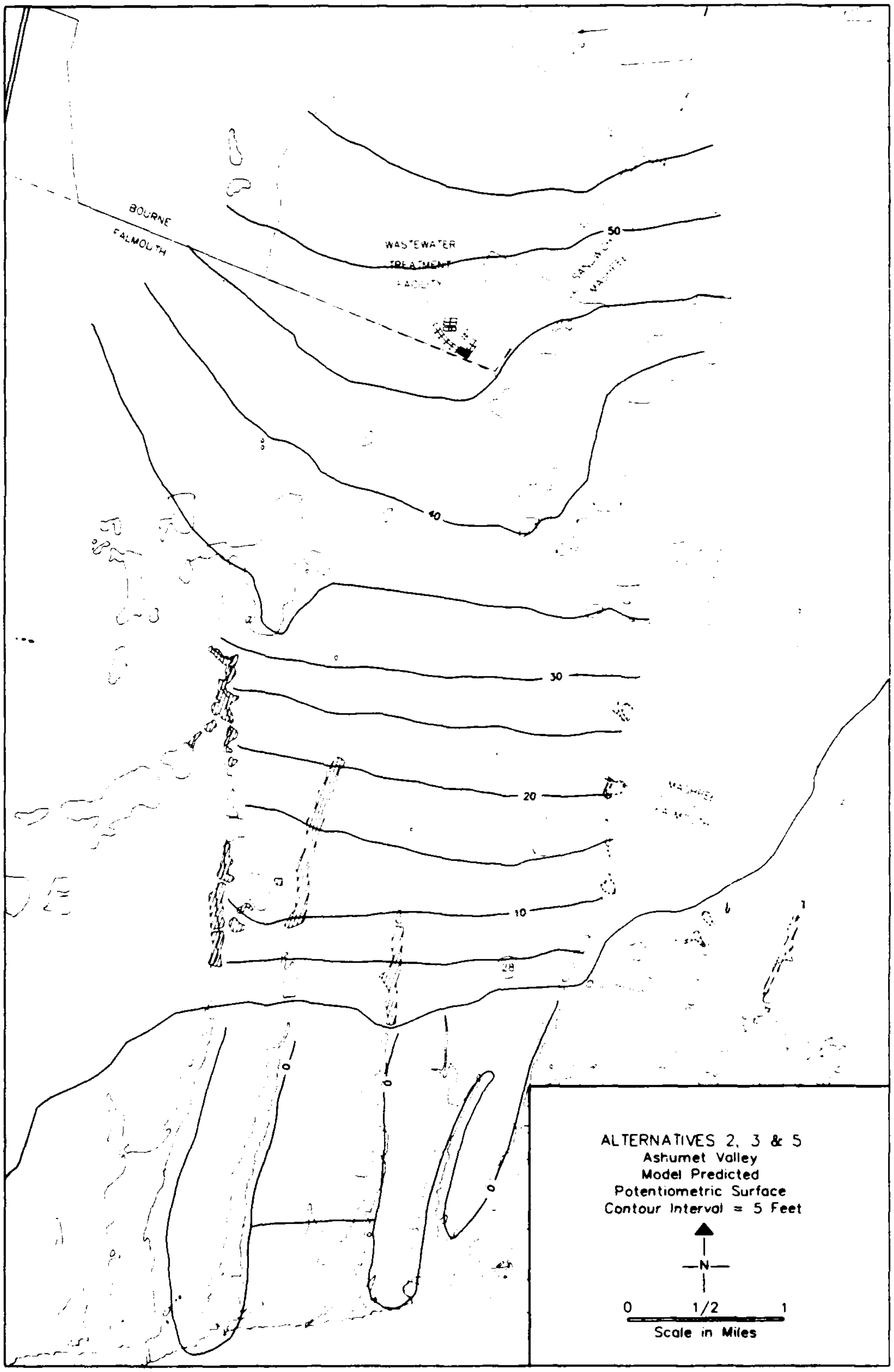

FIGURE 4.25 Model-Projected Groundwater Elevations in the Ashumet Valley, Site for Alternatives 2, 3, and 5 (contours in ft relative to MSL)

distributed so that each acre received the same amount of water. This was done by determining what percentage each element was of the total irrigation area and then applying that percentage of the wastewater to the specific elements. The wastewater applied percolated to the water table because it was assumed that no ponding would occur at the land surface. The initial concentration of total nitrogen in the wastewater was 9 mg/L, based on worst-case nutrient-removal rates for spray irrigating grassy areas. (See Appendix H for a discussion of the assumptions used to estimate this value.)

4.3.7.2 Results of the Modeling

The water-table elevations (Fig. 4.21) were entered in the model as initial conditions. Figure 4.21 was also used in the calibration process to determine the appropriate combination of input parameters resulting in the best match between observed and projected water-level elevations. The model-projected water-level elevations are shown in Fig. 4.25.

The spray-irrigation modeling results indicate that the highest concentrations of nitrogen occur from the higher loading rate. For a loading rate of 300,000 gal/day and an initial concentration of 9 mg/L (see Appendix H), the highest projected concentration of nitrogen in the groundwater was 1.7 mg/L; for a 500,000 gal/day loading rate, the highest projected concentration was 2.4 mg/L. The nitrogen concentrations projected in the groundwater in the vicinity of Ashumet Pond were highest at the northwest corner of the pond -- 1.2 mg/L for 300,00 gal/day, and 1.5 mg/L for 500,000 gal/day.

The effect of mounding was also observed in these simulations. The water-level elevations in the vicinity of the spray irrigation increased 0.21 ft with the application of 300,000 gal/day, and 0.35 ft with 500,000 gal/day. This mounding was only in the immediate vicinity of the spray-irrigation area.

The results of the contaminant-transport modeling did not project nitrogen concentrations of 10 mg/L or more (no Class III area).

4.3.7.3 Ashumet Valley Infiltration-Basin Conceptual Model — Alternative 3

The model for this alternative was identical to the spray-irrigation model (see Sec. 4.3.7.1 and Appendix H) except that the wastewater was entered into the grid element representing the sand filter beds. The wastewater was input with the assumption that it would pond slightly at the surface and induce a slight downward gradient. Loading rates of 300,000 gal/day and 500,000 gal/day were each simulated with initial nitrogen concentrations of 10 mg/L and 4 mg/L. The 10 mg/L concentration is a conservative estimte of the nitrogen in the effluent resulting from tertiary treatment; the 4 mg/L is a more realistic value. As with the spray irrigation, higher nitrogen concentrations result from higher loading rates. The nitrogen concentrations for the 10 mg/L simulations are much higher than those projected for the spray-irrigation model because the wastewater is disposed of in a much smaller area (sand filter beds) relative to the spray irrigated 60-acre field. The projected results of the simulations with an initial nitrogen concentration of 10 mg/L were maximum concentrations of 8.9 mg/L and

9.8 mg/L in the groundwater for loading rates of 300,000 and 500,000 gal/day, respectively. The nitrogen concentrations projected in the vicinity of Ashumet Pond were again highest at the northwest corner, with maximum concentrations of 1.5 and 2.9 mg/L for flow rates of 300,000 and 500,000 gal/day, respectively. The projected results of the simulations with an initial nitrogen concentration of 4 mg/L were maximum concentrations of 3.6 mg/L in the groundwater for the loading rate of 300,000 gal/day, and 3.8 mg/L for the loading rate of 500,000 gal/day. In the vicinity of Ashumet Pond (northwest corner), the maximum concentrations were 0.6 mg/L for the 300,000 gal/day loading rate and 1.1 mg/L for the 500,000 gal/day loading rate. For Alternative 3, the maximum groundwater mounding projected in the area is 0.5 and 0.9 ft for the 300,000 and 500,000 gal/day loading rates, respectively.

Using the contaminant-transport model for Alternative 3, nitrogen concentrations of 10 mg/L or greater (no Class III areas) in the groundwater were not projected.

4.4 ENVIRONMENTAL CONSEQUENCES FOR THE CAPE COD CANAL AREA DUE TO ALTERNATIVES 4, 4a, AND 4b

This section describes the impacts on the environment at the Cape Cod Canal site associated with Alternatives 4, 4a, and 4b. Six groups of impacts are separately addressed: archaeological and historical conditions, socioeconomic conditions, land transportation, natural resources, endangered and threatened species, and land use. This section also describes in detail the results of groundwater-flow and contaminant-transport modeling associated with applying the effluent to infiltration basins at the Cape Cod Canal. In addition, calculations are summarized for the dilution potential of the Cape Cod Canal relative to the nitrogen levels reaching the canal from groundwater or direct discharge.

4.4.1 Archaeological and Historical

A background literature/file search and field survey indicate that the 50,000-ft force main and infiltration basins proposed under Alternatives 4, 4a, and 4b would not have any adverse effects on significant archaeological sites or historic structures. The pumping station/wet-well site has not been surveyed because its specific location remains to be identified (Macomber 1990). It will probably be necessary for the ANG to conduct a survey of the site prior to any construction activities to complete the inventory and evaluation of cultural resources in areas that would be affected by these alternatives (Mills 1988).

4.4.2 Socioeconomic Conditions

The impact on the socioeconomic conditions associated with Alternatives 4, 4a, and 4b would be minimal. There are no population changes associated with these alternatives. Construction costs and work force requirements are well within the range of available contractors located on Cape Cod or other nearby areas.

4.4.3 Land Transportation

The construction of a new pumping station and new infiltration basins would cause minor increases in traffic at the MMR entrance gates during the construction phase of the project. In addition, there would be some minor traffic congestion during rush hours while the force main is constructed under Connery Road, which leads to the main entrance gate to the MMR.

Construction of a pipeline to the Cape Cod Canal across State Rt. 6A would have a moderate impact on traffic. Rush-hour traffic and traffic during the tourist season would be most heavily affected during the construction period. Because engineering studies have not been completed for Alternative 4a, the potential disruption of the Conrail operations during pipeline construction is uncertain; there could, however, be a disruption for a short period of time. The pipeline would be placed under State Rt. 6A; traffic congestion would be minimized if the pipeline is installed during winter months.

4.4.4 Natural Resources

4.4.4.1 Terrestrial Resources

The new construction associated with the proposed action would entail excavation along the 50,000-ft pipeline route and at the roughly 2.1-acre site of the new infiltration basins near the Cape Cod Canal. Most of the new construction and excavation would occur in areas on the MMR near existing buildings and structures or along existing roads or other rights-of-way such as transmission-line corridors. Past construction and activities in these locations have already altered the original soil conditions, and, in some cases, drainage patterns. Excavation and backfilling during early phases of construction may result in a temporary increase in soil erosion rates. However, soil stabilization (e.g., seeding and mulching) after the construction phase would limit erosion potential. Therefore, erosion potential and water infiltration over most of the construction area of Alternatives 4 and 4b would not significantly differ from present levels.

A change in land and soil quality would occur over an area of approximately 3 to 4 acres. Depending on the exact placement, a portion or all of the infiltration basins under Alternatives 4 and 4b would require removal of forest cover and replacement with sand. However, because the area is small relative to the surrounding forest cover, the change is not considered significant.

The impact of Alternatives 4, 4a, and 4b on terrestrial resources involves the disturbance of existing vegetation and soil along the pipeline route and the conversion of habitat from forest cover to an open, low-growing vegetation cover at the infiltration basins. The amount of disturbed area resulting from implementation of any of the action alternatives was presented earlier (Table 2.1). The total area that would be disturbed because of Alternatives 4 and 4b is about 5.5 acres, while Alternative 4a would disturb about 3.4 acres.

Approximately 3.4 acres would be disturbed along the 50,000-ft pipeline route. This is a relatively small area which could be revegetated with cover similar to existing vegetation, and involves the loss of almost no forest cover (i.e., it uses existing, cleared rights-of-way). The impact of this pipeline on terrestrial resources is not considered significant.

Approximately 2.1 acres would be disturbed to create infiltration basins about 800 ft southeast of the Cape Cod Canal. Most of the area is covered by forest. Because the amount of forest cover removed is small, and because the entire area near the new basins is predominately forested (i.e., forest cover is not a limiting resource for wildlife populations in the area), this impact is also not considered significant.

4.4.4.2 Fresh-Water Resources

Because there are no fresh water bodies near the proposed infiltration basins, and because Alternative 4a puts the effluent directly into the canal, no significant impacts to fresh water resources would occur. Alternatives 4, 4a, and 4b would have a beneficial effect on fresh water resources compared to the present situation.

4.4.4.3 Marine Resources

Pumping the effluent to a site near Cape Cod Canal, or directly into the canal, would remove one potential source of nutrients to the marine waters of the South Cape Shore and thus benefit the sensitive estuaries along that part of Cape Cod. However, potential impacts on the proposed receiving marine waters of the Cape Cod Canal must be considered.

In general, the amount of primary productivity in marine waters is limited by nitrogen levels (Caraco et al. 1987; Valiela and Teal 1979a, b). Although heavy additions of nitrogen (e.g., raw or primary-treated sewage) can cause serious problems in marine ecosystems (Boesch and Roberts 1983; Lee and Olsen 1985; Smith et al. 1973; Reish 1984), additions of less than 0.003 mg/L for the preferred alternative, 4b (see Sec. 4.4.7.2) would result in either no measurable change in the system or a relatively small increase in productivity (Vince and Valiela 1981; Larsson and Hagstrom 1982; Boesch and Roberts 1983; Bumpus et al. 1971; World Health Organization 1982). Long-term fertilization of salt marshes has not resulted in detrimental effects to plant composition and productivity (Valiela et al. 1985). There has been very little documentation of serious reductions (or increases) in fisheries stocks caused by municipal waste discharges; in fact, fish are often attracted to these discharges (Boesch and Roberts 1983). Because of the low concentrations of nitrogen and phosphorus compounds in the treated effluent that would reach the marine waters of the Cape Cod Canal, and the effluent's dilution in groundwater that would occur before reaching the canal, the impacts on marine resources would not be significant. A similar conclusion was reached by the Town of Sandwich, even though it proposed discharging effluent with somewhat higher concentrations of nutrients directly into the Cape Cod Canal (EPA 1981). The direct discharge of treated effluent into the canal under Alternative 4a would result in higher concentrations in the immediate vicinity of the outfall location compared to discharge to infiltration basins. These concentrations, however, would be rapidly diluted (see Sec. 4.4.7.2) and would not have a significant effect on the marine biota.

Heavy metals can accumulate in marine sediments and marine organisms (Giblin et al. 1980, 1983a; Giblin and Valiela 1983; Olsen 1984; Banus et al. 1974; Breteler and Teal 1981). Although high levels of heavy metals can adversely affect many types of marine organisms (Barnes and Hughes 1982), it is rare for concentrations to accumulate to high enough levels to pose a hazard to the organisms or their consumers (e.g., humans) (Valiela et al. 1974, 1975, and 1976; Genest and Hatch 1981; World Health Organization 1982; Boesch and Roberts 1983). The concentrations of heavy metals in the Otis effluent are very low (e.g., cadmium, 0.00024 mg/L; zinc, 0.047 mg/L; lead, 0.00054 mg/L). These values are all below EPA drinking water standards (e.g., cadmium, 0.01 mg/L; zinc, 5.0 mg/L; lead, 0.05 mg/L), and they would be further diluted in the groundwater and canal water. The result would be no significant impact on marine organisms from heavy metals.

It is important to minimize the number of bacteria and viruses entering marine waters from anthropogenic sources because these microbes can cause disease in humans who come in contact with the water or who eat shellfish in which the microbes have accumulated (Heuffelder 1987; Vaughn and Landry 1984; World Health Organization 1982). In general, enteric bacteria and virus survival rates are higher in marine sediments; shallow, warm marine waters; or mollusk tissue than in open marine waters (Kirchman and Mitchell 1979; Vaughn and Landry 1984; Erkenbrecher 1981; Smith et al. 1978; Hood and Ness 1982; Mann et al. 1979). This survival phenomenon is due to lower dilution in sediment, decreased predation, and physiochemical stress conditions. The problem of bacteria and virus contamination of marine waters has been largely eliminated, however, by disinfection of the effluent (e.g., by chlorination) (Heuffelder 1987; Goyal et al. 1978 and 1984). Vaughn and Landry (1984) noted that there was little accumulation of viruses in shellfish occupying marine waters that were only slightly contaminated (0.01 virus particles per mL). The residual chlorine in the effluent from the Otis WWTP is less than 0.3 mg/L. Because the effluent from the Otis WWTP is disinfected, the impact of microbes on marine resources would not be significant.

Excessive chlorination of sewage effluents can affect marine organisms, many of which are sensitive to chlorine (Barnes and Hughes 1982; Boesch and Roberts 1983). Chlorine residues are not allowed to exceed 1 mg/L in the effluent at the point of discharge (1984 discharge permit, Appendix A). Levels entering the canal should not exceed 0.01 mg/L for Alternative 4 for two reasons: physical, chemical, and biological processes at the infiltration basins; and dilution in groundwater before reaching the canal waters. A similar conclusion was reached by the Town of Sandwich (EPA 1981). Direct discharge to the canal under Alternative 4a could result in 1 mg/L of chlorine entering the canal. Current discharge permits do not allow for larger concentrations. Because of tidal activity in the canal, dilution effects would occur rapidly; a total flushing of the canal water occurs each day (see Appendix D).

4.4.5 Endangered and Threatened Species

There are no known populations of *Agalinis acuta* in the construction areas for Alternatives 4, 4a, and 4b (Sorrie 1988). To determine whether this species may be affected, the U.S. Fish and Wildlife Source, under Sec. 4.4 of the Threatened and Endangered Species Act (amended in 1988), would require a survey of the pipeline route before construction. If populations were found, the pipeline could be moved to avoid disturbing these populations.

Construction and excavation activities (located primarily along the proposed effluent pipeline) would not occur in the areas used by two of the three state-listed bird species: the northern harrier (Fig. 3.11) and the grasshopper sparrow (Fig. 3.12). About 1,500 ft of the proposed pipeline route would pass through the southern edge of the area used by the upland sandpiper (Fig. 3.13). This portion of the pipeline would be buried along the road right-of-way east of the ANG Base Civil Engineering Building. Although construction activities might cause some temporary disturbance of upland sandpipers in this area, the long-term impacts should be minimal if the area is revegetated, after pipeline placement, with the types of low-growing herbs and grasses that now exist in the area. This conclusion is supported by staff of the Massachusetts National Heritage Program (Michaud 1987) and is based on the bird management plan developed by White and Melvin (1985).

A state-listed Gerhard's underwing moth also occurs along the proposed effluent pipeline route. The exact location is not given at the request of the Massachusetts Natural Heritage Program. Because the proposed action would not affect the amount of pine barren habitat (the preferred habitat of the moth), there would be no significant impacts on the moth (Michaud 1987). Disturbed soil along the proposed pipeline route would be revegetated with the types of low-growing herbs and grasses that now exist in those areas.

No other state-listed species occur in the areas of the proposed action. Therefore, no state-listed species would be affected by the proposed action.

4.4.6 Land Use

The additional use of land at the Otis WWTP associated with Alternatives 4, and 4b is consistent with existing land use in the area. The location of the pipeline and infiltration basins would not affect any training activities on the MMR. No adverse impacts associated with land use under Alternatives 4 and 4b are anticipated. Alternative 4a is located within the 100-year flood hazard zone; an area defined as 80 feet on either side of the canal waters.

4.4.7 Groundwater-Flow and Contaminant-Transport Modeling

4.4.7.1 Model Development for the Cape Cod Canal Site

Geologic Characterization

The geology in the vicinity of the Cape Cod Canal is part of the ridge of glacial deposits called the Sandwich Moraine. As discussed in Sec. 3, the Sandwich Moraine extends along the northern part of the Cape. Its sediments are mostly sand and gravel, with some fine sand, silt, and clay (Oldale and Barlow 1986). Seismic lines and field borings verified the deposits to be primarily well-sorted, fine-to-coarse sand, gravel, and cobbles, with no substantial or continuous confining layers (Weston Geophysical 1987). According to seismic surveys and data from a deep well, crystalline bedrock (granite gneiss) underlies the morainal deposits at an underground depth primarily between 150 ft and 200 ft (Weston Geophysical 1987, 1989).

Hydrology

There are no lakes, ponds, or rivers located at the Cape Cod Canal site. The only surface water in the vicinity is the canal itself, at the northwest border of the study site (Fig. 4.26). The canal is approximately 32 ft deep at mean low water (Weston Geophysical 1987). The tidal variations within the canal are discussed in Appendix D.

Appendix C summarizes groundwater flow dynamics near the Cape Cod Canal. Groundwater at the site is unconfined (water-table conditions), like most groundwater throughout the Cape. Water levels were measured in five monitoring wells at irregular intervals in 1987 (Weston Geophysical 1987). The potentiometric surface (Fig. 4.27) was derived from the average water levels in these monitoring wells (Weston Geophysical 1987). The water-table surface is 100 to 125 ft below the ground surface at an elevation of 0 to 27 ft above MSL. The principal groundwater flow direction is southeast to north-northwest, toward the Cape Cod Canal (Weston Geophysical 1987). The hydraulic gradients measured from the water-table contour map range from 0.006 ft/ft to 0.02 ft/ft, with the steeper gradient in the northwest part of the canal site (Weston Geophysical 1987). The tidal fluctuation in the canal does not reverse the groundwater gradient in the study area; thus, groundwater flows continuously towards the canal (Weston Geophysical 1987).

Groundwater recharge at the canal site like that in the rest of the Cape is from precipitation (Weston Geophysical 1987). The Sandwich Station located at the east end of the Cape Cod Canal measured an annual average precipitation of 44.6 in. between 1946 and 1968. Assuming an evapotranspiration of approximately 55%, the average annual recharge is 19.9 in., or approximately 45% of the annual average precipitation. Precipitation infiltrates rapidly because of the high permeability of the sediments; thus, runoff is assumed to be negligible. There are no pumping wells in the vicinity of the canal site.

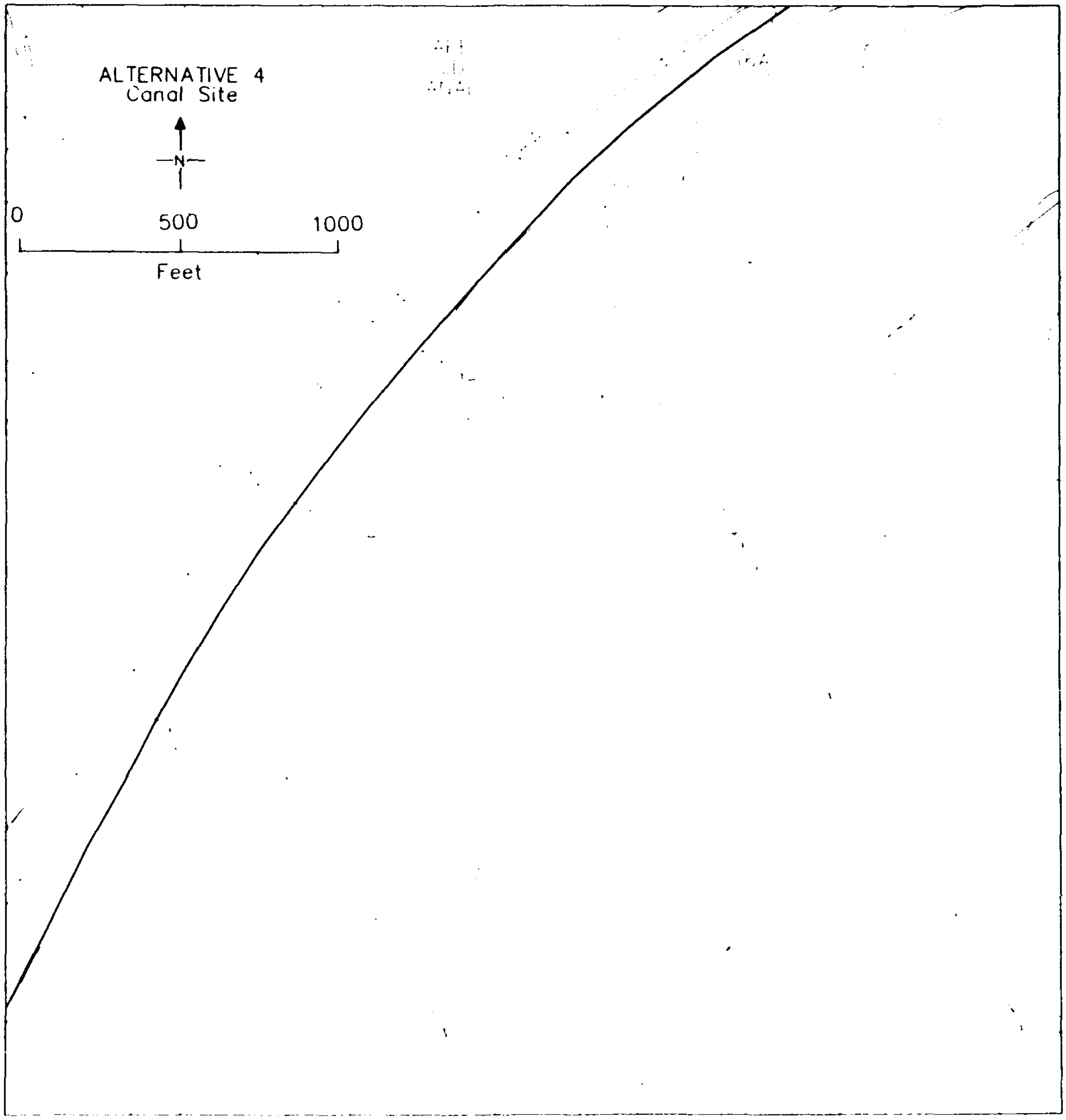

FIGURE 4.26 Topography of Cape Cod Canal Area, Site for Alternatives 4, 4a, and 4b (contours in ft relative to MSL)

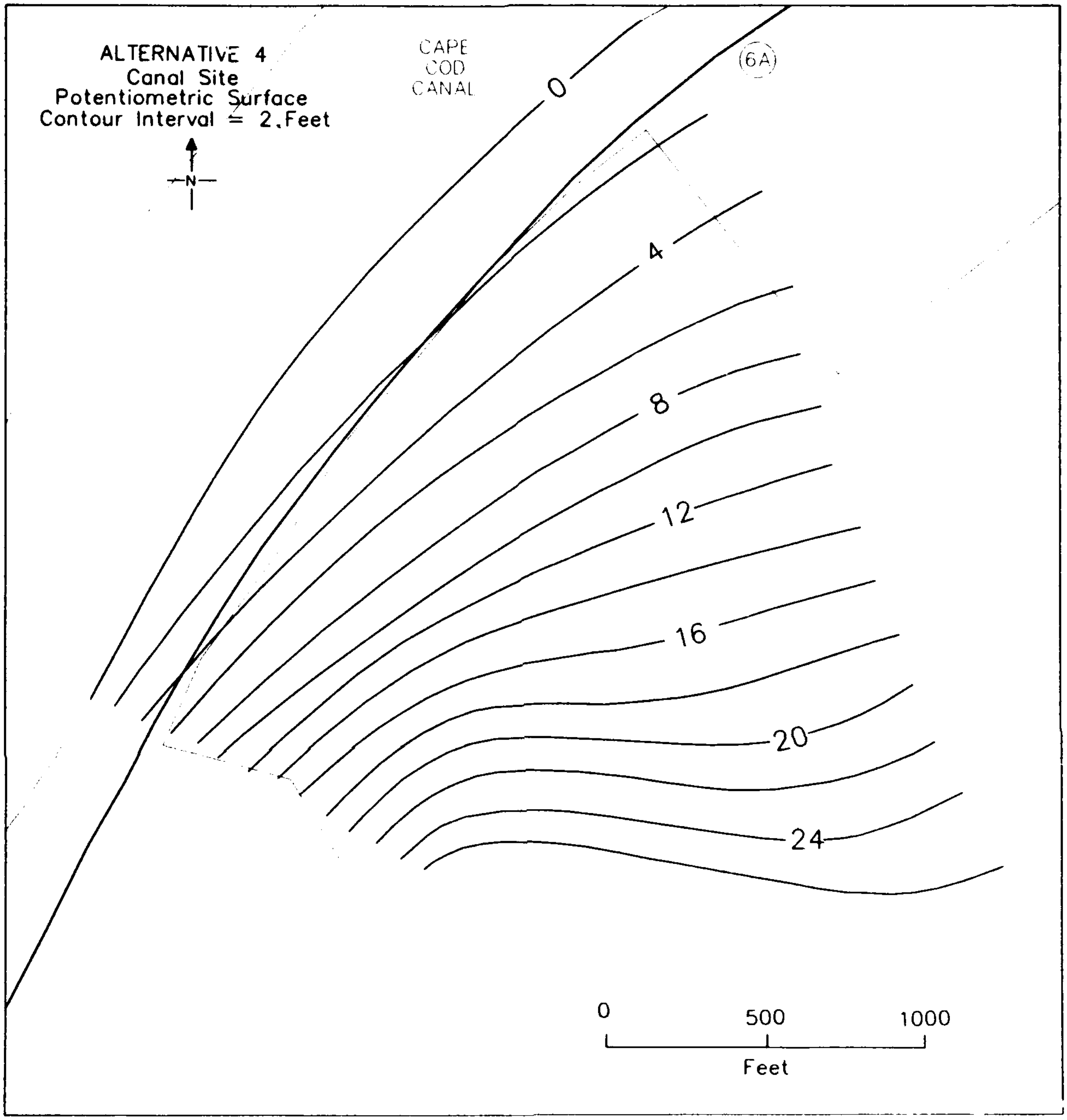

FIGURE 4.27 Groundwater Elevations in the Cape Cod Canal Area, Site for Alternatives 4, 4a, and 4b (contours in ft relative to MSL)

Site Definition

For the modeling study, an aquifer system encompassing an area of approximately 100 acres was selected. The study area was subdivided into an assemblage of 177 quadrilateral elements, with 203 nodal points. The two-dimensional surface representation of the finite-element grid is shown in Fig. 4.28. The quadrilateral elements are all of similar size, with two of the elements representing the approximate size and location of the sand filter beds.

To simulate the hydrologic conditions at the site, two vertical layers were initially used; the top layer consisted of the sediments between the water table and the bottom of the canal, and the bottom layer consisted of sediments from the bottom of the canal to bedrock. In the contaminant-transport simulations, additional layers were added to evaluate groundwater mounding and the spread of contaminants in the vertical direction. For these cases, the aquifer was divided into 10 layers, each approximately 10 ft thick. The bedrock (the bottom of the model) that underlies the unconsolidated material was contoured from the seismic survey data (Fig. 4.29).

Input Parameters

Figure 4.28 shows the boundary conditions imposed on the modeled area. A no-flow condition exists at the southwest and northeast boundaries because the grid system was aligned along flow lines (Weston Geophysical 1987). A constant-head condition of 0 ft above MSL was assumed for the boundary along the Cape Cod Canal. The southeast boundary was also assumed to have a constant head of 32 ft, based on groundwater-level data (Weston Geophysical 1987). In cross section, the model was assumed to be bounded on the bottom by impermeable bedrock. For the area (nodes) along the canal, the location of an assumed salt-water/fresh-water interface was estimated for the nodes along the canal (Appendix G), and an average value of 19.3 ft below MSL was calculated. The salt-water/fresh-water interface is assumed to act as a no-flow boundary along the canal. Away from the canal, the interface is estimated to be below the top of the bedrock. The top boundary of the model represents the water-table surface and was assigned a constant-flux condition consistent with recharge from precipitation.

The average horizontal hydraulic conductivity of the sediments was estimated using slug-test results from five monitoring wells at the site (Weston Geophysical 1987) and a pump test (Weston Geophysical 1989). An initial average hydraulic conductivity range of 10 to 50 ft/day was determined from the slug-test technique (Weston Geophysical 1987). The results of the pump test indicated that the hydraulic conductivity value is approximately 325 ft/day (Weston Geophysical 1989). The hydraulic conductivity value obtained from the pump test is a better representation of the entire aquifer than the slug-test values. Hydraulic conductivities determined from slug tests provide values representative of a small volume of aquifer in the immediate vicinity of the monitoring well, whereas pumping tests provide measurements that are typically averaged over a large aquifer volume (Freeze and Cherry 1979). Therefore, in the Cape Cod Canal model, a hydraulic conductivity of 325 ft/day was assigned to each model layer. A 10:1 ratio of horizontal-to-vertical hydraulic conductivity was used. This

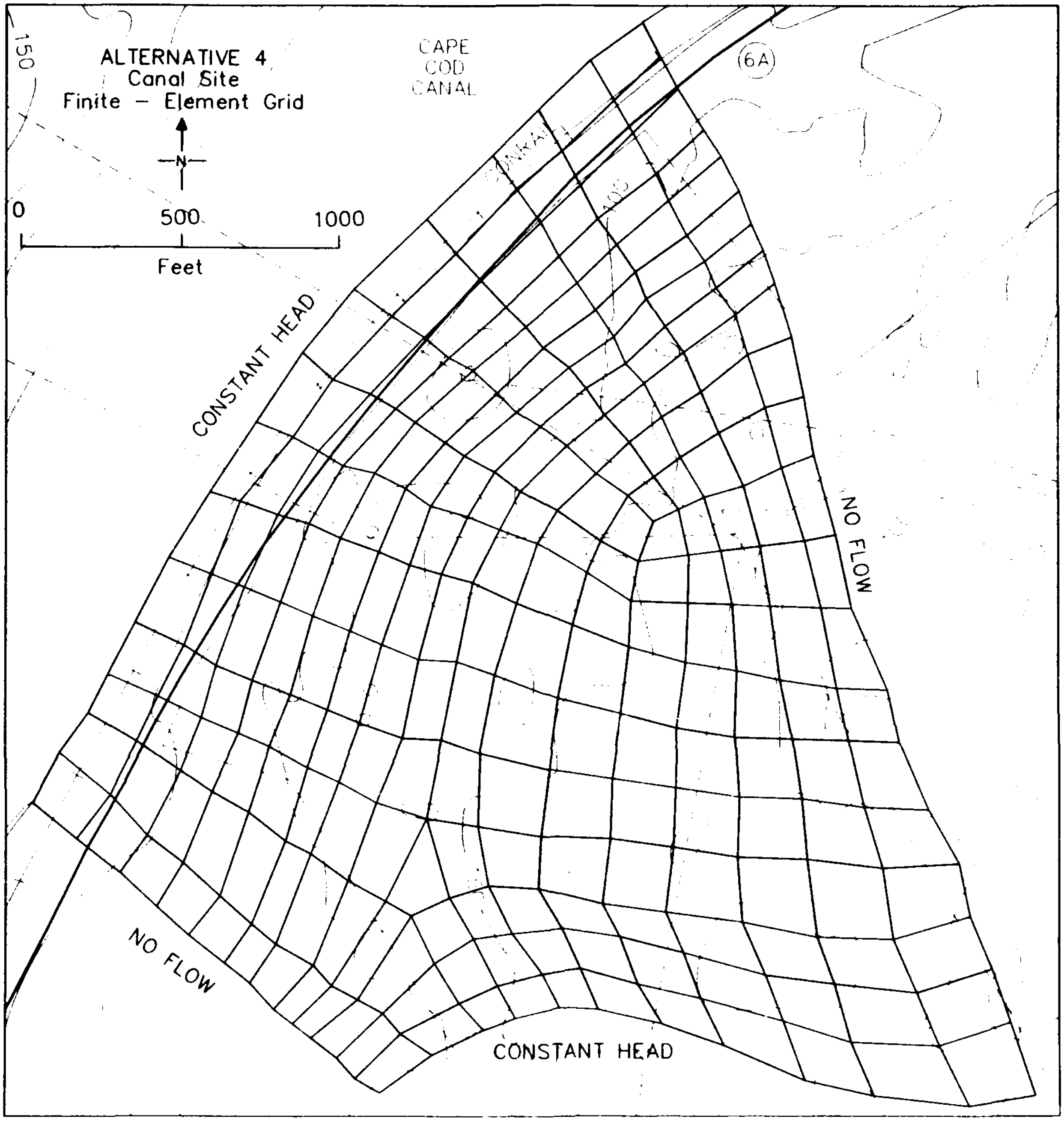

FIGURE 4.28 Surface Representation of Finite-Element Grid and Boundary Conditions for the Cape Cod Canal Area, Site for Alternatives 4 and 4b

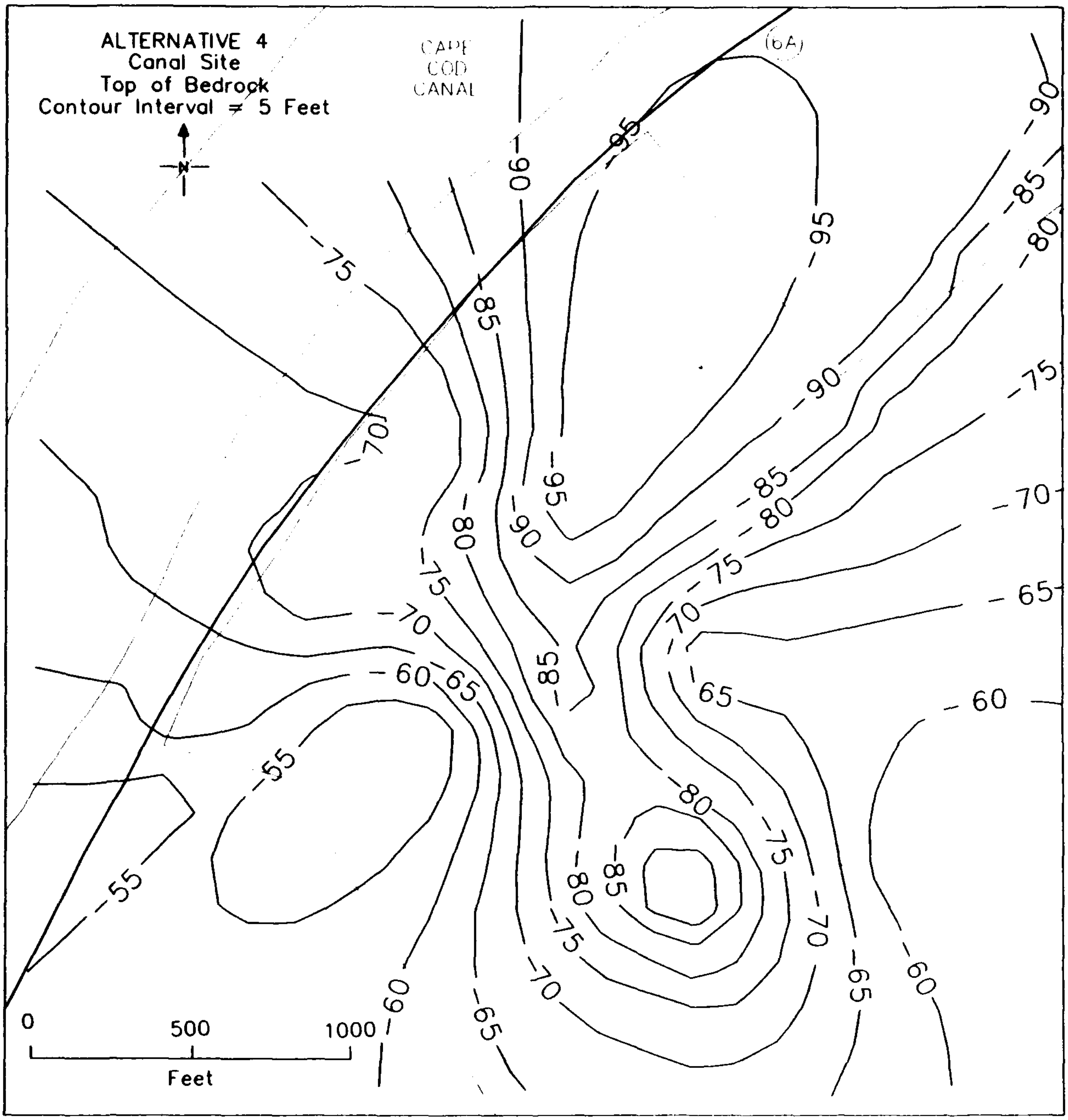

FIGURE 4.29 Bedrock Contours in the Cape Cod Canal Area, Site for Alternatives 4 and 4b (contours in ft relative to MSL)

anisotropic value was selected because it provided a best fit between the model-projected and the observed water-level elevations.

The porosity of the aquifer was estimated after reviewing the site characterization performed by Weston Geophysical (1987). Based on the boring logs, the subsurface consists primarily of fine-to-medium-grained sand. The porosity for sediments on the Cape and for sands of similar glacial material on Long Island, New York, range from 0.32 to 0.42 (LeBlanc 1984b). After reviewing other work done on the Cape by LeBlanc (1984b and 1984d) and by E.C. Jordan (1987), ANL selected a porosity value of 32% to provide the most conservative results in the contaminant-transport simulations. Aquifer recharge was assumed to be from infiltration of precipitation. An estimated recharge of 19.9 in./yr was used in the model (Weston Geophysical 1987).

Hydrodynamic dispersion causes a contaminant plume to spread and mix with uncontaminated groundwater, primarily in the direction of groundwater flow and, to a lesser degree, perpendicular to the flow direction. Dispersion is a function of two components, groundwater velocity and dispersivity; the latter is strictly a property of the porous medium (assuming diffusion is negligible) (Bear 1972). On the Cape, longitudinal dispersivity values have been reported by LeBlanc (1984b) to range from 40 to 100 ft and transverse dispersivity values from 13 to 30 ft. Initial simulations were performed to determine which dispersivity values provide the most conservative results (i.e., the highest contaminant concentrations and the largest Class III area). The lower dispersivities resulted in higher concentrations; therefore, dispersivity values of 40 ft and 13 ft for longitudinal and transverse, respectively, were used in all model simulations.

To provide the most conservative results, a retardation value of 1, which corresponds to a distribution coefficient of 0, was used in the contaminant-transport model.

Disposal Conditions

The groundwater-flow model for the Cape Cod Canal area was developed to assess disposal of wastewater in infiltration basins near the canal. The location of the new sand filter beds for Alternatives 4 and 4b was selected based on a study by Weston Geophysical (1987). Figure 4.30 shows the location of this area represented by two elements of the finite-element grid. Each proposed sand filter bed is located approximately 800 ft. from the canal. The groundwater-flow models for Alternatives 4 and 4b are identical. The projected average annual wastewater flows are 300,000 gal/day and 500,000 gal/day. Each of the two loading rates was simulated in the contaminant-transport model. The wastewater input was assumed to pond at the surface and induce a slight downward gradient.

Total nitrogen was the solute chosen for the contaminant-transport model for simulation of the area of altered groundwater. For Alternative 4, the estimated average concentration of total nitrogen in the secondary treatment of wastewater was 15 mg/L, based on the chemical analysis of the treated wastewater (see Table 1.1). For Alternative 4b, the effluent was assumed to be treated with a tertiary treatment

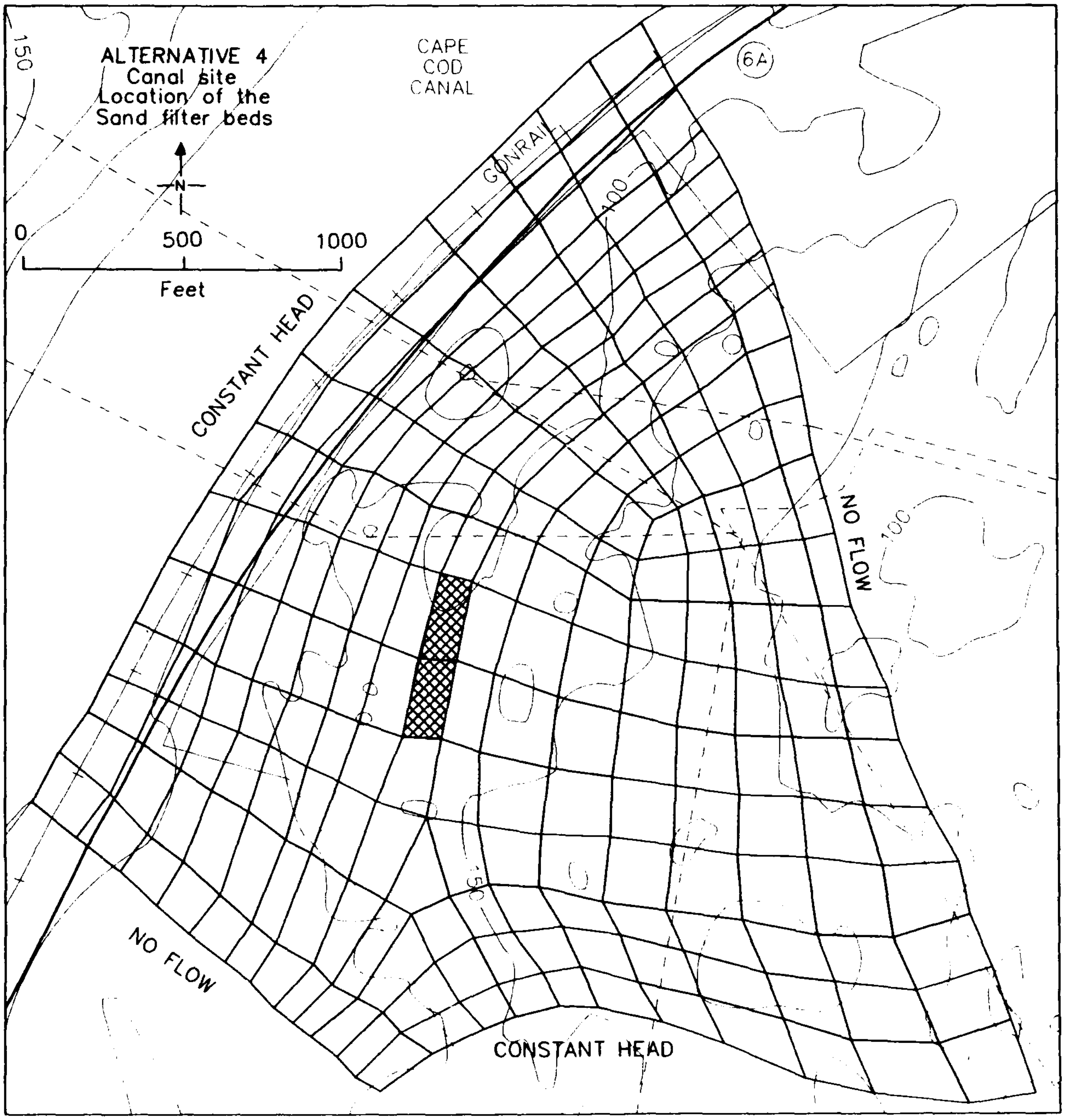

FIGURE 4.30 Approximate Location of Sand Filter Beds in Cape Cod Canal Area, Site for Alternatives 4 and 4b

method. A conservative estimate of the nitrogen concentration was 10 mg/L; a more realistic estimate was 4 mg/L.

4.4.7.2 Results of the Modeling-Alternatives 4 and 4b

Water-table elevations (Weston Geophysical 1987) were used for the flow model calibration. Input parameters such as hydraulic conductivity and anisotropy (ratio of vertical to horizontal hydraulic conductivity) were adjusted (within reasonable limits) in the calibration process until a best match was obtained between projected and observed water-level elevations. The model-projected potentiometric surface is shown in Fig. 4.31.

The modeling results for Alternative 4 -- pumping treated effluent with an initial total nitrogen concentration of 15 mg/L to new infiltration basins -- were simulated. Based on the contaminant-transport simulations, the projected nitrogen concentrations did not exceed 10 mg/L, and thus did not result in a Class III area (steep hydraulic gradients and high hydraulic conductivity cause high groundwater velocity).

A maximum total nitrogen concentration of 3.5 mg/L in the groundwater resulted from the 300,000 gal/day loading rate. For the 500,000 gal/day loading rate, the highest concentration of total nitrogen in the groundwater was 5.5 mg/L. The concentration of nitrogen entering the canal was estimated for both loading rates.

Mounding was observed in the simulations as a result of the water added to the aquifer system. In the 300,000 gal/day simulation, there was a maximum increase of 0.7 ft in water-level elevation; for the 500,000 gal/day simulation, a maximum increase of 1.1 ft in water-level elevation was projected. The slight mounding was in the area of the sand filter beds where the wastewater would be disposed. The high hydraulic conductivity (approximately 325 ft/day) prevents substantial groundwater mounding at the site.

For Alternative 4b, simulations were performed with loading rates of 300,000 and 500,000 gal/day for tertiary-treated effluent, with an initial conservative estimate of a nitrogen concentration of 10 mg/L and a more realistic estimate of 4 mg/L. As with Alternative 4, the higher nitrogen concentration was produced by the higher loading rate. Simulating the initial nitrogen concentration of 10 mg/L, the maximum nitrogen concentrations in the groundwater were 3.1 mg/L and 4.5 mg/L for 300,000 and 500,000 gal/day, respectively. Using an initial nitrogen concentration of 4 mg/L, the maximum nitrogen concentrations in the groundwater were 1.3 mg/L for 300,000 gal/day and 1.8 mg/L for 500,000 gal/day. The maximum mounding projected in the area for Alternative 4b is the same as for Alternative 4; the loading rates and the proposed location for the infiltration basins are identical.

Using the contaminant-transport model for Alternatives 4 and 4b, nitrogen concentrations in the groundwater in excess of 10 mg/L (no Class III area) were not projected.

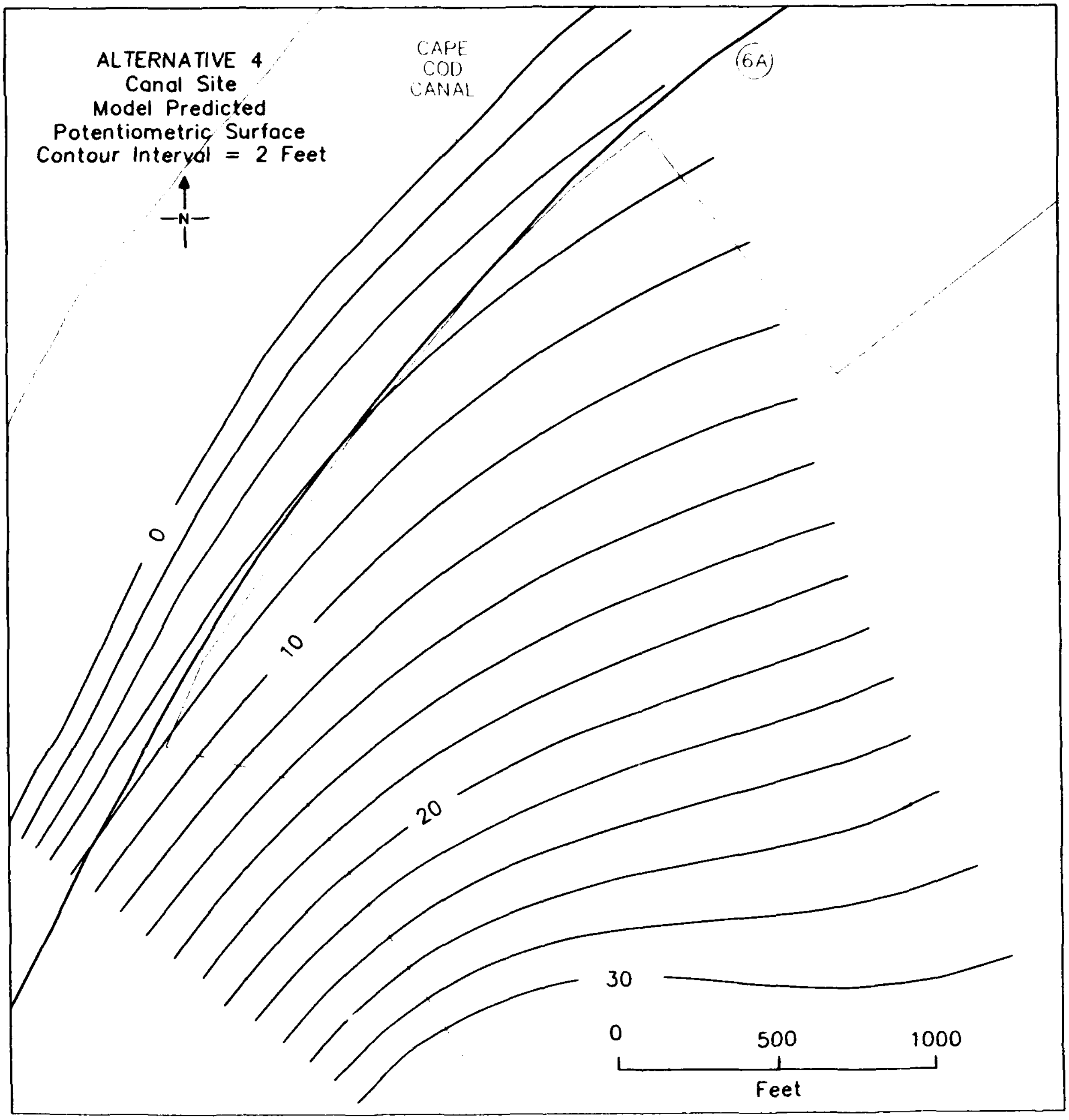

FIGURE 4.31 Model-Projected Groundwater Elevations in the Cape Cod Canal Area, Site for Alternatives 4 and 4b (contours in ft MSL)

Effluent disposal for Alternatives 4, 4a, and 4b will increase the nitrogen concentration in the Cape Cod Canal. Because of complex tidal mixing processes in the canal, nitrogen concentrations will be conservatively diluted by a ratio of 3,000:1 (Anderson-Nichols 1975). For direct disposal into the canal (Alternative 4a), the maximum increase in the canal's nitrogen load will be 0.005 mg/L for an initial effluent nitrogen concentration of 15 mg/L. For option 4, nitrogen levels in the canal will be even less because of additional dilution in the groundwater between the point of injection and the canal. For Alternative 4b, maximum increases in the nitrogen concentration in the canal will be 0.003 and 0.001 mg/L for effluent nitrogen concentrations of 10 and 4 mg/L, respectively. These increases are based on a conservative total dilution factor of 3,000:1 for mixing in the canal, and no additional dilution by the groundwater.

4.5 ENVIRONMENTAL CONSEQUENCES FOR THE MMR DUE TO ALTERNATIVE 5

The MMR impacts associated with Alternative 5 (no action) are based on the action alternative sections of this report. As Secs. 4.5.1 through 4.5.6 indicate, the present environmental conditions on and around the reservation would not change if no action is taken.

4.5.1 Archaeological and Historical

The no-action alternative would have no adverse effects on significant archaeological sites or historic structures.

4.5.2 Socioeconomic Conditions

The socioeconomic conditions would remain unchanged under the no-action alternative.

4.5.3 Land Transportation

All of the minor transportation-related traffic congestion associated with Alternatives 1-4 would be avoided under the no-action alternative. Traffic patterns in the area would remain unchanged.

4.5.4 Natural Resources

The terrestrial and aquatic resources associated with the no-action alternative would remain unchanged.

4.5.5 Endangered and Threatened Species

The endangered and threatened species associated with the no-action alternative would remain unchanged.

4.5.6 Land Use

The land-use impacts associated with the action alternatives would be avoided under the no-action alternative. Land-use patterns in the area would remain unchanged.

4.5.7 Groundwater-Flow and Contaminant-Transport Modeling

The groundwater-flow and contaminant-transport model for the no-action alternative is identical to the Alternative 3 model, except that the initial concentration of total nitrogen was 15 mg/L (based on current concentrations).

The results for the nitrogen simulations at loading rates of 300,000 and 500,000 gal/day are shown, respectively, in Figs. 4.32 and 4.33. The maximum concentrations were 13.4 mg/L for 300,000 gal/day and 14.6 mg/L for 500,000 gal/day. Maximum nitrogen concentrations of 2.2 mg/L and 4.2 mg/L were projected in groundwater in the vicinity of Ashumet Pond for 300,000 and 500,000 gal/day, respectively.

The area defined by the contour of 10 mg/L or greater is 3.3 acres for the 300,000 gal/day rate (Fig. 4.32) and 8.7 acres for the 500,000 gal/day rate (Fig. 4.33). The mounding for the no-action case is the same as it is under Alternative 3 (the loading rates and infiltration basin sites are identical for Alternatives 3 and 5).

4.6 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

4.6.1 Alternatives 1 and 1a

Capital, energy, materials, and labor will be committed to construct the pipeline and infiltration basins at the Town of Falmouth WWTP (Appendix B).

4.6.2 Alternative 2

Capital, energy, materials, and labor will be committed to construct the spray-irrigation system at the Otis WWTP (Appendix B).

4.6.3 Alternative 3

Capital, energy, materials, and labor will be committed to construct the new facilities at the Otis WWTP required for the Bardenpho process (Appendix B).

4.6.4 Alternatives 4, 4a, and 4b

Capital, energy, materials, and labor will be committed to construct the pipeline and the infiltration basins required for disposal at or in the Cape Cod Canal.

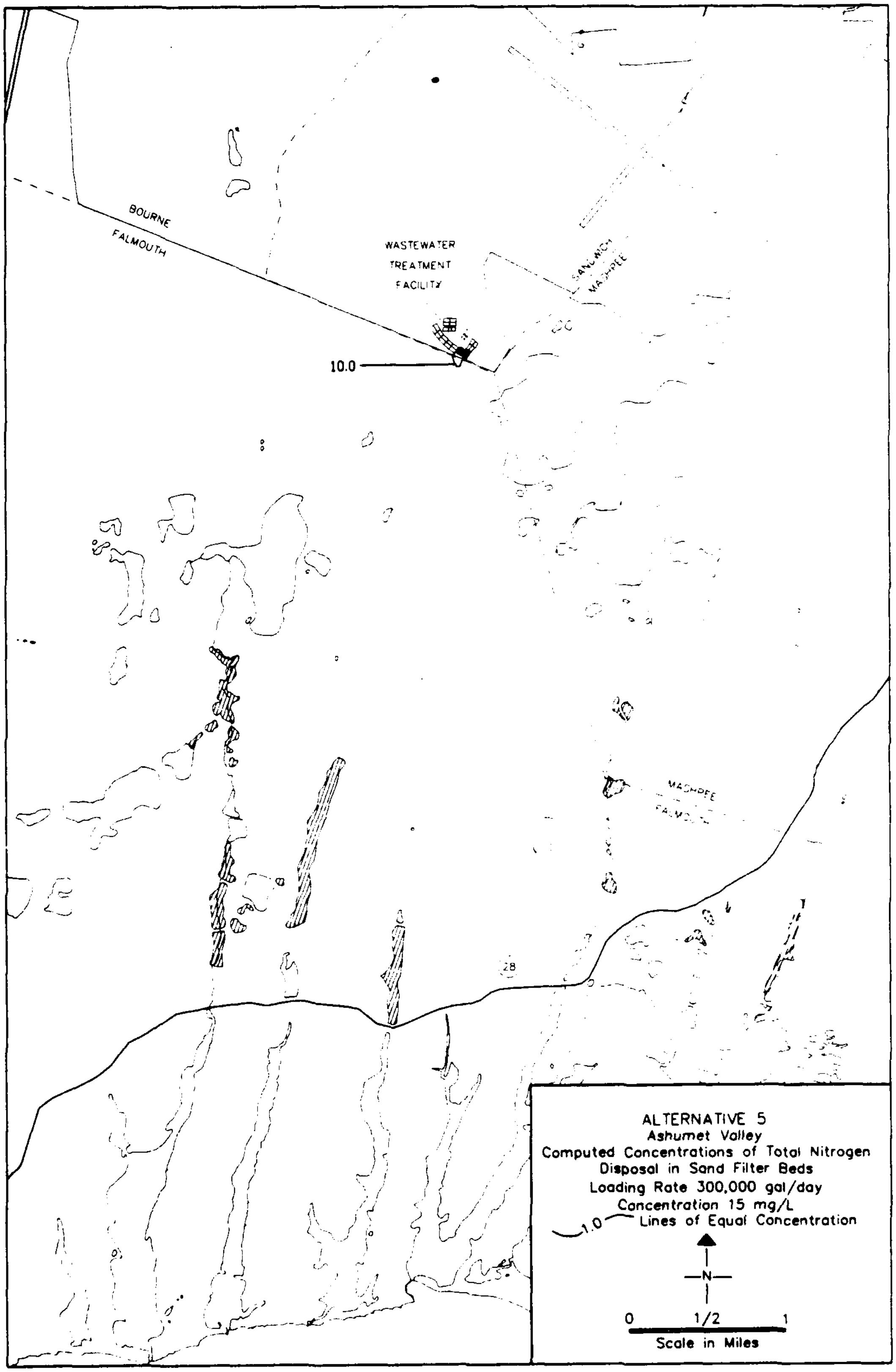

FIGURE 4.32 The 3.3-Acre Area Projected to Have a Nitrogen Concentration of ≥ 10 mg/L, at Loading Rate of *300,000 gal/day* and an *Initial Nitrogen Concentration of 15 mg/L* — Alternative 5 Site

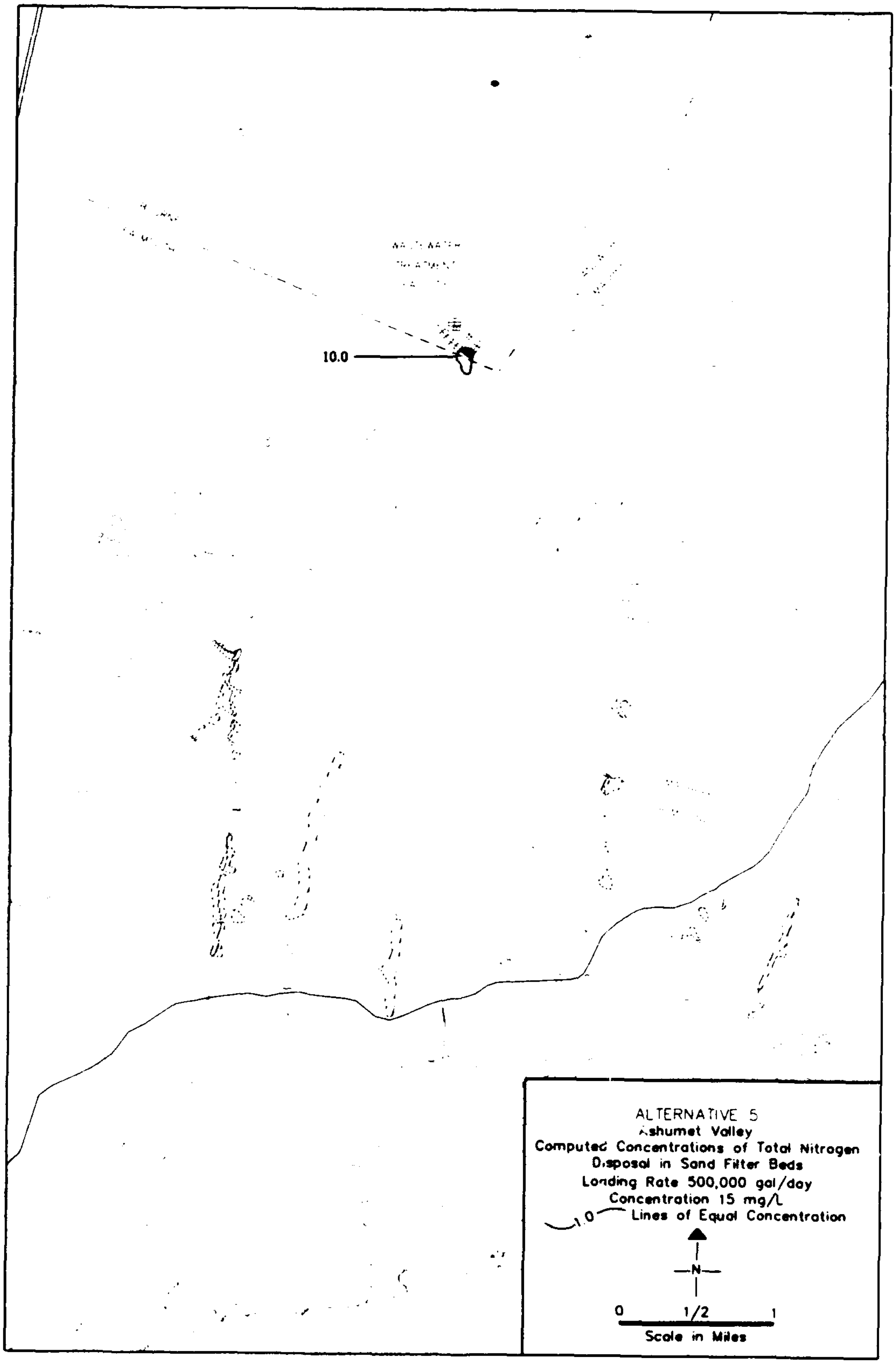

FIGURE 4.33 The 8.7-Acre Area Projected to Have a Nitrogen Concentration of ≥ 10 mg/L, at Loading Rate of *500,000 gal/day* and an *Initial Nitrogen Concentration of 15 mg/L* — Alternative 5 Site

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Pamela Resor, Executive Director
Massachusetts Association of
Conservation Commissions
Lincoln Filene Center
Tufts University
Medford, MA 02155

Gerard A. Bertrand, President
Massachusetts Audubon Society
South Great Road
Lincoln, MA 01773

Otis Civilian Advisory Council
c/o Thomas G. Judge
12 Golf Links Circle
South Sandwich, MA 02563

Otis Task Force
c/o Marie Oliva
Bourne Town Hall
24 Perry Avenue
Bourne, MA 02532

Priscilla Chapman, Executive Director
Sierra Club
3 Joy Street
Boston, MA 02108

Upper Cape Concerned Citizens
c/o Freda Feigenbaum
8 Pine Oak Drive
East Sandwich, MA 02537

Joseph April
Roy F. Weston, Inc.
7 Eagle Square
Concord, NH 03301

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APPENDIX A:

MASSACHUSETTS AND FEDERAL DOCUMENTS OF RECORD ON WASTEWATER DISCHARGES FROM OTIS ANG BASE

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APPENDIX A: PART I

PERMIT FROM MASSACHUSETTS DEP

2. Brogna

The Commonwealth of Massachusetts

FILE 103.4 103.14

Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
Division of Water Pollution Control
One Winter Street, Boston 02108

ANTHONY D. CORTESE, Sc. D.
Commissioner

October 16, 1984

Philip J. McNamara, Lt. Col. MaANG
Headquarters 102nd Fighter Interceptor Wing
Massachusetts Air National Guard
Otis Air National Guard Base
Massachusetts 02542

Re: Ground Water Discharge Permit No. 0-41

Dear Colonel McNamara:

In response to your application for a permit to discharge into the ground a treated effluent from a wastewater treatment facility located at Otis Air National Guard Base and after due public notice, I hereby issue the attached final permit.

No comments objecting to the issuance or terms of the permit were received by the Division of Water Pollution Control during the public comment period. Therefore, in accordance with 314 CMR 2.08, the permit becomes effective upon issuance.

Parties aggrieved by the issuance of this permit are hereby advised of their right to request an Adjudicatory Hearing under the provisions of Chapter 30A of the Massachusetts General Laws and 314 CMR 1.00, Rules for the Conduct of Adjudicatory Proceedings. Unless the person requesting the adjudicatory hearing requests and is granted a stay of the terms and conditions of the permit, the permit shall remain fully effective.

Very truly yours,

Thomas C. McMahon
Director

TCM/MKP/bd

cc: DEQE Southeast Regional Office
Board of Health, Town Hall, Falmouth, MA 02540
Falmouth Department of Public Works, Town Hall, Falmouth, MA 02540
EPA, Water Supply Section, JFK Building, Boston, MA 02203
Association for the Preservation of Cape Cod, P.O. Box 636, Orleans, MA 02653

OCT 1984
BCE

DISCHARGE PERMIT

Name and Address of Applicant: Headquarters 102nd Fighter Interceptor Wing
Massachusetts Air National Guard, Otis Air National Guard Base, MA 02542

Application No.: 0-41

Date of Application: 1/3/84

Permit No.: 0-41

Date of Issuance: ____________________

Date of Expiration: ____________________

AUTHORITY FOR ISSUANCE

Pursuant to authority granted by Chapter 21, Sections 26-53 of the Massachusetts General Laws, as amended, the following permit is hereby issued to:

Massachusetts Air National Guard

____________________ (hereinafter called the "permittee"),

authorizing discharges from an on-site wastewater treatment facility at the Otis Air National Guard Base with discharge into the ground.

such authorization being expressly conditional on compliance by the permittee with all terms and conditions of the permit hereinafter set forth.

This permit shall become effective on the date of the Director's signature and shall expire on ____________________.

Thomas C. McMahon
Thomas C. McMahon, Director
Division of Water Pollution Control

10/10/84
Date

I. SPECIAL CONDITIONS

A. Effluent Limits

The permittee is authorized to discharge into the ground from the wastewater treatment.facilities for which this permit is issued a treated effluent whose characteristics, shall not exceed the following values:

1. Prior to treatment system improvements:

Effluent Characteristic	Discharge Limitations	
Flow cu.M/Day (MGD)	(0.8)	
B.O.D.,5-Day, 20°C	30	mg/l
Total Suspended Solids	30	mg/l
Settleable Solids	0.1	ml/l

2. After treatment system improvements:

Effluent Characteristic	Discharge Limitations	
Flow cu.M/Day (MGD)	(0.8)	
B.O.D.,5-Day, 20°C	30	mg/l
Total Suspended Solids	30	mg/l
Settleable Solids	0.1	mgl/l
Total Coliform Bacteria	1000 Organisms/100 ml	
Nitrate Nitrogen as N	10.0	mg/l
Total Nitrogen as N	10.0	mg/l
Oils & Grease	15.0	mg/l
Fluoride	2.4	mg/l
Chlorine	1.0	mg/l
Boron	20.0	mg/l
MBAS	1.0	mg/l

(a) The pH of the effluent shall not be less than 6.5 nor greater than 8.5 at any time.

(b) The monthly average concentration of BOD and total suspended solids in the discharge shall not exceed 15 percent of the monthly average concentrations of BOD and total suspended solids in the influent into the permittee's wastewater treatment facilities.

(c) When the effluent discharged for a period of 90 consecutive days exceeds 80 percent of the permitted flow limitation, the permittee shall submit to the permitting authorities projected loadings and a program for maintaining satisfactory treatment levels consistent with approved water quality management plans.

B. Monitoring and Reporting

1) Flow shall be monitored daily at the Parshall Weir

2) The permittee shall monitor and record the quality and quantity of effluent at the distribution box prior to the leaching field according to the following schedule and other provisions:

Parameter	Minimum Frequency of Analysis	Sample Type
BOD	2 x weekly	8-hour composite
TSS and Total Solids	2 x weekly	8-hour composite
Settleable Solids	1 x daily	Grab
Total Coliform	1 x weekly	Grab
pH	1 x daily	Grab
Nitrate as N	1 x weekly	8-hour composite
NH_3 as N	1 x weekly	8-hour composite
~~Total Kjeldahl - Nitrogen~~	~~1 x monthly~~	~~8-hour composite~~
Boron	1 x monthly	Grab
MBAS	1 x monthly	8-hour composite

3) The permitte shall monitor at a minimum the five (5) monitoring wells designated as W1, W2, W3, W4, and W5 developed as a result of the Memorandum of Understanding between the U.S. Environmental Protection Agency and the U.S. Air Force dated August 31, 1983. The method and means for sampling therefrom shall be submitted to and approved by the Division of Water Pollution Control. The permittee shall monitor, record and report the quality of water in the monitoring wells according to the approved sampling plan and the following schedule and other provisions.

Arsenic	1 x annually
Total Trihalomethanes	1 x annually
Chloride	1 x annually
Lead	1 x annually
Mercury	1 x annually
Nitrate Nitrogen	1 x monthly
Sodium	1 x monthly
pH	1 x monthly
Specific Conductance	1 x monthly
Static Water Level	1 x monthly
Ammonia Nitrogen	1 x monthly
MBAS	1 x annually
Total dissolved solids	1 x annually
Total Coliform	1 x annually
Barium	1 x annually
Cadmium	1 x annually
Chromium	1 x annually
Selenium	1 x annually
Silver	1 x annually
Total Phosphorus	1 x annually
Boron	1 x annually
Total Volatile Organics	1 x annually
Iron	1 x annually
Manganese	1 x annually

4) Any grab sample or composite sample required to be taken less frequently than daily shall be taken during the period of Monday through Friday inclusive. Eight hour composites and grab samples shall be taken between 8:00 a.m. and 6:00 p.m. All composite samples shall be taken over the operating day.

5) The permittee shall submit all reports on an acceptable form, properly filled and signed, on the fifteenth day of every month, beginning thirty days after the issuance of this permit, to the Regional Environmental Engineer, Department of Environmental Quality Engineering, Lakeville Hospital, Lakeville, MA 02346, and to the Director, Department of Environmental Quality Engineering, Division of Water Pollution Control, One Winter Street, Boston, MA 02108.

C. Implementation Schedule

1) The permittee shall engage a registered professional engineer by December 1, 1984 to prepare engineering plans to improve effluent quality from the wastewater treatment system to meet the discharge limitations listed in A.2 Effluent Limits above.

2) By October 1, 1985, the permittee shall submit for review a preliminary engineering report detailing improvements to the existing treatment system necessary to meet the effluent limits contained in section A-2 above. This preliminary engineering report shall provide detailed information on reasons for selecting the proposed method for treatment plant improvements, the costs associated with such improvements, steps which must be taken to secure money for the improvements and a complete project schedule.

3) By October 1, 1986, the permittee shall submit for approval final plans and specification for improvements to the existing treatment system necessary to meet the effluent limits contained in section A-2 above.

4) Within nine months after DEQE approval, the permittee shall begin construction of the improvements to the existing treatment system in accordance with the approved plans and specifications.

5) Within sixteen months after the initiation of construction, the permittee will have completed all necessary improvements to the treatment system to meet effluent limits as shown in A.2 above and to attain operation level.

6) Should the completed facility be incapable of meeting the effluent limits specified in paragraph A.2 above or if the Division determines that additional treatment is necessary to protect downgradient public water supplies, this permit will be modified to include, as appropriate, new effluent limits and/or an implementation schedule for additional facilities.

314: DIVISION OF WATER POLLUTION CONTROL

5.19: *General Conditions*

The following conditions apply to all permits:

(1) No discharge authorized in the permit shall result in a violation of the Massachusetts Surface Water Quality Standards (314 CMR 4.00) or the Massachusetts Ground Water Quality Standards (314 CMR 6.00), or any amendments thereto. Upon promulgation of any amended standard, this permit may be revised or amended in accordance with such standard and 314 CMR 2.10 and 3.12 or 5.12. For purposes of determining compliance with ground water quality standards, a violation of the ground water quality standards, and the discharge permit will be determined to occur when any parameter measured in any downgradient well exceeds the applicable criteria listed in 314 CMR 6.06. In those cases where it is shown that a measured parameter exceeas the applicable criteria listed in 314 CMR 6.06 at the upgradient monitoring well, a violation of the ground water quality standards and the discharge permit will be determined to occur when it is shown that a measured parameter in any downgradient well exceeds the level of that same measured parameter in the upgradient well for the same sampling period. A statistical procedure approved by the Director shall be used in determining when a measured parameter exceeds the allowable level.

(2) Duty to comply. The permittee shall comply at all times with the terms and conditions of the permit, 314 CMR, the State Act and all other applicable state and federal statutes and regulations.

(3) Standards and prohibitions for toxic pollutants. The permittee shall comply with effluent standards or prohibitions established under section 307(a) of the Federal Act for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

(4) Proper operation and maintenance. The permittee shall at all times properly operate and maintain all facilities and equipment installed or used to achieve compliance with the terms and conditions of the permit, and in accordance with 314 CMR 12.00.

(5) Duty to halt or reduce activity. Upon reduction, loss, or failure of the treatment facility, the permittee shall, to the extent necessary to maintain compliance with its permit, control production or discharges or both until the facility is restored or an alternative method of treatment is provided. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of the permit.

(6) Power Failure. In order to maintain compliance with the effluent limitations and prohibitions of this permit, the permittee shall either:

(a) provide an alternative power source sufficient to operate the wastewater control facilities; or

(b) Halt, reduce or otherwise control production and/or all discharges upon the reduction, loss, or failure of the primary source of power to the wastewater control facilities.

(7) Duty to mitigate. The permittee shall take all reasonable steps to minimize or prevent any adverse impact on human health or the environment resulting from non-compliance with the permit.

(8) Duty to provide information. The permittee shall furnish to the Director within a reasonable time any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating the permit, or to determine whether the permittee is complying with the terms and conditions of the permit.

(9) Inspection and entry. The permittee shall allow the Director or his authorized representatives to:

(a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records required by the permit are kept;

(b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit;

(c) Inspect at reasonable times any facilities, equipment, practices, or operations regulated or required under the permit; and

(d) Sample or monitor at reaonable times for the purpose of determining compliance with the terms and conditions of the permit.

(10) Monitoring. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. Monitoring must be conducted according to test procedures approved under 40 CFR Part 136 unless other test procedures are specified in the permit.

(11) Recordkeeping. The permittee shall retain records of all monitoring information including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by the permit, and all records of all data used to complete the application for the permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

Records of monitoring information shall include:

(a) The date, exact place, and time of sampling or measurements;

(b) The individual(s) who performed the sampling or measurement;

(c) The date(s) analyses were performed;

(d) The individual(s) who performed the analyses;

(e) The analytical techniques or methods used; and

(f) The results of such analyses.

(12) Prohibition of bypassing: Except as provided in General Condition 13, bypassing is prohibited, and the Director may take enforcement action against a permittee for bypassing, unless the discharge is to a surface water and:

(a) The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;

(b) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if the permittee could have installed adequate backup equipment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and

(c) The permittee submitted notice of the bypass to the Director:

1. In the event of an anticipated bypass at least ten days in advance, if possible; or

2. In the event of an unanticipated bypass as soon as the permittee has knowledge of the bypass and no later than 24 hours after its first occurrence.

(13) Bypass not exceeding limitations. The permittee may allow a bypass to occur which does not cause effluent limitations to be exceeded, but only if necessary for the performance of essential maintenance or to assure efficient operation of treatment facilities.

(14) Permit actions. The permit may be modified, suspended, or revoked for cause. The filing of a request by the permittee for a permit modification, reissuance, or termination, or a notification of planned changes or anticipated non-compliance does not stay any permit condition.

(15) Duty to reapply. If the permittee wishes to continue an activity regulated by the permit after the expiration date of the permit, the permittee must apply for and obtain a new permit. The permittee shall submit a new application at least 180 days before the expiration date of the existing permit, unless permission for a later date has been granted by the Director.

(16) Property rights. The permit does not convey any property rights of any sort or any exclusive privilege.

(17) Other laws. The issuance of a permit does not authorize any injury to persons or property or invasion of other private rights, nor does it relieve the permittee of its obligation to comply with any other applicable Federal, State, and local laws and regulations.

(18) Oil and hazardous substance liability. Nothing in the permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Federal Act, and G.L.c.21E.

(19) Removed substances. Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed in a manner consistent with applicable Federal and State laws and regulations including, but not limited to, the State and Federal Acts, the Massachusetts Hazardous Waste Management Act, G.L.c.21C, and the federal Resource Conservation and Recovery Act, 42 U.S.C. s.6901, et seq., 310 CMR 19.00 and 30.000, and other applicable regulations.

(20) Reporting requirements.

(a) Monitoring reports. Monitoring results shall be reported on a Discharge Monitoring Report (DMR) at the intervals specified elsewhere in the permit. If the permittee monitors any pollutant more frequenty than required by the permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.

(b) Compliance schedules. Reports of compliance or non-compliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of the permit shall be submitted no later than 14 days following each schedule date.

(c) Planned changes. The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility or activity which could significantly change the nature or increase the quantity of pollutants discharged. Unless and until the permit is modified, any new or increased discharge in excess of permit limits or not specifically authorized by the permit constitutes a violation.

(d) Anticipated non-compliance. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in non-compliance with permit requirements.

(e) Twenty-four hour reporting. The permittee shall report any non-compliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the non-compliance, including exact dates and times, and if the non-compliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the non-compliance.

The following shall be included as information which must be reported within 24 hours:

1. Any unanticipated bypass which exceeds any effluent limitation in the permit.

2. Violation of a maximum daily discharge limitation for any of the pollutants listed by the Director in the permit to be reported within 24 hours.

(f) Other non-compliance. The permittee shall report all instances of non-compliance not reported under General Condition 20(a),(b), or (e) at the time monitoring reports are submitted. The reports shall contain the information listed in General Condition 20(e).

(g) Toxics. All manufacturing, commercial, mining, or silvicultural dischargers must notify the Director as soon as they know or have reason to believe:

1. That any activity has occurred or will occur which would result in the discharge of any toxic pollutant listed in 314 CMR 3.16 which is not limited in the permit, if that discharge will exceed the highest of the following notification levels:

A. One hundred micrograms per liter (100 ug/l);

B. Two hundred micrograms per liter (200 ug/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/l) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/l) for antimony;

C. Five (5) times the maximum concentration value reported for that pollutant in the permit application; or

2. That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the permit application.

(h) Indirect dischargers. All Publicly Owned Treatment Works shall provide adequate notice to the Director of the following:

1. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to sections 301 or 306 of the Federal Act if it were directly discharging those pollutants; and

2. Any substantial change in the volume or character of pollutants being introduced into the POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

3. For purposes of this paragraph, adequate notice shall include information on the quality and quantity of effluent introduced into the POTW, and any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

(i) Information. Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Director, it shall promptly submit such facts or information.

(21) Signatory requirement. All applications, reports, or information submitted to the Director shall be signed and certified in accordance with 314 CMR 3.14 and 314 CMR 5.14.

(22) Severability. The provisions of the permit are severable, and if any provision of the permit, or the application of any provision of the permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of the permit, shall not be affected thereby.

(23) Reopener clause. The Director reserves the right to make appropriate revisions to the permit in order to establish any appropriate effluent limitations, schedules of compliance, or other provisions which may be authorized under the State or Federal Acts in order to bring all discharges into compliance with said statutes.

(23) Approval of plans and specifications for treatment works. All discharges and associated treatment works authorized herein shall be consistent with the terms and conditions of this permit and the approved plans and specifications. Any modification to the approved treatment works shall require written approval of the Director or the Department.

(24) Transfer of Permits

(a) RCRA facilities. Any permit which authorizes the operation of a RCRA facility which is subject to the requirements of 314 CMR 8.07 shall be valid only for the person to whom it is issued and may not be transferred.

(b) Transfers by modification. Except as provided in paragraphs (a) and (c) of this section, a permit may be transferred by the permittee to a new owner or operator only if the permit has been modified or revoked and reissued or a minor modification made to identify the new permittee.

(c) Automatic transfers. As an alternative to transfers under subsection (b) of this section, any permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Director at least 30 days in advance of the proposed transfer date in division (2) of this subsection;

2. The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and

3. The Director does not notify the existing permittee and the proposed new permittee of his intent to modify or revoke and reissue the permit. A modification under this subsection may also be a minor modification. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in division 2. of this section.

(25) Permit Fees.

(a) Any permittee, other than a public entity, required to obtain a surface water or ground water discharge permit pursuant to G.L.c.21, s.43 and 314 CMR 3.00 and 5.00, shall be required annually to obtain an inspection certificate from the Division, and submit the information and fee associated therewith in accordance with 314 CMR 2.12.

APPENDIX A: PART II

MASSACHUSETTS LAND-DISPOSAL REGULATIONS

The Commonwealth of Massachusetts
SECRETARY OF STATE

REGULATION FILING AND PUBLICATION

1. REGULATION CHAPTER NUMBER AND HEADING:

   314 CMR 1.00 - 30.00

2. NAME OF AGENCY:

   DIVISION OF WATER POLLUTION CONTROL

3. THIS DOCUMENT IS REPRINTED FROM THE CODE OF MASSACHUSETTS REGULATIONS AND CONTAINS THE FOLLOWING:

   314 CMR 1.00 - 30.00   ALL REGULATIONS OF THE DIVISION

   UNDER THE PROVISIONS OF MASSACHUSETTS GENERAL LAWS, CHAPTER 30A, SECTION 6 AND CHAPTER 233, SECTION 75 THIS DOCUMENT MAY BE USED AS EVIDENCE OF THE ORIGINAL DOCUMENTS ON FILE WITH THE STATE SECRETARY.

RECEIVED

COMPILED AS IN FULL FORCE AND EFFECT 6/30/84

REPRINTED 9/24/84
$8.00

A TRUE COPY, ATTEST:

Michael Joseph Connolly

MICHAEL JOSEPH CONNOLLY,

SECRETARY OF STATE

314 CMR 5.00: MASSACHUSETTS GROUND WATER DISCHARGE PERMIT PROGRAM

Section

5.01: Purpose and Authority
5.02: Definitions
5.03: Discharges Requiring a Permit
5.04: Other Activities Requiring a Permit
5.05: Exemptions
5.06: Restrictions on the Issuance of a Permit
5.07: Effect of a Permit
5.08: Continuation of an Expiring Permit
5.09: Application for a Permit
5.10: General Permit Conditions
(314 CMR 5.11: Reserved)
5.12: Modification, Suspension, Revocation and Renewal of Permits
5.13: Transfer of Permits
5.14: Signatories to Permit Applications and Reports
(314 CMR 5.15 through 5.16: Reserved)
5.17: Interim Permit Status
(314 CMR 5.18: Reserved)
5.19: General Conditions
5.20: Application Form 1
(314 CMR 5.21: Reserved)
5.22: Application Form GW-A
(314 CMR 5.23: Reserved)
5.24: Application Form GW-B
(314 CMR 5.25: Reserved)
5.26: Application Form GW-C

5.01: Purpose and Authority

314 CMR 5.00 establishes the program whereby discharges of pollutants to the ground waters of the Commonwealth are regulated by the Division pursuant to M.G.L. c. 21, s. 43. In addition to regulating these discharges, the State Act also requires that the Division regulate the outlets for such discharges and any treatment works associated with these discharges. Through 314 CMR 5.00, the Division will control the discharge of pollutants to the ground waters of the Commonwealth to assure that these waters are protected for their highest potential use.

5.02: Definitions

As used in 314 CMR 5.00, the following words have the following meaning:

(1) Best Management Practices or BMP - schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the Commonwealth. BMP include treatment requirements, operating procedures, and practices to control plant site runoff, spillage, or leaks, sludge or waste disposal, or drainage from raw material storage.

(2) Biological Monitoring - any test which includes the use of aquatic algal, bacterial, invertebrate, or vertebrate species to measure acute or chronic toxicity, and any biological or chemical measure of bioaccumulation.

(3) Bypass - the intentional diversion of wastes from any portion of a treatment works.

(4) Combined Sewer Overflows or CSO - any intermittant overflow, bypass or other discharge from a municipal combined sewer system which results from a flow in excess of the dry weather carrying capacity of the system

5.02: continued

determined by the Department or EPA.

(22) Indirect Discharger - a discharger introducing pollutants to a treatment works.

(23) Industrial Waste - any liquid, gaseous, or solid waste substance or a combination thereof resulting from any process of industry, manufacturing, trade, or business or from the development or recovery of any natural resources.

(24) Land Utilization Practices -. the use of plants, the soil surface, or soil matrix for removal of certain wastewater constituents.

(25) Massachusetts Water Quality Standards - the Massachusetts Surface Water Quality Standards (314 CMR 4.00) and the Massachusetts Ground Water Quality Standards (314 CMR 6.00).

(26) Natural Background Conditions - the chemical, physical or biological characteristics of surface or ground waters unaltered by human activity.

(27) Non-contact Cooling Water - water used to reduce temperature which does not come into direct contact with any raw material, intermediate product, waste product (other than heat), or finished product.

(28) Other Wastes - all liquid discarded matter other than sewage or industrial waste which may cause or might reasonably be expected to cause pollution of the waters of the Commonwealth in contravention of adopted standards.

(29) Outlet - the terminus of a sewer system, or the point of emergence of any water-borne sewage, industrial waste or other wastes or the effluent therefrom, into the waters of the Commonwealth or on the land surface.

(30) Perched Ground Water - unconfined ground water separated from an underlying body of ground water by an unsaturated zone.

(31) Permit - an authorization issued pursuant to M.G.L. c. 21, s. 43 and 314 CMR 2.00, and 3.00, 5.00, or 7.00, to implement the requirements of the State and Federal Acts and regulations adopted thereunder.

(32) Person - any agency or political subdivision of the Commonwealth, the Federal government, any public or private corporation or authority, individual, partnership or association, or other entity, including any officer of a public or private agency or organization, upon whom a duty may be imposed by or pursuant to any provisions of M.G.L. c. 21, s. 26 - 53.

(33) Point Source - any discernible, confined and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, vessel or other floating craft from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture.

(34) Pollutant - any element or property of sewage, agricultural, industrial or commercial waste, runoff, leachate, heated effluent, or other matter, in whatever form and whether originating at a point or major non-point source, which is or may be discharged, drained or otherwise introduced into any sewerage system, treatment works or waters of the Commonwealth.

5.02: continued

(35) Pollution - the presence in the environment of pollutants in quantities or characteristics which are or may be injurious to human, plant or animal life or to property or which unreasonably interfere with the comfortable enjoyment of life and property throughout such areas as may be affected thereby.

(36) Pretreatment - the reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutants properties in wastewater prior to or in lieu of discharging or otherwise introducing such pollutants into a POTW.

(37) Public Entity - any city, town, special district, the Metropolitan District Commission or other existing governmental unit eligible to receive a grant for the construction of treatment works from the United States Environmental Protection Agency pursuant to Title II of the Federal Act, as amended.

(38) Publicly Owned Treatment Works or POTW - any device or system used in the treatment (including recycling and reclamation) of municipal sewage or industrial wastes of a liquid nature which is owned by a public entity. A POTW includes any sewers, pipes, or other conveyances only if they convey wastewater to a POTW providing treatment.

(39) RCRA - the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976 (P.L. 94-580, as amended by P.L. 95-609, 42 U.S.C. Section 6901 et seq.)

(40) RCRA Facility - a hazardous waste management facility as defined in 314 CMR 8.03.

(41) Saturated Zone - any portion of the earth below the land surface where every available opening (pore, fissure, joint, or solution cavity) is filled with water.

(42) Sewage - the water-carried human or animal wastes from residences, buildings, industrial establishments or other places, together with such ground water infiltration and surface water as may be present.

(43) Sewer System - pipelines or conduits, pumping stations, force mains, and all other structures, devices, appurtenances, and facilities used for collecting and conveying wastes to a site or works for treatment or disposal.

(44) Septage - the liquid and solid wastes, primarily of sewage origin, that are removed from a cesspool, septic tank or similar receptacle.

(45) State Act - the Massachusetts Clean Waters Act, as amended, M.G.L. c. 21, s. 26 - 53.

(46) Subsurface Sewage Disposal System - a disposal system which discharges sewage onto or beneath the surface of the ground.

(47) Toxic Pollutants - those pollutants identified in 314 CMR 3.16 or any other pollutants, or combination of pollutants, including disease-causing agents, which after discharge and upon exposure, ingestion, inhalation or assimilation into any organism, either directly from the environment or indirectly through food chains, may, on the basis of information available to the Division, cause death, disease, behavioral abnormalities, cancer, mutations, physiological malfunctions, biochemical abnormalties, including malfunctions in reproduction, or physical deformations, in such organisms or their offspring.

5.02: continued

(48) Treatment Works - any and all devices, processes and properties, real or personal, used in the collection, pumping, transmission, storage, treament, disposal, recycling, reclamation or reuse of waterborne pollutants, but not including any works receiving a hazardous waste from off the site of the works for the purpose of treatment, storage or disposal.

(49) Uncontaminated Water - water which does not contain dredge spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological waste materials, radioactive materials, wrecked or discarded equipment, cellar dirt, industrial, municipal or agricultural waste or any other material which upon discharge could cause a violation of applicable water quality standards.

(50) Underground Injection Control or UIC - the program under Section 1421 of the Safe Drinking Water Act (P.L. 93-523 as amended by P.L. 95-190 and 96-502).

(51) Unconsolidated Deposits - all non-indurated or poorly indurated soil materials above the bed rock.

(52) Unsaturated Zone - that portion of the earth's crust which does not contain sufficient water to fill all interconnected voids or pore spaces. Perched water bodies may exist within the unsaturated zone.

(53) Wastewater - sewage, industrial waste, other wastes or any combination of the three (3).

(54) Waters of the Commonwealth - all waters within the jurisdiction of the Commonwelath, including, without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries, wetlands, coastal waters, and ground waters.

(55) Well - a bored, drilled, or driven shaft or a dug hole, whose depth is greater than its largest surface dimension.

5.03: Discharges Requiring a Permit

(1) No person shall discharge pollutants to ground waters of the Commonwealth without a currently valid permit from the Director pursuant to M.G.L. c. 21, s. 43 and 314 CMR 5.00, unless exempted in 314 CMR 5.05. No person shall construct, install, modify, operate or maintain an outlet for such a discharge or any treatment works required to treat such discharge without having first obtained a discharge permit in accordance with 314 CMR 5.03(1) and written approval from the Department for such activity. Any person who discharges or proposes to discharge to ground waters of the Commonwealth may obtain a permit by filing the appropriate application forms in accordance with 314 CMR 5.00 and 2.00.

(2) Activities which constitute discharges of pollutants requiring a permit under 314 CMR 5.03 (1) include, but are not limited to:

(a) Any facility which discharges a liquid effluent onto or below the land surface;

(b) Any facility which discharges a liquid effluent to a percolation pit, pond, or lagoon;

(c) Any facility which discharges a liquid effluent via subsurface leaching facilities including but not limited to: leaching pits, galleries, chambers, trenches, fields and pipes;

(d) Any facility which discharges a liquid effluent into a Class V injection well as defined in 310 CMR 27.00; or

(e) Any facility with an associated unlined pit, pond, lagoon, or surface impoundment in which wastewaters or sludges are collected,

5.03: continued

stored, treated, or disposed and from which a liquid portion seeps into the ground.

5.04: Other Activities Requiring a Permit

(1) No person shall engage in any other activity, other than those described in 314 CMR 5.03, which may reasonably result, directly or indirectly, in the discharge of pollutants into ground waters of the Commonwealth, without a currently valid permit from the Director, pursuant to 314 CMR 5.00 and 2.00, unless exempted in 314 CMR 5.05. Any person who engages or proposes to engage in such activities may obtain a permit by filing the appropriate application forms in accordance with 314 CMR 5.00 and 2.00.

(2) Such other activities shall specifically include, but not be limited to:

(a) Storm Water Discharges to the ground as defined herein.

"Storm water discharges" means a conveyance or system of conveyances (including pipes, conduits, ditches and channels) primarily used for collecting and conveying storm water runoff, but not including combined municipal sewer systems, and which:

1. Discharges storm water runoff contaminated by contact with process wastes, raw materials, toxic pollutants, hazardous substances, or oil and grease to a leaching facility, or percolation pit, pond, or lagoon; or

2. Is designated under 314 CMR 5.04(2)(b).

Such discharges shall include, but not be limited to, any "storm water discharge" which is located in an industrial plant or in plant associated areas, if there is a potential for significant discharge of storm water contaminated by contact with process wastes, raw materials, toxic pollutants or hazardous substances. "Plant associated areas" means industrial plant yards, immediate access roads, drainage ponds, refuse piles, storage piles or areas, and material or product loading and unloading areas. The term excludes areas located on plant lands separated from the plant's industrial activities, such as office buildings and accompanying parking lots.

(b) Case-by case designation of storm water discharges to the ground. The Director may designate a conveyance or system of conveyances primarily used for collecting and conveying storm water runoff as a storm water discharge to the ground. This designation may be made when the Director determines that a storm water discharge is or may be a significant contributor of pollution to the ground waters of the Commonwealth. In making this determination, the Director shall consider the following factors:

1. The location of the discharge with respect to ground waters of the Commonwealth.

2. The size of the discharge.

3. The quantity and nature of the pollutants reaching ground waters of the Commonwealth and the Massachusetts water quality standards applicable to such waters; and

4. Other relevant factors.

(3) Any person owning, operating or maintaining a "storm water discharge" is subject to the requirements of 314 CMR 5.04(1).

(4) Any person owning, operating or maintaining a conveyance or system of conveyances operated primarily for the purpose of collecting and conveying storm water runoff which does not constitute a "storm water discharge" is subject to the provisions of 314 CMR 5.05(8).

5.05: Exemptions

The following activities are exempt from the need to obtain a permit pursuant to M.G.L. c. 21, s. 43 and 314 CMR 5.00:

(1) Any facility which discharges a liquid effluent as a result of the treatment of sewage at a treatment works which is designed to receive and receives 15,000 gallons per day or less provided that such facility was designed, approved, constructed and is maintained in accordance with 310 CMR 15.00, "The State Environmental Code, Title 5, Minimum Requirements for the Subsurface Disposal of Sanitary Sewage".

(2) Any recharge well used exclusively to replenish the water in an aquifer with uncontaminated water.

(3) Any discharge in compliance with the written instructions of an On-Scene Coordinator pursuant to 40 CFR Part 1510 (The National Oil and Hazardous Substances Pollution Plan) or 33 CFR 153.10(e) (Pollution by Oil and Hazardous Substances) or if approved in writing by the Director, the Commissioner, or their designees, as necessary to abate an imminent hazard to the public health or safety.

(4) Any salt water intrusion barrier well used to inject uncontaminated water into a fresh water aquifer to prevent the intrusion of salt water into the fresh water.

(5) Any facility used to return to the ground the waters used for heating or cooling energy in a heat exchanger provided the flow does not exceed 15,000 gallons per day.

(6) Any facility used to discharge non-contact cooling waters provided the flow does not exceed 2,000 gallons per day and the temperature of the wastewater does not exceed 40 degrees Celsius.

(7) Any facility that recirculates sanitary landfill leachate on top of the sanitary landfill over an area that has been specifically designed with a liner and collection system for the purpose of recycling the leachate.

(8) Any conveyance or system of conveyances operated primarily for the purpose of collecting and conveying storm water runoff which does not constitute a "storm water discharge".

(9) Any introduction of pollutants from non point source agricultural, silvicultural, land management or right-of-way maintenance activities including runoff from orchards, cultivated crops, pastures, range lands, forest lands and rights-of-way, but not including point source discharges from concentrated animal feeding operations, discharges of silvicultural process water or any "storm water discharges [as defined in 314 CMR 5.04(2)].

(10) Any landfill approved by the Department pursuant to 310 CMR 19.00 provided that such facility is not a point source and does not result in a discharge which causes a violation of applicable water quality standards or result in a threat to public health, safety or welfare.

(11) Any land application of sewage sludge provided it is performed in accordance with a plan approved by the Department.

(12) Any treatment works and discharge therefrom with interim permit status pursuant to 314 CMR 5.17(3).

Any exemption in accordance with the provisions of 314 CMR 5.05 does not relieve the discharger of his responsibilities under other state regulations including, but not limited to 310 CMR 27.00 "Under-ground Water Source Protection".

5.06: Restrictions on the Issuance of a Permit

The Director shall not issue a permit pursuant to 314 CMR 5.00:

(1) When the discharge will cause or contribute to a condition in contravention of standards for classified waters of the Commonwealth, pursuant to 314 CMR 4.00 and 6.00;

(2) For the discharge of any radiological, chemical, or biological warfare agent or high-level radioactive waste; or

(3) Where a sewer system is reasonably accessible in the opinion of the Director and where permission to enter such a sewer system can be obtained from the authority having jurisdiction over it, in accorance with 310 CMR 15.02(12) and M.G.L. c. 83, s. 11.

5.07: Effect of a Permit

Issuance of a permit under 314 CMR 5.00 and 2.00 shall be deemed to allow, to the extent specified in the permit and 314 CMR 5.07, the permittee to discharge pollutants to ground waters of the Commonwealth, to construct, install, modify, operate and maintain an outlet for such discharge, together with any treatment works required to meet effluent limitations specified in the permit for such discharge in accordance with plans and specifications approved in writing by the Department. Issuance of a permit under 314 CMR 5.00 and 2.00 shall not relieve the discharger of any responsibilities under 310 CMR 27.00 (the Massachusetts U.I.C. program).

5.08: Continuation of an Expiring Permit

(1) The conditions of a permit continue in force under M.G.L. c. 30A, s. 13 beyond the expiration date if:
(a) the permittee has made timely application for renewal of a new permit pursuant to 314 CMR 5.09(3) which is a complete application under 314 CMR 5.09(4); and
(b) the Director does not renew or issue a new permit with an effective date under 314 CMR 2.08 on or before the expiration date of the previous permit.

(2) Permits continued under 314 CMR 5.08 remain fully effective and enforceable.

5.09: Application for a Permit

(1) Duty to apply. Any person required to obtain a permit pursuant to 314 CMR 5.03 or 5.04 shall complete and submit the application form contained in 314 CMR 5.20, and, if applicable, the appropriate application form contained in 314 CMR 5.22, 5.24, 5.26 and 8.20.

(2) Who must apply. The owner of the treatment works or activity resulting in a discharge of pollutants shall apply for a permit.

(3) Time to apply.
(a) Any person required to obtain a permit pursuant to 314 CMR 5.03 or 5.04, and who does not have a currently effective permit shall submit an application at least one hundred and eighty (180) days before the date on which the discharge is to commence, unless permission for a later date has been granted by the Director. Persons proposing a new discharge are encouraged to submit their applications well in advance of the one hundred and eighty (180) day requirement to avoid delay.
(b) Any person with a currently effective permit shall submit a new application at least one hundred and eighty (180) days before the expiration date of the existing permit, unless permission for a later date has been granted by the Director.

5.09: continued

(4) Completeness. The Director shall not issue a permit before receiving a complete application as required under 314 CMR 2.03(2).

5.10: Permit Conditions

(1) General Conditions. The conditions in 314 CMR 5.19 apply to every permit issued under 314 CMR 5.00, whether or not expressly incorporated into the permit.

(2) Special Conditions.
(a) In addition to conditions applicable to all permits [314 CMR 5.10(1) and 5.19], the Director shall establish special conditions, as required on a case-by-case basis, to provide for and assure compliance with all applicable requirements of the State Act and regulations adopted thereunder. These conditions shall establish effluent limitations, and applicable requirements [314 CMR 5.10(3), and (4)]; the duration of the permit [314 CMR 5.10(5)]; monitoring, recordkeeping and reporting requirements [314 CMR 5.10(6)]; and, where applicable, schedules of compliance [314 CMR 5.10(7)] and other conditions [314 CMR 5.10(8)]. An applicable requirement is a state statutory or regulatory requirement which takes effect prior to issuance of the permit. These requirements will be identified in the fact sheet or statement of basis prepared under 314 CMR 2.05.
(b) Effuluent Limitations. In establishing effluent limitations, the Director shall apply the more stringent of the following:
1. Water quality based effluent limitations under 314 CMR 5.10(3); or
2. Technology based effluent limitations under 314 CMR 5.10(4).

(3) Water quality based effluent limitations. All permits contain limitations which are adequate to assure the attainment and maintenance of the water quality standards of the receiving waters as assigned in the Massachusetts Ground Water Quality Standards (314 CMR 6.00). Toward this end, the following effluent limitations shall apply to any discharge from a point source or outlet:
(a) Primary effluent limitations for Class I and Class II ground waters. The effluent limitations listed below apply to any discharge from a point source or outlet which enters the saturated zone of, or the unsaturated zone above, Class I and Class II ground waters.

Parameter	Limit
1. Coliform Bacteria	Shall not be discharged in amounts sufficient to render ground waters detrimental to public health, safety or welfare, or impair the ground water for use as a source of potable water.
2. Arsenic	Shall not exceed 0.05 mg/l
3. Barium	Shall not exceed 1.0 mg/l
4. Cadmium	Shall not exceed 0.01 mg/l
5. Chromium	Shall not exceed 0.05 mg/l
6. Fluoride	Shall not exceed 2.4 mg/l
7. Lead	Shall not exceed 0.05 mg/l
8. Mercury	Shall not exceed 0.002 mg/l
9. Total Trihalomethanes	Shall not exceed 0.1 mg/l
10. Selenium	Shall not exceed 0.01 mg/l
11. Silver	Shall not exceed 0.05 mg/l
12. Endrin (1,2,3,4,10, 10-hexachloro-1,7-epoxy-1, 4,4a,5,6,7,8,9a-octahydro-1, 4-endo,endo-5,8-dimethano naphthalene)	Shall not exceed 0.0002 mg/l

5.09: continued

(4) Completeness. The Director shall not issue a permit before receiving a complete application as required under 314 CMR 2.03(2).

5.10: Permit Conditions

(1) General Conditions. The conditions in 314 CMR 5.19 apply to every permit issued under 314 CMR 5.00, whether or not expressly incorporated into the permit.

(2) Special Conditions.
(a) In addition to conditions applicable to all permits [314 CMR 5.10(1) and 5.19], the Director shall establish special conditions, as required on a case-by-case basis, to provide for and assure compliance with all applicable requirements of the State Act and regulations adopted thereunder. These conditions shall establish effluent limitations, and applicable requirements [314 CMR 5.10(3), and (4)]; the duration of the permit [314 CMR 5.10(5)]; monitoring, recordkeeping and reporting requirements [314 CMR 5.10(6)]; and, where applicable, schedules of compliance [314 CMR 5.10(7)] and other conditions [314 CMR 5.10(8)]. An applicable requirement is a state statutory or regulatory requirement which takes effect prior to issuance of the permit. These requirements will be identified in the fact sheet or statement of basis prepared under 314 CMR 2.05.
(b) Effuluent Limitations. In establishing effluent limitations, the Director shall apply the more stringent of the following:
1. Water quality based effluent limitations under 314 CMR 5.10(3); or
2. Technology based effluent limitations under 314 CMR 5.10(4).

(3) Water quality based effluent limitations. All permits contain limitations which are adequate to assure the attainment and maintenance of the water quality standards of the receiving waters as assigned in the Massachusetts Ground Water Quality Standards (314 CMR 6.00). Toward this end, the following effluent limitations shall apply to any discharge from a point source or outlet:
(a) Primary effluent limitations for Class I and Class II ground waters. The effluent limitations listed below apply to any discharge from a point source or outlet which enters the saturated zone of, or the unsaturated zone above, Class I and Class II ground waters.

Parameter	Limit
1. Coliform Bacteria	Shall not be discharged in amounts sufficient to render ground waters detrimental to public health, safety or welfare, or impair the ground water for use as a source of potable water.
2. Arsenic	Shall not exceed 0.05 mg/l
3. Barium	Shall not exceed 1.0 mg/l
4. Cadmium	Shall not exceed 0.01 mg/l
5. Chromium	Shall not exceed 0.05 mg/l
6. Fluoride	Shall not exceed 2.4 mg/l
7. Lead	Shall not exceed 0.05 mg/l
8. Mercury	Shall not exceed 0.002 mg/l
9. Total Trihalomethanes	Shall not exceed 0.1 mg/l
10. Selenium	Shall not exceed 0.01 mg/l
11. Silver	Shall not exceed 0.05 mg/l
12. Endrin (1,2,3,4,10, 10-hexachloro-1,7-epoxy-1, 4,4a,5,6,7,8,9a-octahydro-1, 4-endo,endo-5,8-dimethano naphthalene)	Shall not exceed 0.0002 mg/l

5.10: continued

(c) Additional effluent limitations for Class I and Class II ground waters. In addition to the effluent limitations listed in 314 CMR 5.10(3)(a) and (b), the following limitations shall apply to treatment works designed to treat wastewater at flows in excess of 150,000 gallons per day:

Parameter	Limit
1. Nitrate Nitrogen (as Nitrogen)	Shall not exceed 10.0 mg/l
2. Total Nitrogen (as Nitrogen)	Shall not exceed 10.0 mg/l

(d) Additional effluent limitations for Class I ground waters. In addition to the effluent limitations in 314 CMR 5.10(3)(a)(b) and (c) the following limitations shall apply to treatment works discharging to Class I ground waters:

Parameter	Limit
1. Chlorides	Shall not exceed 250 mg/l
2. Total Dissolved Solids	Shall not exceed 1000 mg/l

(e) Effluent limitations for Class III ground waters. The effluent limitations listed below apply to any discharge from a point source or outlet which enters the saturated zone of, or the unsaturated zone above, Class III ground waters.

Parameter	Limit
1. Radioactivity	Shall not exceed the maximum radionuclide contaminant levels as stated in the National Interim Primary Drinking Water Standards.
2. All Other Pollutants	None in concentrations or combinations which upon exposure to humans will cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions or physical deformations or cause any significant adverse effects to the environment, or which would exceed the recommended limits on the most sensitive ground water use.

(4) Technology based effluent limitations.

(a) Technology based effluent limitations for POTW's. Except as provided in 314 CMR 5.10(9) technology based limitations for discharges from POTW's with design flows greater than 15,000 gallons per day shall be as follows:

1. For discharges to Class I and Class II ground waters the technology based limitations shall be secondary treatment, which is defined as that process or group of processes capable of removing from untreated wastewater a minimum of 85% of the five (5) day biochemical oxygen demand and suspended solids, and virtually all floating and settleable solids, followed by disinfection. Disinfection of treated effluent may be discontinued at the discretion of the Director. Limitations defining secondary treatment may be expressed in terms of concentration as well as mass.

5.10: *continued*

(c) Additional effluent limitations for Class I and Class II ground waters. In addition to the effluent limitations listed in 314 CMR 5.10(3)(a) and (b), the following limitations shall apply to treatment works designed to treat wastewater at flows in excess of 150,000 gallons per day:

Parameter	Limit
1. Nitrate Nitrogen (as Nitrogen)	Shall not exceed 10.0 mg/l
2. Total Nitrogen (as Nitrogen)	Shall not exceed 10.0 mg/l

(d) Additional effluent limitations for Class I ground waters. In addition to the effluent limitations in 314 CMR 5.10(3)(a)(b) and (c) the following limitations shall apply to treatment works discharging to Class I ground waters:

Parameter	Limit
1. Chlorides	Shall not exceed 250 mg/l
2. Total Dissolved Solids	Shall not exceed 1000 mg/l

(e) Effluent limitations for Class III ground waters. The effluent limitations listed below apply to any discharge from a point source or outlet which enters the saturated zone of, or the unsaturated zone above, Class III ground waters.

Parameter	Limit
1. Radioactivity	Shall not exceed the maximum radionuclide contaminant levels as stated in the National Interim *Primary Drinking* Water Standards.
2. All Other Pollutants	None in concentrations or combinations which upon exposure to humans will cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions or physical deformations or cause any significant adverse effects to the environment, or which would exceed the recommended limits on the most sensitive ground water use.

(4) Technology based effluent limitations.

(a) Technology based effluent limitations for POTW's. Except as provided in 314 CMR 5.10(9) technology based limitations for discharges from POTW's with design flows greater than 15,000 gallons per day shall be as follows:

1. For discharges to Class I and Class II ground waters the technology based limitations shall be secondary treatment, which is defined as that process or group of processes capable of removing from untreated wastewater a minimum of 85% of the five (5) day biochemical oxygen demand and suspended solids, and virtually all floating and settleable solids, followed by disinfection. Disinfection of treated effluent may be discontinued at the discretion of the Director. Limitations defining secondary treatment may be expressed in terms of concentration as well as mass.

5.10: continued

(b) Each permit shall contain requirements to report monitoring results with a frequency dependent on the nature and effect of the discharge, but in no case less than once a year. Pollutants for which the permittee must report violations of maximum daily discharge limitations under 314 CMR 5.19(20)(e) shall be listed in the permit.

(7) Schedule of Compliance.
(a) A permit may, when appropriate, specify a schedule leading to compliance with the State Act and regulations adopted thereunder. Any such schedule shall require compliance as soon as possible. Each schedule shall set forth dates to accomplish interim requirements leading toward compliance. Beginning with the date of permit issuance, the time between interim dates shall not exceed one (1) year. If the time necessary for completion of any interim requirement is more than one (1) year and is not readily divisible into stages for completion, the permit shall specify interim dates for the submission of reports of progress toward completion of the interim requirements and indicate a projected completion date.
(b) The first permit issued for a discharge which commences after the effective date of 314 CMR 5.00 shall not contain a schedule of compliance. No new or recommencing discharge shall commence operations or discharge prior to installation and operation of all treatment works necessary to comply with the effluent limitations established in the permit.

(8) Other Conditions. In addition to the conditions established under 314 CMR 5.10(1) through (7), a permit may include special conditions as follows:
(a) Requirements for POTWs to comply with pretreatment provisions under 314 CMR 12.00; including:
1. The identification, in terms of character and volume of pollutants, of any significant indirect discharge into the POTW subject to the prohibitions and standards of 314 CMR 12.08;
2. The establishment of a POTW pretreatment program in accordance with 314 CMR 12.09, including any necessary schedule of compliance for adoption of the program;
3. The incorporation of an approved POTW pretreatment program in the permit; and
4. The submittal by a POTW of the reports required by 314 CMR 12.09(3).
(b) Requirements applicable to the management of hazardous wastes for treatment works subject to the provisions of 314 CMR 8.00.
(c) Requirements to control or abate the discharge of pollutants through the application of best management practices when:
1. Authorized under Section 304(e) of the Federal Act for the control of toxic pollutants and hazardous substances from ancillary and industrial activities;
2. Numerical effluent limitations are infeasible; or
3. The practices are reasonably necessary to achieve effluent limitations and standards or to carry out the purposes and intent of State Act.
(d) Requirements to monitor, record, and report the quality of water at upgradient and downgradient monitoring wells to determine that the discharge does not result in a violation of the Massachusetts Ground Water Quality Standards (314 CMR 6.00).
(e) Requirements to prepare and submit monthly operating reports under 314 CMR 12.07.
(f) Requirements imposed in grants made by EPA or the Director to POTW's under Section 201 and 204 of the Federal Act or Section 30A of the State Act which are reasonably necessary for the achievement of effluent limitations.
(g) Requirements governing the disposal of sludge from treatment works.

5.10: continued

(9) Exceptions.

(a) A permit may specify effluent limitations less stringent than the water quality based effluent limitations listed in 314 CMR 5.10(3)(b), (c) and (d) and the technology based effluent limitations specified in 314 CMR 5.10(4)(a) in the folowing cases:

1. The permitted facility is a treatment works employing land application techniques and land utilization practices provided that it has been demonstrated to the satisfaction of the Director that any discharge from such facility:

a. Will not present an actual or potential public health hazard;

b. Will not violate applicable water quality standards in the saturated zone;

c. Will not violate applicable water quality standards in adjacent waters of the Commonwealth; or

2. The permitted facility is a treatment works designed, constructed, operated and maintained for the purpose of restoring a contaminated ground water provided that it has been demonstrated to the satisfaction of the Director that any discharge from such facilities will not cause the ground waters receiving the discharge or any adjacent waters of the Commonwealth to be further degraded.

(b) A permit may specify effluent limitations less stringent than the water quality based effluent limitations listed in 314 CMR 5.10(3)(b), (c) and (d) where it can be demonstrated to the satisfaction of the Director that natural background conditions preclude the ground water receiving the discharge from meeting the minimum ground water quality criteria specified in 314 CMR 6.06(1) and that any discharge with such less stringent effluent limitations will not adversely impact any current or potential use of that ground water.

(314 CMR 5.11: Reserved)

5.12: Modification, Suspension, Revocation and Renewal of Permits

(1) As provided in M.G.L. c. 21, s. 43(10), the Director may propose and determine to modify, suspend or revoke any outstanding permit, in whole or in part, for cause including, but not limited to, violation of any permit term, obtaining a permit by misrepresentation or failure to disclose fully all relevant facts or any change in or discovery of conditions that calls for reduction or discontinuance of the authorized discharge or activity. The Director may also modify a permit at the request of the permittee upon a showing, satisfactory to the Director, that the requested modification is appropriate in view of circumstances for which the permittee is not at fault.

(2) The modification, suspension, revocation or renewal of a permit shall be processed in accordance with the provisions of 314 CMR 2.10.

(3) Minor Modifications of Permits. Upon the consent of the permittee, the Director may modify a permit to make the corrections or allowances for changes in the permitted activity listed in 314 CMR 5.12(3) without following the procedures of 314 CMR 2.00. Any permit modification not processed as a minor modification under 314 CMR 5.12 must be made for cause and in accordance with the draft permit and public notice requirements of 314 CMR 2.00. Minor modifications may only:

(a) Correct typographical errors

(b) Require more frequent monitoring or reporting by the permittee;

(c) Change an interim compliance date in a schedule of compliance, provided the new date is not more than one hundred and twenty (120) days after the date specified in the existing permit and does not interfere with attainment of the final compliance date requirement;

5.12: continued

(d) Allow for a change in ownership or operational control of a facility where the Director determines that no other change in the permit is necessary, provided that a written agreement containing a specific date for transfer of permit responsibility, coverage, and liability between the current and new permittee has been submitted to the Director; or
(e) Delete an outfall when the discharge from that outfall is terminated and does not result in the discharge of pollutants from other outfalls except in accordance with permit limits.

5.13: Transfer of Permits

(1) RCRA facilities. Any permit which authorizes the operation of a RCRA facility subject to the requirements of 314 CMR 8.07 shall be valid only for the person to whom it is issued and may not be transferred. Operation by an owner or operator other than those named in the permit shall be a violation of 314 CMR 5.00 and a basis for revocation of the permit, or other enforcement action.

(2) Transfers by modification. Except as provided in 314 CMR 5.13(1) and (3), a permit may be transferred by the permittee to a new owner or operator only if the permit has been modified or revoked and reissued under 314 CMR 5.12(1) and (2), or a minor modification made under 314 CMR 5.12(3)(d) to identify the new permittee.

(3) Automatic transfers. As an alternative to transfers under 314 CMR 5.13(2), any permit may be automatically transferred to a new permittee if:
(a) The current permittee notifies the Director at least thirty (30) days in advance of the proposed transfer date in 314 CMR 5.13(3)(b);
(b) The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and
(c) The Director does not notify the existing permittee and the proposed new permittee of his intent to modify or revoke and reissue the permit. A modification under 314 CMR 5.13(3) may also be a minor modification under 314 CMR 5.12(3)(d). If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in 314 CMR 5.13(3)(b).

5.14: Signatories to Permit Applications and Reports

(1) Applications. All permit applications shall be signed as follows:
(a) For a corporation by a responsible corporate officer. For the purpose of 314 CMR 5.14, a responsible corporate officer means:
1. A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decisionmaking functions for the corporation; or
2. The manager of one or more manufacturing, production, or operating facility employing more than two hundred and fifty (250) persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.
(b) For a partnership or sole proprietorship, by a general partner or the proprietor, respectively; or
(c) For a municipality, State, Federal, or other public agency: by either a principal executive officer, or ranking elected official. For purposes of 314 CMR 5.14, a principal executive officer of a Federal agency includes:
1. The chief executive officer of the agency; or

5.14: continued

2. A senior executive officer having responsibility for the overall operations of a principal geographic unit of the agency (e.g., Regional Administrator of EPA).

(2) Reports. All reports required by permits and other information requested by the Director shall be signed by a person described in 314 CMR 5.14(1), or by a duly authorized representative of that person. A person is a duly authorized representative only if:
(a) The authorization is made in writing by a person described in 314 CMR 5.14(1);
(b) The authorization specifies either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, superintendent, or position of equivalent responsibility; and
(c) The written authorization is submitted to the Director.

(3) Certification. Any person signing a document under 314 CMR 5.14(1) or (2) shall make the following certification:
"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

(314 CMR 5.15 through 5.16: Reserved)

5.17: Interim Permit Status

(1) The continued use and operation of existing treatment works and the discharges to the ground waters therefrom may be authorized in accordance with 314 CMR 5.17 during the period following the effective date of 314 CMR 5.00, and prior to the issuance of an individual discharge permit for such works and discharges. Treatment works and discharges authorized pursuant to 314 CMR 5.17 shall be given "interim permit status" and shall be exempt from the need for an individual discharge permit under M.G.L. c. 21, s. 43, pursuant to 314 CMR 5.05(12).

(2) Any person owning an existing treatment works with a discharge to the ground waters of the Commonwealth which:
(a) has written approval from the Division, the Department or, if approved prior to July 1975, from the Department of Public Health for the treatment works, and
(b) does not have a valid permit from the Director pursuant to M.G.L. c. 21, s. 43, and
(c) requires a permit pursuant to 314 CMR 5.03 and 5.04, and
(d) is not exempt from the need for an individual permit pursuant to 314 CMR 5.05(1) through (11),
may apply for interim permit status by completing and submitting the appropriate permit application forms in 314 CMR 5.20, 5.22, 5.24 and 5.26, together with a copy of the written approval from the Division, the Department or, if approved prior to July 1975, from the Department of Public Health. Such application forms and written approval shall be submitted to the Division by January 1, 1984.

(3) Existing treatment works and discharges for which an application and written approval are received pursuant to 314 CMR 5.17(2) are hereby given interim permit status and are exempt from the need for

5.17: continued

an individual permit until such time as the Director processes the permit application or issues a final determination to deny the permit in accordance with 314 CMR 2.08, provided the treatment works and discharge authorized herein comply with the following:

(a) the treatment works were designed, constructed and are operated and maintained in accordance with the terms and conditions of the written approval from the Division, the Department or the Department of Public Health;

(b) the discharge to the ground waters does not result in a violation of the Massachusetts Surface Water Quality Standards, 314 CMR 4.00, or result in a threat to the public health, safety, welfare or the environment; and

(c) the operation of the treatment works or the discharge therefrom does not result in a violation of any other state or federal law or regulation.

(4) Monitoring at interim status facilities shall continue to be conducted in accordance with the letter of approval for the treatment works unless notified in writing by the Director. The Director may require the installation of monitoring wells and the sampling and analysis of the discharge and the ground water at monitoring wells for any facility given interim permit status under 314 CMR 3.17.

(314 CMR 5.18: Reserved)

5.19: *General Conditions*

The following conditions apply to all permits:

(1) No discharge authorized in the permit shall result in a violation of the Massachusetts Surface Water Quality Standards (314 CMR 4.00) or the Massachusetts Ground Water Quality Standards (314 CMR 6.00), or any amendments thereto. Upon promulgation of any amended standard, this permit may be revised or amended in accordance with such standard and 314 CMR 2.10 and 3.12 or 5.12. For purposes of determining compliance with ground water quality standards, a violation of the ground water quality standards, and the discharge permit will be determined to occur when any parameter measured in any downgradient well exceeds the applicable criteria listed in 314 CMR 6.06. In those cases where it is shown that a measured parameter exceeds the applicable criteria listed in 314 CMR 6.06 at the upgradient monitoring well, a violation of the ground water quality standards and the discharge permit will be determined to occur when it is shown that a measured parameter in any downgradient well exceeds the level of that same measured parameter in the upgradient well for the same sampling period. A statistical procedure approved by the Director shall be used in determining when a measured parameter exceeds the allowable level.

(2) Duty to comply. The permittee shall comply at all times with the terms and conditions of the permit, 314 CMR, the State Act and all other applicable state and federal statutes and regulations.

(3) Standards and prohibitions toxic pollutants. The permittee shall comply with effluent standards or prohibitions established under Section 307(a) of the Federal Act for toxic pollutants within the time provided in the regulations that establish these standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

(4) Proper operation and maintenance. The permittee shall at all times properly operate and maintain all facilities and equipment installed or used to achieve compliance with the terms and conditions of the permit, and in accordance with 314 CMR 12.00.

5.19: continued

(5) Duty to halt or reduce activity. Upon reduction, loss, or failure of the treatment facility, the permittee shall, to the extent necessary to maintain compliance with its permit, control production or discharges or both until the facility is restored or an alternative method of treatment is provided. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of the permit.

(6) Power Failure. In order to maintain compliance with the effluent limitations and prohibitions of this permit, the permittee shall either:
(a) provide an alternative power source sufficient to operate the wastewater control facilities; or
(b) Halt, reduce or otherwise control production and/or all discharges upon the reduction, loss, or failure of the primary source of power to the wastewater control facilities.

(7) Duty to mitigate. The permittee shall take all reasonable steps to minimize or prevent any adverse impact on human health or the environment resulting from non-compliance with the permit.

(8) Duty to provide information. The permittee shall furnish to the Director within a reasonable time any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating the permit, or to determine whether the permittee is complying with the terms and conditions of the permit.

(9) Inspection and entry. The permittee shall allow the Director or his authorized representatives to:
(a) Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records required by the permit are kept;
(b) Have access to and copy, at reasonable times, any records that must be kept under the conditions of the permit;
(c) Inspect at reasonable times any facilities, equipment, practices, or operations regulated or required under the permit; and
(d) Sample or monitor at reasonable times for the purpose of determining compliance with the terms and conditions of the permit.

(10) Monitoring. Samples and measurements taken for the purpose of monitoring shall be representative of the monitored activity. Monitoring must be conducted according to test procedures approved under 40 CFR Part 136 unless other test procedures are specified in the permit.

(11) Recordkeeping. The permittee shall retain records of all monitoring information including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by the permit, and all records of all data used to complete the application for the permit, for a period of at least three (3) years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.
Records of monitoring information shall include:
(a) The date, exact place, and time of sampling or measurements;
(b) The individual(s) who performed the sampling or measurement;
(c) The date(s) analyses were performed;
(d) The individual(s) who performed the analyses;
(e) The analytical techniques or methods used; and
(f) The results of such analyses.

(12) Prohibition of bypassing. Except as provided in 314 CMR 5.19(13), bypassing is prohibited, and the Director may take enforcement action against a permittee for bypassing, unless the discharge is to a surface water and:

5.19: continued

(a) The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
(b) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if the permittee could have installed adequate backup equipment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
(c) The permittee submitted notice of the bypass to the Director:
1. In the event of an anticipated bypass at least ten (10) days in advance, if possible; or
2. In the event of an unanticipated bypass as soon as the permittee has knowledge of the bypass and no later than twenty-four (24) hours after its first occurrence.

(13) Bypass not exceeding limitations. The permittee may allow a bypass to occur which does not cause effluent limitations to be exceeded, but only if necessary for the performance of essential maintenance or to assure efficient operation of treatment facilities.

(14) Permit actions. The permit may be modified, suspended, or revoked for cause. The filing of a request by the permittee for a permit modification, reissuance, or termination, or a notification of planned changes or anticipated non-compliance does not stay any permit condition.

(15) Duty to reapply. If the permittee wishes to continue an activity regulated by the permit after the expiration date of the permit, the permittee must apply for and obtain a new permit. The permittee shall submit a new application at least one hundred and eighty (180) days before the expiration date of the existing permit, unless permission for a later date has been granted by the Director.

(16) Property rights. The permit does not convey any property rights of any sort or any exclusive privilege.

(17) Other laws. The issuance of a permit does not authorize any injury to persons or property or invasion of other private rights, nor does it relieve the permittee of its obligation to comply with any other applicable Federal, State, and local laws and regulations.

(18) Oil and hazardous substance liability. Nothing in the permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the Federal Act, and M.G.L. c. 21E.

(19) Removed substances. Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed in a manner consistent with applicable Federal and State laws and regulations including, but not limited to, the State and Federal Acts, the Massachusetts Hazardous Waste Management Act, M.G.L. c. 21C, and the federal Resource Conservation and Recovery Act, 42 U.S.C. s. 6901, et seq., 310 CMR 19.00 and 30.000, and other applicable regulations.

(20) Reporting requirements.
(a) Monitoring reports. Monitoring results shall be reported on a Discharge Monitoring Report (DMR) at the intervals specified elsewhere in the permit. If the permittee monitors any pollutant more frequenty than required by the permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.

5.19: continued

(b) Compliance schedules. Reports of compliance or non-compliance with, or any progress reports on, interim and final requirements contained in any compliance schedule of the permit shall be submitted no later than fourteen (14) days following each schedule date.

(c) Planned changes. The permittee shall give notice to the Director as soon as possible of any planned physical alterations or additions to the permitted facility or activity which could significantly change the nature or increase the quantity of pollutants discharged. Unless and until the permit is modified, any new or increased discharge in excess of permit limits or not specifically authorized by the permit constitutes a violation.

(d) Anticipated non-compliance. The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in non-compliance with permit requirements.

(e) Twenty-four (24) hour reporting. The permittee shall report any non-compliance which may endanger health or the environment. Any information shall be provided orally within twenty-four (24) hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within five (5) days of the time the permittee becomes aware of the circumstances. The written submission shall contain a description of the non-compliance, including exact dates and times, and if the non-compliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the non-compliance.

The following shall be included as information which must be reported within twenty-four (24) hours:

1. Any unanticipated bypass which exceeds any effluent limitation in the permit.

2. Violation of a maximum daily discharge limitation for any of the pollutants listed by the Director in the permit to be reported within twenty-four (24) hours.

(f) Other non-compliance. The permittee shall report all instances of non-compliance not reported under 314 CMR 5.19(20)(a), (b), or (e) at the time monitoring reports are submitted. The reports shall contain the information listed in 314 CMR 5.19(20)(e).

(g) Toxics. All manufacturing, commercial, mining, or silvicultural dischargers must notify the Director as soon as they know or have reason to believe:

1. That any activity has occurred or will occur which would result in the discharge of any toxic pollutant listed in 314 CMR 3.16 which is not limited in the permit, if that discharge will exceed the highest of the following notification levels:

a. One hundred micrograms per liter (100 ug/l);

b. Two hundred micrograms per liter (200 ug/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/l) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/l) for antimony;

c. Five (5) times the maximum concentration value reported for that pollutant in the permit application; or

2. That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the permit application.

(h) Indirect dischargers. All Publicly Owned Treatment Works shall provide adequate notice to the Director of the following:

1. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to Sections 301 or 306 of the Federal Act if it were directly discharging those pollutants; and

2. Any substantial change in the volume or character of pollutants being introduced into the POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

5.19: continued

3. For purposes of 314 CMR 5.19, adequate notice shall include information on the quality and quantity of effluent introduced into the POTW, and any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

(i) Information. Where the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or in any report to the Director, it shall promptly submit such facts or information.

(21) Signatory requirement. All applications, reports, or information submitted to the Director shall be signed and certified in accordance with 314 CMR 3.14 and 5.14.

(22) Severability. The provisions of the permit are severable, and if any provision of the permit, or the application of any provision of the permit to any circumstance, is held invalid, the application of such provision to other circumstances, and the remainder of the permit, shall not be affected thereby.

(23) Reopener clause. The Director reserves the right to make appropriate revisions to the permit in order to establish any appropriate effluent limitations, schedules of compliance, or other provisions which may be authorized under the State or Federal Acts in order to bring all discharges into compliance with said statutes.

(24) Approval of plans and specifications for treatment works. All discharges and associated treatment works authorized herein shall be consistent with the terms and conditions of this permit and the approved plans and specifications. Any modification to the approved treatment works shall require written approval of the Director or the Department.

(25) Transfer of Permits.

(a) RCRA facilities. Any permit which authorizes the operation of a RCRA facility which is subject to the requirements of 314 CMR 8.07 shall be valid only for the person to whom it is issued and may not be transferred.

(b) Transfers by modification. Except as provided in 314 CMR 5.19(24)(a) and (c), a permit may be transferred by the permittee to a new owner or operator only if the permit has been modified or revoked and reissued or a minor modification made to identify the new permittee.

(c) Automatic transfers. As an alternative to transfers under 314 CMR 5.19(24)(b), any permit may be automatically transferred to a new permittee if:

1. The current permittee notifies the Director at least thirty (30) days in advance of the proposed transfer date in 314 CMR 5.19(2);

2. The notice includes a written agreement between the existing and new permittees containing a specific date for transfer of permit responsibility, coverage, and liability between them; and

3. The Director does not notify the existing permittee and the proposed new permittee of his intent to modify or revoke and reissue the permit. A modification under 314 CMR 5.19(24)(c) may also be a minor modification. If this notice is not received, the transfer is effective on the date specified in the agreement mentioned in 314 CMR 5.19(24)(c)2.

(26) Permit Fees.

(a) Any permittee, other than a public entity, required to obtain a surface water or ground water discharge permit pursuant to M.G.L. c. 21, s. 43 and 314 CMR 3.00 and 5.00, shall be required annually to obtain an inspection certificate from the Division, and submit the information and fee associated therewith in accordance with 314 CMR 2.12.

5.20: Application Form 1

314 CMR: DIVISION OF WATER POLLUTION CONTROL

5.20: Form 1

General Information
and Notification

DATE RECEIVED

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
DIVISION OF WATER POLLUTION CONTROL

APPLICATION FOR PERMIT TO DISCHARGE TO WATERS OF THE COMMONWEALTH

To be filed by all persons required to obtain a permit to discharge to waters of the Commonwealth.

Do not attempt to complete this form before reading the accompanying instructions.

- Please type or print -

1. NAME, ADDRESS, LOCATION, AND TELEPHONE NUMBER OF FACILITY PRODUCING THE DISCHARGE -

   A. Name ______________________
   B. Mailing Address
      Street ______________________
      City ____________ State ____________ Zip ________
   C. Location
      Street ____________ City ____________
      County ______________
   D. Telephone No. ( ) - ______ - ______

   OWNERSHIP

   Individual ______
   Corporation ______
   Partnership ______
   Other ______

   STATUS

   Private ______
   Public ______
   Other ______

2. CONTACT PERSON -

   Give the name, title, and work telephone number of a person who is thoroughly familiar with the operation of the facility and with the facts reported in this application and who can be contacted by the Division of Water Pollution Control if necessary.

   A. Name ______________________
   B. Title ______________________
   C. Telephone No. ( ) - ______ - ______

5.20: continued

314 CMR: DIVISION OF WATER POLLUTION CONTROL

3. FACILITY STATUS -

existing ____________ proposed ____________

4. Does this project affect a site of historic or archeological significance as defined in regulations of the Massachusetts Historical Commission, 950 CMR 71.00?

Yes ________ No ________

5. Does this project require a filing under 301 CMR 10.00, the Massachusetts Environmental Policy Act?

Yes ________ No ________

If yes, has a filing been made?

Yes ________ No ________

6. APPLICATION FORMS NEEDED -

Answer questions A through F to determine which additional application forms you need to submit to the Division of Water Pollution Control. If you answer "Yes" to any question, you must submit this form and the supplemental form listed in the parentheses following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "No" to each question, you need not submit any of these forms.

	Yes	No	Form Attached
A. Is this facility an existing or proposed publicly owned treatment works which results in a discharge to surface waters of the Commonwealth? (Form 2A)			
B. Does or will this facility (either existing or proposed) include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to the surface waters of the Commonwealth? (Form 2B)			
C. Does or will this facility result in a discharge to surface waters of the Commonwealth other than those described in A or B above? (Form 2C)			

5.20: continued

314 CMR: DIVISION OF WATER POLLUTION CONTROL

D. Is this facility an existing or proposed treatment works which results in a discharge only of treated sewage to the land surface or to the ground waters of the Commonwealth? (Form GW-A)			
E. Does or will this facility include a concentrated animal feeding operation or aquatic animal production facility which results in a discharge to the land surface or ground waters of the Commonwealth? (Form GW-B)			
F. Does or will this facility result in a discharge to the land surface or the ground waters of the Commonwealth other than those described in D or E above? (Form GW-C)			

7. Is this a RCRA facility as defined in 314 CMR 8.03?

   Yes ______________ No ______________

   If yes, submit the information on Form HW contained in 314 CMR 8.20 in accordance with the provisions of 314 CMR 8.08.

8. INDUSTRIAL CLASSIFICATION -

   List, in descending order of significance, the four (4) digit standard industrial classification (SIC) codes which best describe your facility in terms of the principal products or services you produce or provide. Also, specify each classification in words.

   SIC CODE   SPECIFY

   A.
   B.
   C.
   D.

5.20: continued

314 CMR: DIVISION OF WATER POLLUTION CONTROL

9. FACILITY OPERATOR -

Give the name, as it is legally referred to, of the person, firm, public organization, or other entity which operates the facility described in this application. If the facility owner is also the operator, write owner and list mailing address only if different from that listed in number 1 above.

A. Name ______________________________
B. Mailing Address
Street ______________________________
City ____________ State ____________ Zip ____________

OWNERSHIP		STATUS	
Individual	______	Private	______
Corporation	______	Public	______
Partnership	______	Other	______
Other	______		

10. LOCATION OF FACILITY -

A. Is the facility located on Indian Lands?

Yes __________ No __________

B. Provide a topographic map or maps of the area extending at least to one mile beyond the property boundaries of the facility which clearly show the following:

The legal boundaries of the facility;

The location and serial number of each of your existing and proposed intake and discharge structures;

All hazardous waste management facilities;

All springs and surface water bodies in the area, plus all drinking water wells within one mile of the facility which are identified in the public record or otherwise known to you.

If an intake or discharge structure, hazardous waste disposal site, or injection well associated with the facility is located more than one mile from the plant, include it on the map, if possible. If not, attach additional sheets describing the location of the structure, disposal site, or well, and identify the U.S. Geological Survey (or other) map corresponding to the location.

5.20: continued

314 CMR: DIVISION OF ' °OLLUTION CONTROL

On each map, include the map scale, meridian arrow showing north, and latitude and longitude to the nearest whole second. On all maps of rivers, show the direction of the current, and in tidal waters, show the directions of the ebb and flow tides. Use a 7-1/2 minute series map published by the U.S. Geologic Survey.

11. NATURE OF BUSINESS -

Briefly describe the nature of your business, include products produced or services provided.

12. WATER SUPPLY DATA -

A. List sources of water supply and annual water consumption for the past 5 years.

Water Sources	Year 1.	2.	3.	4.	5.
1.					
2.					
3.					
TOTAL:					

B. Please show the location of your water sources on the map described in paragraph 7.

13. CERTIFICATION -

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Printed Name of Applicant ____________ Title ____________

Signature of Applicant ____________ Date Signed ____________

Name of Preparer ____________ Title ____________ Telephone No. ____________

5.22: Application Form GW-A

5.22: Form GW-A

Ground Water Discharge

APPLICATION NO.
DATE RECEIVED

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
DIVISION OF WATER POLLUTION CONTROL

APPLICATION FOR PERMIT TO DISCHARGE TO GROUND

To be filed for municipalities and for residential and commercial establishments discharging sewage only.

Do not attempt to complete this form before reading accompanying instructions.

- Please type or print -

1. Name, address, location, and telephone number of facility producing the discharge.

   A. Name ______________________________
   B. Mailing Address
      Street ______________________________
      City __________ State __________ Zip __________
   C. Location
      Street __________ City ______________________
   D. Telephone No. __________ ______________________

2. Ownership status: public ______ private ______

3. Type of establishment producing or contributing to discharge.

   Residential housing: Total number of bedrooms __________
   Other: Nature of business ______________________

4. When did or when will this discharge begin? __________ (date)

5. Design flow: Daily average ______gpd; Daily maximum ____gpd

6. Basis for design flow:

   The State Environmental Code - Title 5 ______________
   Measurement ______________________
   Other: *Specify:* ______________________

7. (a) Check here if discharge occurs all year ________, or
   (b) List the months discharge occurs ______________
   (c) *Number of days per week discharge occurs* ______________

5.22: continued

8. Type of treatment and disposal system for discharge to ground
____

9. Location and method of wastewater treatment solids disposal
____

10. Are you now required by any Federal, State or local authority to meet any implementation schedule for the construction, upgrading or operation of wastewater treatment equipment or practices or any other environmental program which may affect the discharge described in this application?

    Yes ______________ Please explain
    No ______________

11. If a commercial establishment:

    A. Are any types of wastewater other than sanitary sewage produced?

        Yes   Specify ______________________
              Quantity ______________ gpd
              Method and location of disposal ______________

        No ______________

    B. Are any hazardous wastes generated?   Yes ____ No ____

12. Does or will the treatment/disposal facility receive industrial wastes?

    Yes ______________
    No ______________

13. Are you seeking a reclassification of the ground waters impacted by your discharge?

    Yes ______________
    No ______________

    If the answer to this question is yes additional information should be submitted pursuant to 314 CMR 6.00, The Massachusetts Ground Water Quality Standards.

14. Are there any public or private drinking water supply wells within 2500 feet of the discharge area?

    Yes ______________ (Please list below)
    No ______________

5.22: continued

Well Location	Type of Well (Public/Private)	Status (Active/ Inactive)	Safe Yield of Well

15. Has a hydrogeologic study been performed to determine the potential impact on the ground water of the discharge or activity?

    Yes ______________ (Please attach copy)
    No ______________

16. Have plans and specifications for the treatment works been approved by the Department or if approved prior to July 1975, the Department of Public Health? (Please attach copy of plans and specifications and approval letter.)

    Yes ______________
    No ______________

17. Are there any ground water monitoring wells currently in place in the vicinity of the discharge or proposed discharge?

    Yes ______________ (Please attach information on type of well, and location of wells and available monitoring data)
    No ______________

18. Do you own the property at the discharge site?

    Yes ______________
    No ______________

19. "I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

    ______________________ ______________________
    Printed Name of Applicant Title

    ______________________ ______________________
    Signature of Applicant Date Signed

    ______________________ ______________________
    Name of Preparer Title Telephone No.

5.24: Application Form GW-B

5.24: Form GW-B

Ground Water Discharge

APPLICATION NO.
DATE RECEIVED

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
DIVISION OF WATER POLLUTION CONTROL

APPLICATION FOR PERMIT TO DISCHARGE TO THE GROUND

To be filed for facilities which include a concentrated animal feeding operation which results in a discharge to the land surface or ground waters of the Commonwealth.

Do not attempt to complete this form before reading the accompanying instructions.

- Please type of print -

1. NAME, ADDRESS, LOCATION, AND TELEPHONE NUMBER OF FACILITY PROVIDING THE DISCHARGE.
   A. Name ______
   B. Mailing Address ______
      Street ______
      City ______ State ______ Zip ______
   C. Location
      Street ______ City ______
      County ______
   D. Telephone No. ( ) - -

2. TYPE AND NUMBER OF ANIMALS IN OPEN CONFINEMENT AND HOUSED UNDER ROOF -

A. Type	B. Number in open confinement	C. Number housed under roof

3. BASIS OF DESIGN -

   A. Is a runoff diversion being used or planned?

   Yes ______ No ______

5.24: continued

B. What is the design basis for the control system? (Specify frequency and duration of storm, and total amount of rain in inches.)

C. Number of acres contributing drainage. ________________

D. Design safety factor. __________

4. TREATMENT FACILITY -

Type of treatment and disposal system provided for discharge to ground

____
____
____
____

5. SOLIDS DISPOSAL -

Location and method of wastewater treatment solids disposal

____
____
____
____

6. IMPROVEMENTS -

Are you now required by any Federal, State or local authority to meet any implementation schedule for the construction upgrading or operation of wastewater treatment equipment or practices or any other environmental program which may affect the discharge described in this application?

Yes ________(Please explain below) No _________

7. IMPACT OF DISCHARGE -

A. Are you seeking a reclassification of the ground waters impacted by your discharge?

Yes _________ No _________

If the answer to this question is yes, additional information should be submitted pursuant to 314 CMR 6.00, The Massachusetts Ground Water Quality Standards.

5.24: continued

B. Are there any private drinking water supply wells within 2500 feet or any public drinking water supply wells within 10,000 feet of the discharge area?

Yes ________(Please list below) No __________

Well Location	Type of Well (Public/Private)	Status (Active/ Inactive)	Safe Yield of Well

C. Has a hydrogeologic study been performed to determine the potential impact on the ground water of the discharge or activity?

Yes _______(Please attach a copy) No _________

8. APPROVAL OF TREATMENT WORKS -

A. Have plans and specifications for the treatment works been approved by the Department or if approved prior to July 1975, the Department of Public Health? (Please attach copy of plans and specifications and approval letter.)

Yes _______ No __________

B. When did or when will these discharges being? ________(date)

9. Are there any ground water monitoring wells currently in place in the vicinity of the discharge or proposed discharge?

Yes _______(Please attach information on the type, and location of the wells and available monitoring data)
No _______

10. CERTIFICATION -

"I certify under penalty of law that this document and all attachments were prepared under my direction or sunervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on the my inqufry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

5.24: continued

Printed Name of Applicant	Title
Signature of Applicant	Date Signed
Name of Preparer	Title Telephone No.

(314 CMR 5.25: Reserved)

5.26: Application Form GW-C

5.26: Form GW-C

Ground Water Discharge

APPLICATION NO.
DATE RECEIVED

COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF ENVIRONMENTAL QUALITY ENGINEERING
DIVISION OF WATER POLLUTION CONTROL

APPLICATION FOR PERMIT TO DISCHARGE TO THE GROUND

To be filed by persons engaged in manufacturing, mining or any activity producing industrial wastes.

Do not attempt to complete this form before reading the accompanying instructions.

- Please type or print -

1. NAME, ADDRESS, LOCATION, AND TELEPHONE NUMBER OF FACILITY PRODUCING THE DISCHARGE -

A. Name ______________________________

B. Mailing Address
Street ______________ ______________
City ______________ State ______________ Zip ______________

C. Location
Street ______________ City ______________

D. Telephone No. ( ) - -

2. TREATMENT FACILITY -

A. Identification Number	B. General Description	C. Location

5.26: continued

3. FLOWS, SOURCES OF POLLUTION AND TREATMENT TECHNOLOGIES -

A. Attach a line drawing showing the water flow through the facility. Indicate sources of intake water, operations contributing wastewater to the effluent, and treatment units labeled to correspond to the more defined descriptions in Item B. Construct a water balance on the line drawing by showing average flows between intakes, operations, treatment units, and outfalls. If a water balance cannot be determined (e.g. for certain mining activities), provide a pictorial description of the nature and amount of any sources of water and any collection or treatment measures.

B. For each discharge, provide a description of:

(1) All operations contributing wastewater to the effluent, including process wastewater, sewage, cooling water, and storm water runoff;
(2) The average flow contributed by each operation; and
(3) The treatment received by the wastewater. Continue on additional sheets if necessary.

1. Identification Number	2. Operations Contributing Flow a. Operations	b. Average Flow	3. Treatment

C. Except for storm water runoff, leaks, or spills, are any of the discharges described in item 3A or B intermittent or seasonal?

Yes __________(Complete the following table) No ____________

5.26: continued

1. Identification Number	2. Operations Contributing Flow	3. Frequency a. Days Per Week	3. Frequency b. Months Per Year	4. Flow a. Flow Rate	4. Flow b. Total Volume	4. Flow c. Duration

4. MAXIMUM PRODUCTION -

A. List the quantity which represents an actual measurement of your maximum level of production, and indicate the affected treatment facility. Please indicate terms and units used.

1. Identification Number of Treatment Facility Affected	2. Quantity Per Day	3. Unit of Measure	4. Operations, Product Material, Etc.

5. IMPROVEMENTS -

Are you now required by any Federal, State or local authority to meet any implementation schedule for the construction, upgrading or operation of wastewater treatment equipment or practices or any other environmental programs which may affect the discharges described in this application? This includes but is not limited to, permit conditions, administrative or enforcement orders, enforcement compliance schedule letters, stipulations, court orders, and grant or loan conditions.

Yes ______(Complete the following table) No _______(Go to Item 6)

5.26: continued

1. Description of Order or Agreement	2. Identification Number of Affected Treatment Facility	3. Description of Project	4. Final Compliance Date

6. EFFLUENT LIMITATIONS -

A. List any pollutant which you know or have reason to believe is discharged or may be discharged from the treatment facilities. For every pollutant you list, briefly describe the reason you believe it to be present, its approximate concentration in the discharge and any analytical data in your possession which will support your statement. Additional wastewater analysis may be required as part of this application.

1. Identification Number of Treatment Facility	2. Pollutant	3. Concentration	4. Source	5. Available Analytical Data

B. Are your operations such that your raw materials, processes, or products can reasonably be expected to vary so that your discharges of pollutants may during the next five years exceed three times the approximate concentrations reported in item 6A?

Yes ______________(Please explain below) No ____________

5.26: continued

D. Are you planning on adding any new processes over the next five years?
Yes ___________(Please explain below) No ___________

C. Are hazardous wastes generated at your facility?

Yes ___________(Please explain below) No ___________

B. Are organic compounds used at your facility?

Yes ___________(Please explain below) No ___________

7. BIOLOGICAL TOXICITY TESTING DATA -

A. Do you have any knowledge or reason to believe that any biological test for acute or chronic toxicity has been made on any of the discharges within the last three years?

Yes ___________(Please explain below) No ___________

8. CONTRACT ANALYSIS INFORMATION -

A. Were any of the analyses or testing reported in items 6A or 7A performed by a contract laboratory or consulting firm?

Yes ___________(Please explain below) No ___________

5.26: continued

1. Name of Laboratory or Consultant	2. Address	3. Telephone	4. Pollutant Analyzed

9. IMPACT OF DISCHARGE -

A. Are you seeking a reclassification of the ground waters impacted by your discharge?

Yes ______________ No ______________

If the answer to this question is yes, additional information should be submitted pursuant to 314 CMR 6.00, the Massachusetts Ground Water Quality Standards.

B. Are there any private drinking water supply wells within 2500 feet or any public drinking water supply wells within one mile of the discharge area?

Yes ______________(Please list below) No ______________

Well Location	Type of Well (Public/Private)	Status (Active/Inactive)	Safe Yield of Well

5.26: continued

C. Has a hydrogeologic study been performed to determine the potential impact on the ground water of the discharge or activity?

Yes ____________(Please attach a copy) No ____________

10. APPROVAL OF TREATMENT WORKS -

A. Have plans and specifications for the treatment works been approved by the Department or, if approved prior to July 1975, the Department of Public Health? Please attach copy of plans and specifications, if available, and a copy of the approval letter.

Yes ____________
No ____________

B. When did or when will these discharges begin? ____________(date)

C. Location and method of wastewater treatment solids disposal ______________________________

11. Are there any ground water monitoring wells currently in place in the vicinity of the discharge or proposed discharge?

Yes ____________(Please attach information on the type and location of the wells and available monitoring data)
No ____________

12. Do you own the property at the discharge site?

Yes ____________
No ____________(Please explain)

13. CERTIFICATION -

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

______________________________ ______________________________
Printed Name of Applicant Title

______________________________ ______________________________
Signature of Applicant Date Signed

______________________________ ______________________________
Name of Preparer Title Telephone No.

REGULATORY AUTHORITY

314 CMR 5.00: M.G.L. c. 21, ss. 27(12) and 43.

314 CMR 6.00: MASSACHUSETTS GROUND WATER QUALITY STANDARDS

Section

6.01: Purpose and Authority
6.02: Definitions
6.03: Ground Water Classes and Designated Uses
6.04: Establishing Ground Water Classifications
6.05: Assignment of Class III Ground Waters
6.06: Minimum Ground Water Quality Criteria
6.07: Application of Standards
6.08: Monitoring
(314 CMR 6.09: Reserved)
6.10: Interim Provisions

6.01: Purpose and Authority

314 CMR 6.00 establishes the Massachusetts Ground Water Quality Standards pursuant to the provisions of M.G.L. c. 21 ss. 27(5), 27(6), and 27(12). These standards consist of ground water classifications, which designate and assign the uses for which the various ground waters of the Commonwealth shall be maintained and protected; water quality criteria necessary to sustain the designated uses; and regulations necessary to achieve the designated uses or maintain the existing ground water quality.

6.02: Definitions

As used in 314 CMR 6.00, the following words have the following meanings:

(1) Aquifer - a geological formation, group of formations, or part of a formation that is capable of yielding a significant amount of water to a well or spring.

(2) Consolidated Rock or Bed Rock - any solid hard rock exposed at the surface of the earth or overlain by unconsolidated deposits.

(3) Degraded - a change in ground water quality from local natural background ground water quality which is determined by the Division to be deteriorating in terms of the magnitude of the change and the importance of the parameters describing ground water quality.

(4) Department - the Massachusetts Department of Environmental Quality Engineering, as established by M.G.L. c. 21A, s. 7.

(5) Director - the Director of the Division of Water Pollution Control or his designee.

(6) Discharge or Discharge of Pollutants - any addition of any pollutant or combination of pollutants to waters of the Commonwealth from any source, including but not limited to, discharges from surface runoff which is collected or channelled by man; discharges through pipes, sewers, or other conveyances owned by a State, municipality, or other person which do not lead to a POTW and discharges through pipes, sewers, or other conveyances, leading into privately owned treatment works. This term does not include an addition of pollutants by any indirect discharger.

(7) Disposal System - a system for disposing of sewage, industrial waste or other wastes, and including sewer systems and treatment works.

(8) Division - the Division of Water Pollution Control of the Department, established pursuant to M.G.L. c. 21, s. 26.

6.02: continued

(9) Effluent - a discharge of pollutants into the environment, whether or not treated.

(10) Effluent Limitation or Effluent Limit - any requirement, restriction, or standard imposed by the Director on quantities, discharge rates, and concentrations of pollutants which are discharged from point sources into waters of the Commonwealth or to publicly owned treatment works.

(11) Environmental Protection Agency or EPA - the United States Environmental Protection Agency.

(12) Existing Ground Water Quality - characteristics of the physical, biological, chemical, and radiological parameters representative of the ground water quality at a site at the time of permit issuance, permit renewal or nonpermitted discharge as determined by an accepted hydrogeologic study.

(13) Federal Act - the Clean Water Act, P.L. 92-500 as amended by P.L. 95-217 and P.L. 95-576, 33 U.S.C. 125.

(14) Fresh Water - water having a chloride concentration equal to or less than 250 mg/l, or a total dissolved solids concentration equal to or less than 10,000 mg/l.

(15) Ground Water - water below the land surface in a saturated zone, including perched ground water.

(16) Health Advisory - the level of a pollutant in water at which, with a margin of safety, adverse health effects would not be anticipated, as determined by the Department or EPA.

(17) Industrial Waste - any liquid, gaseous, or solid waste substance or a combination thereof resulting from any process of industry, manufacturing, trade, or business or from the development or recovery of any natural resources.

(18) Leachate - any liquid, including any suspended or dissolved components in the liquid, that has percolated through or drained from a landfill or other solid waste disposal site.

(19) Massachusetts Water Quality Standards - the Massachusetts Surface Water Quality Standards (314 CMR 4.00) and the Massachusetts Ground Water Quality Standards (314 CMR 6.00).

(20) Milligrams Per Liter or mg/l - the weight in milligrams of any specific substance or substances contained in one liter of solution.

(21) Monitoring Well - a well that is specifically designed, constructed, emplaced and located to measure the impact of a subsurface discharge.

(22) Natural Background Condition - the chemical, physical or biological characteristics of surface or ground waters unaltered by human activity.

(23) Observation Well - a well that is used to determine existing hydrogeological conditions.

(24) Other Wastes - all liquid discarded matter other than sewage or industrial waste which may cause or might reasonably be expected to cause pollution of the waters of the Commonwealth in contravention of adopted standards.

6.02: continued

(25) Outlet - the terminus of a sewer system, or the point of emergence of any wastewater or effluent into the waters of the Commonwealth or onto the land surface.

(26) Pathogenic Organism - any disease-producing organism.

(27) Perched Ground Water - unconfined ground water separated from an underlying body of ground water by an unsaturated zone.

(28) Permit - an authorization issued pursuant to M.G.L. c. 21, ss. 43 and 314 CMR 2.00 and 3.00, 5.00, or 7.00, to implement the requirements of the State and Federal Acts and regulations adopted thereunder.

(29) Person - any agency or political subdivision of the Commonwealth, the federal govenment, any public or private corporation or authority, individual, partnership or association, or other entity, including any officer of a public or private agency or organization, upon whom a duty may be imposed by or pursuant to any provisions of M.G.L. c. 21, ss. 26 - 53.

(30) Pollutant - any element or property of sewage, agricultural, industrial or commercial waste, runoff, leachate, heated effluent, or other matter, in whatever form and whether originating at a point or major non-point source, which is or may be discharged, drained or otherwise introduced into any sewerage system, treatment works or waters of the Commonwealth.

(31) Pollution - the presence in the environment of pollutants in quantities or characteristics which are or may be injurious to human, plant or animal life or to property or which unreasonably interfere with the comfortable enjoyment of life and property throughout such areas as may be affected thereby.

(32) Potable Waters - fresh waters usable for drinking, culinary or food processing purposes.

(33) Quality Standard - the assigned level of purity or quality for any waters in relation to their designated usage.

(34) Saline Water - water having a chloride concentration of more than 250 mg/l or a total dissolved solids concentration of more than 10,000 mg/l.

(35) Saturated Zone - any portion of the earth below the land surface where every available opening (pore, fissure, joint, or solution cavity) is filled with water.

(36) Sewage - the water-carried human or animal wastes from residences, buildings, industrial establishments or other places, together with such ground water infiltration and surface water as may be present.

(37) Septage - the liquid and solid wastes, primarily of sewage origin, that are removed from a cesspool, septic tank or similar receptacle.

(38) State Act - the Massachusetts Clean Waters Act, as amended, M.G.L. c. 21, ss. 26 - 53.

(39) Subsurface Sewage Disposal System - a disposal system which discharges sewage onto or beneath the surface of the ground.

(40) Toxic Pollutants- those pollutants identified in 314 CMR 3.16, or any other pollutants or combination of pollutants, including disease-

6.02: continued

causing agents, which after discharge and upon exposure, ingestion, inhalation or assimilation into any organism, either directly from the environment or indirectly through food chains, may, on the basis of information available to the Division, cause death, disease, behavioral abnormalities, cancer, mutations, physiological malfunctions, biochemical abnormalties, including malfunctions in reproduction, or physical deformations, in such organisms or their offspring.

(41) Treatment Works - any and all devices, processes and properties, real or personal, used in the collection, pumping, transmission, storage, treatment, disposal, recycling, reclamation or reuse of waterborne pollutants, but not including any works receiving a hazardous waste from off the site of the works for the purpose of treatment, storage or disposal.

(42) Underground Injection Control or UIC - the program under Section 1421 of the Safe Drinking Water Act (P.L. 93-523 as amended by P.L. 95-190 and 96-502).

(43) Unconsolidated Deposits - all non-indurated or poorly indurated soil materials above the bed rock.

(44) Unsaturated Zone - that portion of the earth's crust which does not contain sufficient water to fill all interconnected voids or pore spaces. Perched water bodies may exist within the unsaturated zone.

(45) Waste Management System - includes the management of mechanical equipment, crops, irrigation and monitors as an operational unit.

(46) Wastewater - sewage, industrial waste, other wastes or any combination of the three (3).

(47) Waters of the Commonwealth - all waters within the jurisdiction of the Commonwealth, including, without limitation, rivers, streams, lakes, ponds, springs, impoundments, estuaries, wetlands, coastal waters, and ground waters.

(48) Well - a bored, drilled, or driven shaft or a dug hole, whose depth is greater than its largest surface dimension.

6.03: Ground Water Classes and Designated Uses

All ground waters of the Commonwealth shall be assigned to one of the Classes listed below based upon the most sensitive uses for which the ground water is to be maintained and protected. The classes are:

(1) Class I - Ground waters assigned to this class are fresh ground waters found in the saturated zone of unconsolidated deposits or consolidated rock and bed rock and are designated as a source of potable water supply.

(2) Class II - Ground waters assigned to this class are saline waters found in the saturated zone of the unconsolidated deposits or consolidated rock and bed rock and are designated as a source of potable mineral waters, for conversion to fresh potable waters, or as raw material for the manufacture of sodium chloride or its derivatives or similar products.

6.03: continued

(3) Class III - Ground water assigned to this class are fresh or saline waters found in the saturated zone of unconsolidated deposits or consolidated rock and bed rock and are designated for uses other than as a source of potable water supply. At a minimum the most sensitive use of these waters shall be as a source of non-potable water which may come in contact with, but is not ingested by humans.

6.04: Establishing Ground Water Classifications

(1) The procedure by which the classes designated in 314 CMR 6.03 are assigned to particular ground waters shall be known as a "classification". The initial classification of ground waters of the Commonwealth by the Division shall be done in accordance with the provisions of 314 CMR 6.04 and 6.10. Any person desiring a classification of the ground waters shall submit a petition to the Division. All such petitions shall contain at a minimum the following information:

(a) The name, mailing address and telephone number of the petitioner;
(b) The location and description of the ground waters including any aquifers for which the classification is proposed;
(c) The current classification and proposed classification for the ground waters in question;
(d) The current uses of the ground waters in question and the potential uses with and without the classification;
(e) A listing of all existing and planned public water supplies and all existing private water supplies in the area impacted by the classification;
(f) A listing of all known existing and proposed discharges of pollutants to the ground waters impacted by the classification;
(g) The reason or reasons why the classification is necessary; and
(h) In those cases where the proposed classification for the ground waters is Class III, documentation of compliance with the requirements of 314 CMR 6.05.

(2) In addition to complying with the requirements of 314 CMR 6.05, where a Class III classification is proposed, the person proposing the classification may also be required to:

(a) Comply with the requirements of 301 CMR 10.00, if applicable;
(b) Submit a hydrogeologic study which may include, but not be limited to, soil borings, installation of ground water monitoring and observation wells, determination of infiltration capacity, percolation tests, determination of transmissivity, defining the mounding potential, determining water table elevations, estimating the potential movement of the contaminant plume, analyses of soils, water quality analyses and computer modelling of the ground waters; and
(c) Any additional information deemed necessary by the Director to evaluate the classification request.

(3) Any classification under this section constitutes a modification of 314 CMR 6.00 and shall be promulgated in accordance with the procedures set forth in M.G.L. c. 30A s. 2. As part of any classification of ground waters as Class III, the Division shall publish a map of appropriate scale delineating the Class III area.

(4) In any classification, the burden of proof relative to justifying the classification shall be on the person requesting the classification.

6.05: Assignment of Class III Ground Waters

(1) The Class III designation shall not be assigned to any ground waters of the Commonwealth unless the Director finds that adjacent,

6.05: continued

tributary and downgradient ground waters and surface waters and the most sensitive designated uses thereof will not be impaired by such classification.

(2) No Class III classification shall be made if there is no existing or proposed discharge to the ground water requiring such a classification. If the discharge is to be made by means of injection into a well, no Class III classification shall be made except in compliance with the provisions of 310 CMR 27.07 and 40 CFR 144.7.

(3) A Class III classification shall only be considered for the following cases:

(a) The ground water impacted by the classification is under single ownership by the discharger proposing the classification; or

(b) The ground water impacted by the classification does not currently serve, and will not in the future serve, as a source of drinking water because:

1. The ground water is situated at a depth or location that makes recovery of water for drinking water purposes economically or technologically infeasible; or

2. The ground water is contaminated or degraded to the point that recovery of water for drinking water purposes is economically or technologically infeasible; or

3. The discharge of the person proposing the classification is located over a federally defined Class III well mining area subject to subsidence or catastrophic collapse; or

(c) The ground water impacted by the classification currently serves as a drinking water source, or could potentially serve as a drinking water source, but an alternate source of drinking water is available and will be provided by the discharger proposing the classification to all existing and potential users of the aquifer impacted by the discharge.

(4) Where it can be demonstrated that 314 CMR 6.05(3) has been satisfied, the following potential adverse effects on hydraulically connected surface and ground waters shall be evaluated in a classification proceeding under 314 CMR 6.04:

(a) The volume and physical, chemical and biological characteristics of the waste in the discharge to the proposed Class III ground waters, including the potential for migration;

(b) The hydrogeologic characteristics of the disposal site and the area immediately surrounding the proposed Class III area;

(c) The existing quantity and quality of ground water within the proposed Class III area, and the direction of ground water flow into and out of the proposed Class III area;

(d) The proximity of the disposal system to the proposed Class III area and hydraulically connected ground waters and surface waters;

(e) The proximity and withdrawal rates of ground water users in relation to the proposed Class III area;

(f) The potential for health risks caused by human exposure to waste constituents within the proposed Class III ground waters;

(g) The current and future uses of surface waters and ground waters in the areas adjacent to the proposed Class III area and the water quality standards established for those waters;

(h) The existing quality of surface waters and ground water adjacent to the proposed Class III area including other sources of contamination and the cumulative impact on water quality;

(i) The potential damage to wildlife, crops, vegetation, and physical structures caused by the pollutants; and

(j) The persistence and permanence of the potential adverse effects.

6.06: Minimum Ground Water Quality Criteria

(1) Class I and Class II Ground Waters. The following minimum criteria are applicable to all Class I and Class II ground waters:

Parameter	Criteria
(a) Pathogenic Organisms	Shall not be in amounts sufficient to render the ground waters detrimental to public health and welfare or impair the ground water for use as source of potable water.
(b) Coliform Bacteria	Shall not exceed the maximum contaminant level as stated in the National Interim Primary Drinking Water Standards.
(c) Arsenic	Shall not exceed 0.05 mg/l
(d) Barium	Shall not exceed 1.0 mg/l
(e) Cadmium	Shall not exceed 0.01 mg/l
(f) Chromium	Shall not exceed 0.05 mg/l
(g) Copper	Shall not exceed 1.0 mg/l
(h) Fluoride	Shall not exceed 2.4 mg/l
(i) Foaming Agents	Shall not exceed 0.5 mg/l
(j) Iron	Shall not exceed 0.3 mg/l
(k) Lead	Shall not exceed 0.05 mg/l
(l) Manganese	Shall not exceed 0.05 mg/l
(m) Mercury	Shall not exceed 0.002 mg/l
(n) Nitrate Nitrogen (as Nitrogen)	Shall not exceed 10.0 mg/l
(o) Total Trihalomethanes	Shall not exceed 0.1 mg/l
(p) Selenium	Shall not exceed 0.01 mg/l
(q) Silver	Shall not exceed 0.05 mg/l
(r) Sulfate	Shall not exceed 250 mg/l
(s) Zinc	Shall not exceed 5.0 mg/l
(t) Endrin (1,2,3,4,10, 10-hexachloro-1,7-epoxy-1, 4,4a,5,6,7,8,9a-octahydro-1,4-endo,endo-5,8-dimethano naphthalene)	Shall not exceed 0.0002 mg/l
(u) Lindane (1,2,3,4,5, 6-hexachlorocyclohexane, gamma isomer)	Shall not exceed 0.004 mg/l
(v) Methoxychlor (1,1,1-Trichloro-2, 2-bis (p-methoxyphenyl) ethane)	Shall not exceed 0.1 mg/l
(w) Toxaphene ($C_{10}H_{10}Cl_8$, Technical Chlorinated Camphene, 67-69 percent chlorine)	Shall not exceed 0.005 mg/l
(x) Chlorophenoxys:	
2,4-D,(2,4-Dichlorophenoxyacetic acid)	Shall not exceed 0.1 mg/l
2,4,5-TP Silvex (2,4, 5-Trichlorophenoxy-propionic acid)	Shall not exceed 0.01 mg/l
(y) Radioactivity	Shall not exceed the maximum radionuclide contaminant levels as stated in the National Interim Primary Drinking Water Standards.

6.06: continued

Parameter	Criteria
(z) pH	Shall be in the range of 6.5-8.5 standard units or not more than 0.2 units outside of the naturally occurring range.
(aa) All Other Pollutants	None in such concentrations which in the opinion of the Director would impair the waters for use as a source of potable water or to cause or contribute to a condition in contravention of standards for other classified waters of the Commonwealth.

(2) Class III Ground Waters. The following minimum criteria are applicable to all Class III ground waters:

Parameter	Criteria
(a) Pathegenic Organisms	Shall not be in amounts sufficient to render the ground waters detrimental to public health, safety or welfare.
(b) Radioactivity	Shall not exceed the maximum radionuclide contaminant levels as stated in the National Interim Primary Drinking Water Standards.
(c) All Other Pollutants	None in concentrations or combinations which upon exposure to humans will cause death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions or physical deformations or cause any significant adverse effects to the environment, or which would exceed the recommended limits on the most sensitive ground water use.

6.07: Application of Standards

(1) Ground Water Discharge Permits. No person shall make or permit an outlet for the discharge of sewage or industrial waste or other wastes or the effluent therefrom, into any ground water of the Commonwealth without first obtaining a permit from the Director of the Division of Water Pollution Control pursuant to 314 CMR 5.00. Said permit shall be issued subject to such conditions as the Director may deem necessary to insure compliance with the standards established in 314 CMR 6.06. Applications for ground water discharge permits shall be submitted within times and on forms prescribed by the Director and shall contain such information as he may require.

(2) Establishment of Discharge Limits. In regulating discharges of pollutants to ground waters of the Commonwealth, the Division shall limit or prohibit such discharges to insure that the quality standards of the receiving waters will be maintained or attained. The determina-

6.07: continued

tion by the Division of the applicable level of treatment for an individual discharger will be made in the establishment of discharge limits in the individual ground water discharge permit. In establishing effluent limitations in the individual permits, the Division must consider natural background conditions, must protect existing adjacent and downgradient uses and must not interfere with the maintenance and attainment of beneficial uses in adjacent and downgradient waters. Toward this end, the Division may provide a reasonable margin of safety to account for any lack of knowledge concerning the relationship between the pollutants being discharged and their impact on the quality of the ground waters.

(3) For purposes of determining compliance with 314 CMR 6.06(1)(aa) for toxic pollutants in Class I and Class II ground waters, the Division shall use Health Advisories which have been adopted by the Department or EPA. Generally, the level of a toxic pollutant which may result in one additional incident of cancer in 100,000 given a lifetime exposure (10^{-5} Excess Lifetime Cancer Risk) will be used in determining compliance with that section of the regulations.

(4) Coordination with Federal Criteria. The Division may use available published water quality criteria documents as guidance in establishing case-by-case discharge limits on specific pollutants to ground waters including but not limited to EPA guidance published in accordance with Section 304(b) of the Federal Act.

6.08: Monitoring

(1) Collection of Samples. The determination of compliance or non-compliance of sewage, industrial waste or other waste discharges with the requirements of 314 CMR 6.00 shall be made through tests or analytical determinations of ground water or effluent samples collected, transported and stored in such manner as is approved by the Division. The location at which ground water samples are collected shall be determined by the Division. In selecting or approving such locations, the Division shall consider all relevant facts including, but not limited to:

(a) The mobility of pollutants in the unsaturated zone and the pollutant attenuation mechanisms in this zone.

(b) Attenuation mechanisms which may remove potential pollutants in passage through the soil.

(c) The relative thickness of the unsaturated zone.

(d) Attenuation of pollutant concentrations with distance which may occur in the saturated zone, as a result of attenuation processes occurring below the water table.

The location at which effluent samples are collected shall be at a point where the effluent emerges from a treatment works, disposal system, outlet or point source and prior to being discharged to the ground.

(2) Number of Monitoring Wells. The Division shall determine the number of observation and and monitoring wells necessary for the determination of compliance with 314 CMR 6.00.

(3) Tests or Analytical Determinations. Test or analytical determinations to determine compliance or non-compliance with standards shall be made in accordance with:

(a) the latest edition of Standard Methods for the Examination of Water and Wastewater prepared by the Ammerican Public Health Association, American Water Works Association, and Water Pollution Control Federation;

(b) the latest edition of Methods for Chemical Analysis of Water and Wastes prepared by the Environmental Protection Agency;

6.08: continued

(c) the latest edition of Water Standards of The American Society for Testing and Materials; or
(d) other methods approved by the Director as giving results equal to or superior to methods listed above.

(314 CMR 6.09: Reserved)

6.10: Interim Provisions

(1) Ground water classifications will be assigned state-wide by the Division on or after June 1, 1985. Any person desiring an initial assignment of a specific classification for particular ground waters as part of the state-wide classifications should submit the information specified in 314 CMR 6.04 to the Division prior to January 1, 1985. All ground waters for which no petition for consideration of a specific classification is filed with the Division prior to January 1, 1985 will be proposed by the Division for assignment as Class I. The Division may consider individual petitions for Class III assignment on a case-by-case basis at any time, such petitions shall comply with the provisions of 314 CMR 6.04.

(2) In the absence of a classification all ground waters will be protected for the most sensitive of the uses designated in 314 CMR 6.03, that is as a source of potable water supply. All ground water discharge permits issued after October 1, 1983, but prior to the classification of the ground waters receiving the discharge, shall contain such special conditions necessary to protect the ground waters for use as a source of potable water supply, including but not limited to the applicable Class I effluent limitations contained in 314 CMR 5.10(3).

REGULATORY AUTHORITY

314 CMR 6.00: M.G.L. c. 21, ss. 27(5) and 28(12).

APPENDIX A: PART III

ALTERNATIVE PREFERRED BY MASSACHUSETSS DEP

The Commonwealth of Massachusetts

Executive Office of Environmental Affairs

Department of Environmental Quality Engineering

Division of Water Pollution Control

One Winter Street, Boston, Mass. 02108

Thomas C. McMahon
Director

December 22, 1986

Ronald M. Watson, Deputy Chief
Engineering and Services Division
Departments of the Army and the Air Force
National Guard Bureau
Washington, D.C. 20310

Dear Mr. Watson:

This Division is in receipt of your letters of November 6, 1986 and December 4, 1986 relative to possible future actions at the Otis ANG Base Wastewater Treatment Plant (WWTP).

As we have previously stated in a letter dated February 21, 1986 to Major Keating, Mass. ANG., the Camp Dresser and McKee "Final Report Otis Wastewater Treatment Evaluation" (Sept. 1985) proposed two alternative improvement schemes to the wastewater treatment facility as being "considered acceptable". Of these (Alternatives 1A and 4), Alternative 4 is preferable and warranted further study. We also stated on page 3 of our letter that the discharge limitations set forth in Section A-2 of the discharge permit for the WWTP do not contemplate Class III designation of the groundwater. The limitations as stated in the permit are in accordance with Class I groundwater standards, and in the event that a petition for a Class III designation of the groundwater associated with Alternative 4 is denied, the permittee will be required to comply with the Class I standards contained in the permit.

Therefore, we reiterate, that in addition to undertaking a more complete study of Alternative 4, the permittee should design an alternative to meet the effluent limits of the discharge permit which would also allow for eventual restoration of the groundwater quality in the area impacted by the Otis plume. We had, in fact, anticipated the receipt of such plans and specifications by October 1, 1986 in accordance with the provisions of the groundwater discharge permit as issued (Special Conditions, Item C(3)).

Should you have any questions regarding this matter, please contact Mr. Mark Pare at 292-5893.

Very truly yours,

Thomas C. McMahon
Director

TCM/CW/rew

Ronald M. Watson, Deputy Chief
December 22, 1986
Page 2

cc: DEQE Southeast Regional Office, Lakeville
Reed Zars, Office of the Attorney General, McCormack Building, Boston, Massachusetts 02108
Marsha Sherman, DEQE, Office of Legal Counsel
Falmouth Department of Public Works c/o Richard Witt, Director, Town Offices, Falmouth, Massachusetts 02540
Major Ernest R. Keating, MA ANG, Installation Commander, Headquaters Air National Guard, Otis Air National Guard Base, Massachusetts 02542-5001
Joe DiCola, EPA-Groundwater Section, JFK Federal Building, Boston, Massachusetts 02203

APPENDIX A: PART IV

SCOPING INSTRUCTION FROM EPA REGION I

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J. F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

March 9, 1987

Mr. William Sullivan,
OLAA/PA
Otis Air National Guard
Massachusetts 02542

Dear Mr. Sullivan:

We have reviewed the Air Force's notice of intent to prepare an environmental impact statement for the proposed development of new sand filter beds next to the Cape Cod Canal along the northern edge of Camp Edwards, Massachusetts Military Reservation, Cape Cod, Massachusetts for the land disposal of 0.3 million gallons per day of secondarily treated wastewater. We support the Air National Guard's (ANG's) efforts to evaluate alternatives that will reduce groundwater contamination caused by current land disposal at the southern boundary of Otis ANG Base.

As you know, under Section 1424(e) of the Safe Drinking Water Act, EPA designated the Cape Cod aquifer as the sole drinking water source for Cape Cod. Under Section 1424(e), no commitment for federal financial assistance may be entered into for any project which EPA determines may contaminate the aquifer so as to create a significant hazard to public health, but federal financial assistance may be entered into to plan or design the project to assure it will not contaminate the aquifer. A copy of our sole source determination [47 Federal Register 30282] is enclosed.

We believe the existing National Environmental Policy Act (NEPA) project review process will for the most part serve to provide the opportunity for development and review of the groundwater impacts information necessary for EPA's sole source review. We do, however, request that a meeting be scheduled at your earliest convenience to discuss potential project impacts to groundwater and other areas of environmental concern, including water quality (surface waters), wetlands and special aquatic sites, air quality, and noise.

According to the notice of intent, the ANG will evaluate six alternatives including the no action alternative. In addition to these alternatives, we believe the analysis should be expanded to include rapid filtration, advanced wastewater treatment (AWT), and discharge to Cape Cod Canal.

If you have any questions with regard to Cape Cod's sole source designation, please feel free to contact Rob Adler, our Massachusetts State Groundwater Coordinator at (617) 565-3601 or FTS 835-3601 for assistance. Donald Cooke of my staff will be the contact for the overall NEPA process, please contact Don for any other assistance you may need. Mr. Cooke may be reached by telephone at (617) 565-3416 or FTS 835-3416.

Sincerely yours,

Elizabeth Higgins Congram

Elizabeth Higgins Congram, Assistant Director
for Environmental Review
Office of Government Relations and
Environmental Review

Enclosure

cc: Rob Adler, EPA MA State Groundwater Coordinator
Charles Bishop, EPA Federal Facilities Coordinator
Clint Watson, MA DEQE, DWPC - Boston, MA

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J. F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203

August 3, 1987

Mr. William Sullivan
Public Affairs Officer
NGA HQ OLAA/PA
Massachusetts Air National Guard
Otis Air National Guard Base
Cataumet, Massachusetts 02542-5001

RE: Otis Waste Water Treatment Plant Project

Dear Mr. Sullivan:

This letter is in response to a June 11, 1987 letter to Douglas Heath of EPA's Groundwater Office from Leroy W. Householder of the National Guard Bureau regarding scoping for the Otis Waste Water Treatment Plant project.

Because Mr. Householder's letter indicates that he is apparently unaware of EPA's ongoing involvement in this project, we wish to clarify several points. First, this agency has already written to you on March 9, 1987 in response to the Air Force's notice of intent to prepare an EIS for the proposed Otis Air National Guard Wastewater Treatment Plant on Cape Cod. The notice of intent, published in the February 9, 1987 Federal Register (52 FR 4046), requested written scoping comments and announced a future public scoping meeting, time and location at that time unknown. In our March 9 letter, we requested that a meeting be scheduled at your earliest convenience due to the project's potential impacts to areas of EPA's jurisdiction and expertise (groundwater, water quality, wetlands and special aquatic sites, air quality, and noise). Most importantly the letter identified three alternatives that in our opinion must be evaluated in the EIS: 1.) rapid filtration; 2.) advanced wastewater treatment (AWT); and 3.) discharge to Cape Cod Canal.

Second, EPA was not notified of the April 14, 1987 scoping meeting which Mr. Householder's letter indicates we should have attended. A second scoping meeting was scheduled for May 6, 1987, and that time EPA was notified one week before the meeting. Due to prior commitments, EPA was unable to attend the May 6, 1987 meeting. Instead, a meeting at EPA's request was scheduled for the next day, May 7, 1987. Those attending the meeting were Dick Masse, Project Manager HQ ANG; Henry H. Lowman, Environmental Engineer, ANG Andrews Air Force Base; Jane Alford, Massachusetts Executive Office of Environmental Affairs; Rob Adler EPA Region I, Office of Groundwater; and Donald Cooke of this office. At that meeting the EPA personnel described the importance of the Cape Cod Sole Source Aquifer and the potential for the EIS to be subject to a review pursuant to Section 1424 (e) of the Safe Drinking Water Act. We also discussed our March 9, 1987 letter with an emphasis on the importance of evaluating the three alternatives, rapid filtration, advanced wastewater treatment (AWT), and discharge to Cape Cod Canal.

We are pleased that the Air National Guard is still soliciting alternatives and types of analysis to be evaluated in the EIS process as indicated in Mr. Householder's letter. However, we are concerned that EPA's as well as other agencies' comments have not been acknowledged in the scoping documents. The two scope of work documents which we have received to date, "Draft Statement of Work for Environmental Impact Statement and Class III Permit Data Collection for Land Disposal of Treated Effluent Originating from the Otis Air National Guard Base Wastewater Treatment Facility" (August, 1986) and "Scope of Work - Evaluating Groundwater and Terrestrial Effects of Effluent Disposal at the Massachusetts Military Reservation" (August, 1986) are written in a generalized manner such that they probably could encompass our specific needs. However, it would be helpful if specific statements of work regarding the proposed hydrogeological work plan could be sent to us for our review. Following that review it might be appropriate for a meeting to be scheduled with Argonne National Laboratory and the Air National Guard.

Third, this office, the Office of Government Relations and Environmental Review, is the lead EPA contact point for all EIS-related matters concerning the Otis Waste Water Treatment Plant. All information and requests for EPA review of preliminary environmental documents should be submitted to me at the following address: Office of Government Relations and Environmental Review, RGR2203, JFK Federal Building, Boston, Massachusetts 02203. I can be reached by telephone at 617/565-3416 (FTS 835-3416).

Also, for your information the EPA Region I Federal Facilities Coordinator is Ms. Clara Chow and her telephone number is 617/565-3287 (FTS 835-3287). EPA's Groundwater Coordinator for Massachusetts is Mr. Rob Adler 617/565-3601 (FTS 835-3601). Both Ms. Chow and Mr. Adler will be involved in the environmental studies for the Otis Waste Water Treatment Plant project with coordination being provided by this office.

We look forward to participating in the NEPA process for this project and hope that this letter assists you for purposes of future coordination with EPA. Please contact me or Donald Cooke of my staff if you have any questions. Mr. Cooke may be reached by telephone at 617/565-3416 or FTS 835-3416.

Sincerely yours

Elizabeth Higgins Congram

Elizabeth Higgins Congram, Assistant Director
for Environmental Review
Office of Government Relations
& Environmental Review

cc: Leroy W. Householder, NGB Washington, D.C.
Ronald M. Watson, NGB Washington, D.C.
Jane Alford, MA EOEA
Steve Davis, MA EOEA, MEPA Unit
Clint Watson, MA DEQE, DWPA Boston

pipeline (Continental Divide Pipeline Company), which is the subject of an application before the Federal Energy Regulatory Commission, will be jointly owned by subsidiaries of Transwestern and Northwest.

The Agreement provides that the price Transwestern will pay ProGas for the imported natural gas will be the authorized international order price, currently U.S. $4.94 per MMBtu.

Transwestern also states that on April 2, 1982, ProGas filed an application with the National Energy Board of Canada (NEB) to export the gas for sale to Transwestern. The NEB has not yet approved ProGas' proposed export to Transwestern.

Transwestern is obligated under the Agreement to take or otherwise pay for a minimum annual quantity of gas equal to 75 percent of the maximum daily contract quantity times the number of days in the particular contract year, less the difference between the daily volumes requested by Transwestern and the actual amounts delivered. The price that Transwestern will be required to pay for the gas under the take-or-pay provisions is the prevailing Canadian border price.

In any contract year after it has met its minimum annual purchase obligation, Transwestern may recover any gas paid for but not previously taken (prepaid gas).

The Agreement also provides a mechanism for reducing Transwestern's volume of prepaid gas if ProGas contractual obligations to take gas from the Alberta producers which supply it are less than the total volume of prepaid gas of all of ProGas' customers. In that case, Transwestern's prepaid gas will be adjusted by its pro rata share of the difference (obtained by mulitplying ProGas' prepaid volume by Transwestern's prepaid volume and dividing by the total prepaid volume).

In support of its application Transwestern asserts that it is experiencing a decline in its supply of natural gas from present sources and that it is making extensive efforts to secure replacement gas by various means in order to meet, in future years, its existing contractual supply commitments to its customers. Transwestern states the proposed import is one of several sources it intends to pursue to offset this decline, and that the import is in the public interest of the United States.

Transwestern requests that the processing of this application be expedited.

OTHER INFORMATION: Any person wishing to become a party to the proceeding, and thus to participate in any conference or hearing which might be convened, must file a petition to intervene. Any person may file a protest with respect to this application. The filing of a protest will not serve to make the protestant a party to the proceeding. Protests will be considered in determining the appropriate action to be taken on the application.

All protests and petitions to intervene must meet the requirements specified in 18 CFR 1.8 and 1.10. They should be filed with the Natural Gas Branch, Economic Regulatory Administration, Room 6144, RG-631, 12th & Pennsylvania Avenue NW., Washington, D.C. 20461. All protests and petitions to intervene must be filed no later than 4:30 p.m., August 12, 1982.

A hearing will not be held unless a motion for a hearing is made by a party or person seeking intervention and granted by ERA, or if ERA on its own motion believes that a hearing is necessary or required. A person filing a motion for hearing must demonstrate how a hearing will advance the proceedings. If a hearing is scheduled, ERA will provide notice to all parties and persons whose petitions to intervene are pending.

A copy of Transwestern's application is available for inspection and copying in the Natural Gas Branch Docket Room, located in Room 6144, 12th & Pennsylvania Avenue NW., Washington, D.C., between the hours of 8:00 a.m. and 4:30 p.m., Monday through Friday, except Federal holidays.

Issued in Washington, D.C. on July 6, 1982.

James W. Workman,

Director, Office of Fuels Programs, Economic Regulatory Administration.

[FR Doc. 82-18[illegible] Filed 7-13-82; 8:45 am]

BILLING CODE 6450-01-M

Office of Energy Research

Solar Panel Energy Research Advisory Board; Meeting

Notice is hereby given of the following meeting:

Name: Solar Panel of the Energy Research Advisory Board (ERAB). ERAB is a Committee constituted under the Federal Advisory Committee Act (Public Law 92-463, 86 Stat. 770)

Date and time: August 2 and 3, 1982, 9 a.m. to 5 p.m.

Place: Room 4A-110, Forrestal Building, 1000 Independence Avenue SW., Washington, D.C. 20585

Contact: William Woodard, Energy Research Advisory Board, Department of Energy, Forrestal Building, ER-4, 1000 Independence Avenue SW., Washington, DC 20585, Telephone: 202/252-8933.

Purpose of the parent board: To advise the Department of Energy on the overall research and development conducted in DOE and to provide long-range guidance in these areas to the Department.

Tentative agenda:

Meet and discuss with solar technology and engineering and development community, including individuals from universities, industry, and the National Laboratories the draft report of the Solar R&D Panel.

Review draft of the Solar R&D Panel's report and obtain public comments thereon.

Public participation: The meeting is open to the public. Written statements may be filed with the Panel either before or after the meeting. Members of the public who wish to make oral statements pertaining to agenda items should contact the Energy Research Advisory Board at the address or telephone number listed above. Requests must be received five days prior to the meeting and reasonable provision will be made to include the presentation on the agenda. The Chairperson of the Panel is empowered to conduct the meeting in a fashion that will facilitate the orderly conduct of business.

Transcripts: Available for public review and copying at the Freedom of Information Public Reading Room, 1E-190, Forrestal Building, 1000 Independence Avenue, SW., Washington, DC, between 8:30 a.m. and 4 p.m. Monday through Friday, except Federal holidays.

Issued at Washington, DC, on July 7, 1982.

Ira M. Adler,

Acting Director for Management, Office of Energy Research.

[FR Doc. 82-18[illegible] Filed 7-13-82; 8:45 am]

BILLING CODE 6450-01-M

ENVIRONMENTAL PROTECTION AGENCY

[W-1-FRL 2133-6]

Cape Cod Aquifer Determination

AGENCY: U.S. Environmental Protection Agency.

ACTION: Final determination.

SUMMARY: Pursuant to Section 1424(e) of the Safe Drinking Water Act the Administrator of the U.S. Environmental Protection Agency (EPA) has determined that the Cape Cod aquifer is the sole or principal source of drinking water for Cape Cod, Massachusetts, and that the Cape Cod aquifer, if contaminated, would create a significant hazard to public health. As a result of this action, Federal financially assisted projects constructed anywhere on Cape Cod will be subject to EPA review to ensure that these projects are designed and constructed so that they do not

create a significant hazard to public health.

ADDRESSES: The data on which these findings are based are available to the public and may be inspectd during normal business hours at the U.S. Environmental Protection Agency, Region I, Drinking Water Branch, J.F. Kennedy Federal Building, Boston, Massachusetts, 02203.

FOR FURTHER INFORMATION CONTACT: Steven J. Koorse, Drinking Water Branch, Environmental Protection Agency, Region I, at (617) 223-6688.

SUPPLEMENTARY INFORMATION: Notice is hereby given that pursuant to Section 1424(e) of the Safe Drinking Water Act (42 U.S.C. 300h-3(e), Pub. L. 93-523) the Administrator of the U.S. Environmental Protection Agency (EPA) has determined that the Cape Cod aquifer is the sole or principal source of drinking water for Cape Cod, Massachusetts. Pursuant to Section 1424(e), Federal financially assisted projects constructed anywhere on Cape Cod will be subject to EPA review.

I. Background

Section 1424(e) of the Safe Drinking Water Act states:

> If the Administrator determines, on his own initiative or upon petition, that an area has an aquifer which is the sole or principal drinking water source for the area and which, if contaminated, would create a significant hazard to public health, he shall publish notice of that determination in the Federal Register. After the publication of any such notice, no commitment for Federal financial assistance (through a grant, contract, loan guarantee, or otherwise) may be entered into for any project which the Administrator determines may contaminate such aquifer through a recharge zone so as to create a significant hazard to public health, but a commitment for Federal financial assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not so contaminate the aquifer.

On March 4, 1981, EPA received a petition from the Cape Cod Planning and Economic Development Commission requesting EPA to designate the Cape Cod aquifer as a sole source aquifer. In response to this petition, EPA published a notice in the Federal Register on November 18, 1981 (46 Fed. Reg. 56232), announcing a public comment period and setting a public hearing date. A public hearing was conducted on January 4, 1982, and the public was allowed to submit comments on the petition until February 12, 1982.

II. Basis for Determination

Among the factors to be considered by the Administrator in connection with the designation of an area under Section 1424(e) are: (1) Whether the aquifer is the area's sole or principal source of drinking water, and (2) whether contamination of the aquifer would create a significant hazard to public health.

On the basis of information available to this Agency, the Administrator has made the following findings, which are the bases for the determination noted above:

1. The Cape Cod aquifer is a single continuous aquifer which currently serves as the "sole source" of drinking water for the approximately 147,725 permanent residents and 424,445 peak seasonal residents of Cape Cod.

2. There is no existing alternative drinking water source, or combination of sources, which provides fifty percent or more of the drinking water to the designated area, nor is there any reasonably available alternative future source capable of supplying Cape Cod's drinking water demands.

3. The Cape Cod aquifer is glacial in origin and is composed of unconsolidated sand, gravel, silt and clay deposits. As a result of its highly permeable soil characteristics, the Cape Code aquifer is susceptible to contamination through its recharge zone from a number of sources, including but not limited to, chemical spills, highway runoff, septic tanks, leaking storage tanks, and leaching from open dumps. There is present evidence of localized contamination of the aquifer from chemical spills, individual disposal systems, leaking fuel tanks, and wastewater treatment systems. Since ground water contamination can be difficult or impossible to reverse, and since this aquifer is relied on for drinking water purposes by the general population, contamination of the aquifer would pose a significant hazard to public health.

III. Description of the Cape Cod Aquifer and Its Recharge Zone

Cape Cod, located within Barnstable County in southeastern Massachusetts, is a peninsula that extends 40 miles into the Atlantic Ocean. It is 440 square miles in area and is separated from the mainland by Cape Cod Canal. The area in which Federal financially assisted projects will be subject to review is the area that includes the Cape Cod aquifer, its streamflow source zone, and its recharge zone, which are one and the same.

For purposes of this designation, the Cape Cod aquifer is considered a single continuous aquifer with the Cape Cod Canal, Cape Cod Bay, the Atlantic Ocean, Nantucket Sound and Buzzards Bay its lateral boundaries. Similarly, the recharge zone boundaries of the aquifer will be regarded as coterminous with the lateral boundaries of the aquifer.

IV. Information Utilized in Determination

The information utilized in this determination includes the petition, written and verbal comments submitted by the public, U.S. Environmental Protection Agency technical publications, and a ground water resources study conducted by the U.S. Geological Survey (Cape Cod Aquifer, Water-Resources Investigation 80-571). The above data is available to the public and may be inspected during normal business hours at the Environmental Protection Agency, Region I, Drinking Water Branch, J. F. Kennedy Federal Building, Boston, Massachusetts.

V. Project Review

EPA Region I is working with the Federal agencies that may in the future provide financial assistance to projects in the area of concern. Interagency procedures are being developed in which EPA will be notified of proposed commitments by Federal agencies for projects which could contaminate the Cape Cod aquifer. EPA will evaluate such projects and, where necessary, conduct an in-depth review, including soliciting public comments where appropriate. Should the Administrator determine that a project may contaminate the aquifer through its recharge zone so as to create a significant hazard to public health, no commitment for Federal financial assistance may be entered into. However, a commitment for Federal financial assistance may, if authorized under another provision of law, be entered into to plan or design the project to assure that it will not so contaminate the aquifer.

Although the project review process cannot be delegated, the U.S. Environmental Protection Agency will rely to the maximum extent possible on any existing or future State and local control mechanisms in protecting the ground water quality of the Cape Cod aquifer. Included in the review of any Federal financially assisted project will be coordination with the State and local agencies. Their comments will be given full consideration and the Federal review process will attempt to complement and support State and local ground water protection mechanisms.

VI. Summary and Discussion of Public Comments

Most of the comments received from Federal, State and local government agencies and from the public were strongly in favor of designation. Only three commenters expressed any reservations regarding the designation.

One commenter felt that EPA currently has sufficient ground water protection mechanisms, which together with State and local mechanisms, render a sole source designation unnecessary. Although a number of ground water protection measures are available at the Federal, State and local level, none of these, either individually or collectively, permit EPA to act as directly and comprehensively as would a sole source designation in the review and approval of Federal financially assisted projects. In addition, EPA feels that the sole source project review process will foster integration rather than duplication of environmental review efforts.

Two commenters, although generally in favor of the designation, expressed concern that sole source designation might preclude the use of land application as a wastewater treatment technique on Cape Cod. If properly sited, designed, operated and maintained land application treatment can be an environmentally sound and cost effective waste management alternative. Sole source designation will not interfere with the development of any environmentally sound waste management solutions for Cape Cod municipalities. Federal financial assistance will only be withheld in those instances where it is determined that a proposed project may contaminate the aquifer so as to create a significant hazard to public health and no acceptable remedial measures are available to prevent the potential hazard.

VII. Economic and Regulatory Impact

Pursuant to the provisions of the Regulatory Flexibility Act (RFA), 5 U.S.C. 605(b), I hereby certify that the attached rule will not have a significant impact on a substantial number of small entities. For purposes of this Certification the term "small entity" shall have the same meaning as given in Section 601 of the RFA. This action is only applicable to Cape Cod. The only affected entities will be those Cape-based businesses, organizations or governmental jurisdictions that request Federal financial assistance for projects which have the potential for contaminating the aquifer so as to create a significant hazard to public health. EPA does not expect to be reviewing small isolated commitments of financial assistance on an individual basis, unless a cumulative impact on the aquifer is anticipated; accordingly, the number of affected small entities will be minimal.

For those small entities which are subject to review, the impact of today's action will not be significant. Most projects subject to this review will be preceded by a groundwater impact assessment required pursuant to other Federal laws, such as the National Environmental Policy Act, as amended (NEPA), 42 U.S.C. 4321, *et seq.* Integration of those related review procedures with sole source aquifer review will allow EPA and other Federal agencies to avoid delay or duplication of effort in approving financial assistance, thus minimizing any adverse effect on those small entities which are affected. Finally, today's action does not prevent grants of Federal financial assistance which may be available to any affected small entity in order to pay for the redesign of the project to assure protection of the aquifer.

Under Executive Order 12291, EPA must judge whether a regulation is "major" and therefore subject to the requirement of a Regulatory Impact Analysis. This regulation is not major because it will not have an annual effect of $100 million or more on the economy, will not cause any major increase in costs or prices, and will not have significant adverse effects on competition, employment, investment, productivity, innovation, or the ability of United States enterprises to compete in domestic or export markets. Today's action only affects Cape Cod. It provides an additional review of groundwater protection measures, incorporating State and local measures whenever possible, for only those projects which request Federal financial assistance. This regulation was submitted to OMB for review under EO 12291.

Dated: July 8, 1982.

Anne M. Gorsuch,

Administrator.

[FR Doc. 82-18XX Filed 7-12-82; 8:45 am]

BILLING CODE 6560-50-M

[OPTS-00034; TSH-FRL 2168-5]

Interagency Toxic Substances Data Committee; Cancellation of Meeting

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice.

SUMMARY: The August meeting of the Interagency Toxic Substances Data Committee has been cancelled.

DATE: The next meeting of the Committee has been scheduled for September 14, 1982.

FOR FURTHER INFORMATION CONTACT: Mary Bellerman (TS-777), Executive Secretary, Interagency Toxic Substances Data Committee, Office of Pesticides and Toxic Substances, Environmental Protection Agency, 401 M St., SW., Washington, D.C. 20460, (202-554-1404).

SUPPLEMENTARY INFORMATION: The regular meetings of the Interagency Toxic Substances Data Committee usually take place on the first Tuesday of alternate months at 9:30 a.m. and are open to the public. The meetings are held in: Rm. 2010, New Executive Office Building, 17th St. and Pennsylvania Ave., NW., Washington, D.C. 20006.

The August meeting has been cancelled, the next meeting of the Interagency Toxic Substances Data Committee will take place on the second Tuesday in September, September 14, 1982. The meeting after that will be held on November 2, 1982.

Dated: July 6, 1982.

Mary Bellerman,

Executive Secretary, Interagency Toxic Substances Data Committee.

[FR Doc. 82-18XXX Filed 7-12-82; 8:45 am]

BILLING CODE 6560-50-M

FEDERAL COMMUNICATIONS COMMISSION

Interconnection of Customer-Provided Telephone Equipment With Nationwide Telephone Network; Grant of Request for Permanent Exemption

AGENCY: Federal Communications Commission.

ACTION: Grant of request for permanent exemption.

SUMMARY: Section 68.2(e) of the Commission's Rules and Regulations, 47 CFR 68.2(e), permits governmental departments, agencies or administrations to apply for exemption from the technical and legal requirements of Part 68 of the Commission's rules, in the interest of national defense and security. Part 68 governs the interconnection of customer-provided telephone equipment with the nationwide telephone network.

The Department of Energy has requested permanent exemption under § 68.2(e). The Commission hereby grants the Department of Energy's request.

FOR FURTHER INFORMATION CONTACT: James M. Talens, Senior Attorney, Common Carrier Bureau, Federal Communications Commission, Washington, D.C. 20554, (202) 634-1832.

APPENDIX B:

TERTIARY-TREATMENT COSTS OF ACTION ALTERNATIVES

APPENDIX B:

TERTIARY-TREATMENT COSTS OF ACTION ALTERNATIVES

Implementation of any of the action alternatives considered in this FEIS requires capital for operation and maintenance (O&M) disbursements. Camp Dresser & McKee, Inc., prepared a cost evaluation of the alternatives in 1985 (CDM 1985). The costs are updated in this document using the *Engineering News Record* cost indexes for mid-1985 and mid-1988. Cost indexes used and index ratios are presented in Table B.1.

B.1 COMPARISON OF TERTIARY-TREATMENT DISPOSAL COSTS

Updated (1988) costs associated with the implementation of Alternatives 1-4 (excluding Alternative 4a) are summarized in Table B.2. The basis on which CDM obtained the 1988 values presented in Table B.2 is summarized in Sec. B.2.

Table B.2 shows that Alternative 3 (nitrification/denitrification) has the lowest capital cost. However, this alternative is chemical- and labor-intensive. Therefore, O&M costs associated with this alternative and Alternative 4b are higher than those of any of the alternatives considered.

The alternatives presented in Table B.2 have approximately the same present worth with the exception of Alternative 4b; the maximum difference between the lowest (Alternative 1a) and highest (Alternative 4) cost is less than 12%. This difference is not significant, considering the degree of uncertainty associated with cost estimation. No alternative has an obvious economic advantage over the other. Consequently, alternative selection must be conducted based on other factors, such as environmental and social issues, than economic constraints. Alternative 4b is more than double the cost associated with the least costly alternative (Alternative a).

TABLE B.1 Cost Indexes and Cost Ratios

Item	1988 Index	1985 Index	Ratio[a]
Construction cost	4,476	4,172	1.07
Labor cost	4,061	3,765	1.08
Fuel and supplies cost	1,701	1,610	1.06

[a] 1988:1985.

TABLE B.2 Tertiary Treatment and Disposal Costs (1988 $ x 10^3),* by Action Alternative (1-4b)‡

	Alternative 1	Alternative 1a	Alternative 2	Alternative 3	Alternative 4‡	Alternative 4b§
	Falmouth WWTP		Otis WWTP			
Economic Component	Raw	Treated	Spray Irri-gation	Nitrifi-cation/ Denitri-fication	Cape Cod Canal, Land Disposal	Nitrification/ Denitrification Cape Cod Canal, Land Disposal
Capital Costs						
Site work	0	0	214	268	0	268
Storage lagoons	0	0	1,381	0	0	0
Pump station(s)	343	343	439	268	343	611
Force main	1,799	1,414	0	0	2,195	2,195
Spray-irrigation	0	0	343	0	0	0
Monitoring wells	0	21	21	0	21	21
Instruments, electrical	0	0	193	246	0	246
Tractor, attachment	0	0	27	0	0	0
Treatment equipment	1,135	0	0	830	0	830
Disposal equipment	648	632	0	0	348	348
Sludge beds	0	0	0	32	0	32
Phased constr. contracting	0	0	0	107	0	107
Engineering contracting	1,177	723	785	525	872	1,397
Total	5,102	3,132	3,404	2,276	3,780	6,056
O&M Costs						
Labor	71	204	204	243	204	447
Maintenance/repair	55	27	27	54	27	81
Fuel	4	4	4	0	4	4
Electricity	29	29	32	26	29	55
Chemicals, supplies	8	10	14	11	10	21
Groundwater analysis	0	12	12	5	12	17
Total	167	285	292	339	285	624
Present Worth						
Capital costs	4,616	2,859	3,109	2,348	3,502	5,850
Operation/maintenance	1,598	2,718	2,789	3,235	2,718	5,953
Total	6,215	5,578	5,898	5,584	6,220	11,804
Percentage over least costly alternative (%)	11.4	0	5.7	0.1	11.5	111.6

*Except entry at bottom of table.

‡Alternative 4a (disposal in the canal) was not included because there are no engineering analyses of this option.

§Sum of costs for Alternatives 3 and 4.

B.2 BASIC ASSUMPTIONS MADE TO DETERMINE COST ESTIMATES

The 1985 CDM cost evaluation provides a detailed explanation of assumptions used to derive the cost basis in Table B.2. The document's basic assumptions are summarized below.

The size of hydraulic structures depends on average and peak wastewater flow rate. CDM assumed 300,000 and 500,000 gal/day for average and peak flow rates, respectively. A discount rate of 8.375% was used in all present-worth computations. The cost-effectiveness analysis assumes that the plant is constructed to its design flow capacity and that flows remain constant throughout the lifetime of the project.

The lifetime of the project is 20 yr. Cost factors take into account the initial capital cost, and the present worth of any capital costs to replace equipment that will not last the full 20 yr. Present-worth factors were computed by multiplying capital costs by life-cycle cost factors. These factors are 1.166 and 0.88 for mechanical equipment and structures, respectively, which have predicted lives of 15 and 50 yr. The present worth of uniform annual costs was calculated by multiplying such costs by a present-worth factor of 9.55.

APPENDIX C:

GROUNDWATER FLOW DYNAMICS NEAR CAPE COD CANAL

APPENDIX C:

GROUNDWATER FLOW DYNAMICS NEAR CAPE COD CANAL

Weston Geophysical (1987, 1989) under contract to ANL conducted Phase I and Phase II hydrogeologic investigations at the northern boundary of the MMR adjacent to the Cape Cod Canal. The purpose of the Phase I investigation was to locate the most suitable site for construction and operation of infiltration basins for disposal of secondarily treated wastewater. The purpose of the Phase II investigation was to determine the hydrogeologic characteristics of the site selected in Phase I for construction and operation of infiltrations basins receiving up to 500,000 gal/day of treated wastewater discharge.

The Phase I hydrogeologic investigation characterized subsurface conditions for an area of approximately 100 acres. The investigation consisted of geophysical surveys, borings and well installations, water-table mapping, in-situ permeability testing, groundwater sampling and analysis, soil sieve analysis, geophysical reconnaissance, and a literature review for available background information. The following is a summary of the Weston 1987 report.

Groundwater in the area is 100 to 125 ft below the ground surface at an elevation of 0 to 27 ft above MSL. Water-level measurements indicate groundwater flows to the north-northwest and toward the Cape Cod Canal. Flow directions in the study area coincide with earlier maps published by LeBlanc and Guswa (1977).

The stratified sands and gravel that underlie the sandy till portion of the Sandwich Moraine constitute the majority of the subsurface at the site. Slug tests (rising and falling head) were used to estimate in-situ hydraulic conductivity. The results indicate a range of hydraulic conductivity values, from approximately 10 to 50 ft/day.

A seismic-refraction geophysical survey determined that there are four separate subsurface horizons in the area. In order of decreasing elevation they are: loose, unconsolidated, dry sands; unconsolidated, yet more compact dry sands and gravel; saturated sands and gravel; and bedrock. These surveys indicate that the bedrock elevation ranges from about 60 to about 110 ft below MSL.

To characterize the subsurface material, eight borings were drilled. Five of the borings went to an approximate depth of 15 ft below the water table, where 2-in. polyvinyl chloride monitoring wells were installed. Three borings were drilled to a depth of 40 to 60 ft. Drilling was alternately rough and smooth at irregular intervals, indicating stratification. Minor silt and clay layers were not encountered at consistent elevations. Based on the geophysics, boring data, and sieve analysis, the subsurface material was found to consist primarily of fine-to-medium sand, with some gravel and coarse sand.

Sampling was conducted to determine the groundwater quality. Samples were collected from each monitoring well and analyzed for total dissolved solids, sodium, potassium, calcium, magnesium, carbonate, bicarbonate, sulfate, chloride, fluoride, nitrogen as nitrate, iron, manganese, arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. Low concentrations of arsenic and selenium were the only parameters to exceed drinking water standards. These two solutes were also present in two blank samples, which makes the validity of the analysis questionable.

A 2-mo monitoring program was implemented to assess the influence of diurnal Cape Cod Canal tidal fluctuations on groundwater elevations in the study area. The maximum fluctuation is approximately 9 ft from low to high water in the canal, while the level in the closest monitoring well changed approximately 1 ft in response. Though the groundwater fluctuation lags behind the tidal change by approximately 3 hr, this period of fluctuation is consistent with the tidal changes.

By comparing the measured water levels from the well closest to the canal with water levels in the other monitoring wells, it was determined that tidal influence on the water-table elevation decreases as distance from the canal increases. However, the gradient across the study area does not reverse, and groundwater flows consistently towards the canal at all times.

The hydraulic gradients range from 0.006 to 0.02 across the study area. The steeper gradient is located in the northwest part of the study area and probably indicates a decrease in transmissivity in that area.

The flux of groundwater through the upper 1 ft of the aquifer into Cape Cod Canal was calculated to be 1000 ft^3/day along a canal length of approximately 2,430 ft, assuming a hydraulic conductivity of 50 ft/day. Total flux of groundwater into the canal was not calculated because the cross-sectional distribution of groundwater flow is not known.

Based on the results of its investigation, Weston Geophysical concluded that:

- The glacially emplaced sand and gravel composing the subsurface is generally uniform.
- Measured hydraulic conductivities are high (10 to 50 ft/day).
- The saturated and unsaturated zones are of substantial thickness, providing ample room for attenuation and dilution of wastewater.
- Depth to bedrock, according to seismic data, is generally more than 150 feet, and commonly more than 200 ft below ground surface.
- The measured hydraulic gradient ranges from 0.006 to 0.02, and groundwater flows northwest to the Cape Cod Canal.
- The Cape Cod Canal is hydraulically connected to the study area.
- Tidal fluctuation in the Cape Cod Canal produced a water-level response of approximately 1 ft in well MW-3, with a lag time of approximately 3 hr.

- The tidal effect is not enough to reverse the groundwater flow direction at the study area.

- The only downgradient receptor of groundwater from the study area is the Cape Cod Canal. The nearest public supply well on the south side of the canal is located approximately 1.7 mi to the east, in the village of Sagamore. On the north side of the canal, the nearest public supply well is located approximately 1.7 mi northwest of the site at Goat Pasture Pond.

- The Cape Cod Canal is capable of adequately dispersing and diluting up to 4 million gal/day of treated effluent, based on a study by Anderson-Nichols (1975).

- Based on the available data, the study area is geologically and hydrologically suitable for construction and operation of a sand filter bed for the purpose of treated wastewater infiltration.

The Phase II hydrogeologic investigation consisted of geophysical testing, borings and well installations, a long-term aquifer test, in-situ permeability testing, percolation testing, groundwater sampling and analyses, and hydrogeologic analysis. In addition, several other tasks were completed to determine historical groundwater quality, potential impacts to groundwater users in the area, current and future use of adjacent ground and surface water, local precipitation and recharge characteristics, and water movement through the Cape Cod Canal. The following is a summary of the Phase II investigation.

- The subsurface materials beneath the proposed infiltration basin locations confirm the results of the Phase I investigation.

- Bedrock was encountered 195 ft below ground surface at a monitoring well located in the proposed infiltration basin area. Bedrock at a monitoring well approximately 325 ft northwest of the proposed infiltration area was encountered at a depth of 210 ft below ground surface. The bedrock was identified as a competent granitic biotite gneiss.

- The groundwater table was encountered from 92 to 109 ft below ground surface in the Phase II monitoring wells. Minimum and maximum water-table elevations encountered in the wells were approximately 3.0 and 7.5 ft above MSL, respectively.

- In-situ permeability tests and an extended aquifer pumping test indicate permeable surficial deposits throughout the saturated zone. The pump test was conducted for five days at 325 gal/min.

- Percolation tests and infiltration tests indicate permeable surficial deposits throughout tested portions of the unsaturated zone.

- Analysis of the pump-test data indicates a tide-induced groundwater response in all wells because of the proximity of the Cape Cod Canal. The magnitude of the response is not sufficient to reverse the groundwater gradient.

- Hydraulic conductivity values range from 85 to 540 ft/day. The wide range in values is attributed to the complexity of analyzing the data because of tide-induced groundwater oscillation in the wells. However, the most defensible hydraulic conductivity range, based on consideration of all available information, is 200 to 325 ft/day.

- Recharge from a precipitation event at the air base measuring 2.75 in. over 12 hours was recorded in the wells within a few hours after it occurred. These data indicate rapid infiltration through the unsaturated zone.

- Groundwater quality in the Phase II wells is consistent with findings from the Phase I investigation. The water quality is very good, based on the water quality analyses. Water quality did not vary significantly between the two sampling events during the pump test.

- Groundwater mounding calculations, which were made based on the average daily flow value of 500,000 gal/day, indicate minor mounding potential. The mounding is not expected to significantly alter groundwater flow in the area.

- According to the results of the groundwater user survey, only a limited number of private wells are located within a 1-mi radius of the proposed disposal area. Municipal water mains from four water districts extend into the development where the private wells are in use. Most private wells in these developments were abandoned when the municipal lines were constructed. The closest private well not serviced by a municipal water line is located in a picnic area south-southwest of the proposed disposal site. A municipal water line extends to within approximately 0.4 miles of the picnic area.

- Few plans for the development of municipal groundwater resources in the vicinity of the site were available. Additional housing development is expected, and connection to the municipal water supply is available. Additional municipal supply wells are not currently planned within the area that will be affected by the land disposal of treated wastewater.

- The Cape Cod Canal is the only surface water body in the vicinity of the proposed infiltration basin site. Based on the proposed wastewater treatment levels, the hydrogeology of the site, and the dilution and dispersion capability of the canal, minimal impact is anticipated from the proposed project.

APPENDIX D:

CAPE COD CANAL FLOW DYNAMICS

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CAPE COD CANAL FLOW DYNAMICS

Tidal fluctuation, current direction, and current strength in the canal are controlled by the tides in both Cape Cod Bay and Buzzards Bay. At the eastern end of the canal, high tide is concurrent with high tide in Cape Cod Bay. High tide at the western end of the canal is controlled by the Buzzards Bay high tide, which is 3 hr earlier than high tide in Cape Cod Bay (Anderson-Nichols 1975; EPA 1981).

The tidal ranges in Buzzards Bay and Cape Cod Bay are about 3.5 and 8.7 ft, respectively, at the two canal entrances (Anderson-Nichols 1975). Because of the difference in elevation and amplitude of the tides, there is reversal of the strong tidal currents that ebb and flow through the canal at approximately 6-hr intervals, the westerly current being stronger (Collings et al. 1981). The greatest flow velocity occurs on the ebb tide when water is flowing into Buzzards Bay. These high flow velocities are maintained because water from Cape Cod Bay is flowing into Buzzards Bay during a falling tide. Therefore, maximum flow velocities occur after high tide in Cape Cod Bay. Conversely, maximum easterly flows through the canal occur before high tide in Buzzards Bay because this flow is confronted by a rising water level at Cape Cod Bay. As a result, the westerly velocities (ebb flow) are greater than the easterly velocities (flood flow) (Anderson-Nichols 1975).

The average maximum flow velocity through the canal is 4.6 mi/hr during a rising tide (flood tide) and 5.2 mi/hr during a falling tide (ebb tide). The calculated water volume of the canal is just over 42 million yd^3. The flood flow and ebb flow average per tide cycle is about 60 million yd^3 and 68 million yd^3, respectively (Anderson-Nichols 1975).

Previous studies determined that a net discharge of water flows westward through the canal into Buzzards Bay during each tidal cycle; this discharge does not return to Cape Cod Bay (Anderson-Nichols 1975). In a computer simulation using a mathematical model of the canal's dimensions and flows, it was found that about 4.5 billion gal of water flow out into Buzzards Bay during each period of westward flow; this water does not return on the eastward flow (Anderson-Nichols 1975).

Recording thermographs were used to trace water flow through the canal (Collings et al. 1981). The study found that representative summer water temperatures of Cape Cod and Buzzards bays are distinctively different, 50°F and 68°F, respectively. Water movement from the bays into the canal was then monitored by measuring water temperature. The study concluded that water flowing from the east (Cape Cod Bay) does not re-enter the canal; thus, about two-thirds of the flow that passes the western end of the canal (Buzzards Bay) during each tidal cycle is "new" water (Anderson-Nichols 1975). Based on this factor alone, the effective net dilution is about 3,000:1, and the water in the canal is completely flushed in 1-1/2 tidal cycles (less than one day).

Tidal action in the two bays results in (1) a total flushing of the canal water each day, (2) new water filling the canal from Cape Cod Bay during each east-to-west flow period, and (3) canal water turbulence and thorough mixing from top to bottom throughout the year (Anderson-Nichols 1975; EPA 1981).

APPENDIX E:

OVERVIEW OF PAST GROUNDWATER STUDIES ON THE INNER CAPE

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OVERVIEW OF PAST GROUNDWATER STUDIES ON THE INNER CAPE

Since 1974, the hydrogeological conditions of the inner Cape have been extensively studied and modeled by many investigators. These investigations have dealt primarily with the transport and fate of the wastewater effluent plume originating from the Otis WWTP and the plume from the Town of Falmouth landfill. The pertinent studies are summarized below.

In the Ashumet Valley, south of the MMR, there are many shallow wells which draw water from zones above the plume from the Otis WWTP (E.C. Jordan 1987). Using a three-dimensional version of the Prickett and Lonquist (1971) PLASM model entitled INTERSAT, E.C. Jordan (1987) evaluated the impact of shallow wells on local groundwater flow and the potential for interaction between the wells and the plume. The investigation concluded that contamination of private wells is possible under conditions of general well use, the conditions found in the Ashumet Valley. Analyses showed that capture zones (the region from which water flows to the well) of 5 to 25 ft below the bottom of a shallow well are possible when water is drawn within the capacity of household well pumps. In many of the wells, the 25-ft capture zone would extend to a depth at which contaminants are present in the aquifer. In homes having deeper wells, even a 10-ft capture zone has the potential to intercept the plume (E.C. Jordan 1987).

As part of a 4-yr study of the groundwater resources of Cape Cod, Guswa and LeBlanc (1985) modeled the entire Cape Cod aquifer system using a finite-difference groundwater flow model. Five areas were modeled to provide information that can be used to evaluate the hydrologic impacts of regional groundwater development and waste disposal. The models were developed based on three assumptions: (1) the interface of fresh and salt water can be treated as a boundary, (2) the interface of fresh and salt water is static, and (3) the natural discharge boundaries subdivide the aquifer system on Cape Cod into individual aquifers that can be modeled separately. It was determined under steady-state conditions (i.e., no changes in aquifer discharge or recharge) that the fresh water flow rate through the five areas is approximately 412 ft^3/sec. For the area surrounding the MMR, it was determined that the steady-state recharge is 267 ft^3/sec; the rate of withdrawal by wells is 17 ft^3/sec; and the discharge to streams, marshes, and the ocean is 250 ft^3/sec.

Kipp (1987) tried to determine whether a reasonable set of transport and reaction properties could account for the observed ammonium and nitrate concentration profiles downgradient of the MMR. The ammonium-nitrogen and nitrate-nitrogen profiles over time, from the start-up of the Otis WWTP to the present, were calculated using a one-dimensional solute transport model. Sets of transport and reaction parameters were estimated using a least-squares fitting procedure which resulted in the best match of the present ammonium-nitrogen profile. It was determined that the calculated nitrate-nitrogen profile associated with the calculated ammonium-nitrogen profile deviates by a factor of 10. This possibly suggests that either (1) there is a mechanism for denitrification that has not yet been identified, or (2) there is not a complete conversion of ammonium to nitrate. This latter hypothesis is consistent with the assumption that the conversion is limited by the supply of oxygen in the groundwater, but that there needs to be a mechanism for the disappearance of unconverted ammonium or it would be detected along the flow path.

As part of an investigation related to renovation and retrieval of contaminated groundwater, Vaccaro et al. (1979) used a steady-state flow model to predict the water-table surface if the Town of Falmouth disposed of treated effluent through an ocean outfall or spray irrigation at the Otis WWTP. This disposal option would replace the current practice of on-site land disposal at Falmouth and Otis, which also exists at most domestic and commercial establishments. The investigation showed that the effects of ocean outfall and spray irrigation would be roughly the same within the affected areas. Ocean outfall would drop Long Pond's water level by 0.5 ft; spray irrigation may reduce this drop to 0.3 ft. The study showed that the water table would rise 5.5 ft around the spray-irrigation site at the MMR.

To aid the Town of Falmouth in obtaining a Class III permit for its wastewater treatment facility, CDM (1987) developed a groundwater-flow and contaminant-transport model of the area. The model results showed that (1) the general direction of groundwater flow is westerly, discharging at Snug Harbor; (2) groundwater mounding has a minimal impact on the direction of groundwater flow beyond the facility boundary; (3) mounding beneath the infiltration basins is expected to range from 1 to 3 ft; and (4) mounding resulting from spray irrigation will be significantly less than that associated with the use of infiltration basins. The contaminant-transport modeling determined the boundaries of the Class III area for both disposal in sand beds and disposal via spray irrigation.

A study of Ashumet Pond was conducted by K-V Associates, Inc., and IEP, Inc., (1987). This study included potential sources of contamination from an abandoned cranberry bog, surrounding domestic septic systems, and lawn fertilization. The study (1) evaluated the conditions of the pond (how it physically, chemically, and biologically operates); (2) determined the relationship between groundwater and surface water; and (3) estimated present land-use effects on recharge and regions of the watershed contributing nutrients and potentially toxic materials to the pond. As part of this study, a transport model was used to track the progress of the phosphate plume from the Otis infiltration beds and to predict the plume's future impact on Fisherman's Cove (located along the northwest corner of the pond). The extent of the phosphorus plume was predicted for the years 1970, 1980, 1984, 1990, and 2000. The simulation showed that between the years 1990 and 2000 concentrations greater than 1.0 mg/L will enter the pond.

To aid in the study of processes affecting contaminant movement in the Otis wastewater plume, a two-dimensional solute transport model was developed by LeBlanc (1984b). The model was developed to (1) investigate the feasibility of simulating the plume with a numerical model, (2) describe and evaluate the behavior and movement of solutes in the plume, and (3) examine the geologic and hydrologic processes that affect solute transport in the sand and gravel outwash. The assumptions of the two-dimensional model are not completely met at the Otis site, due to the vertical extent of the plume.

The simulation of solute transport in the wastewater plume using boron as a tracer agreed reasonably well with the location of the plume observed in 1978-1979 (after 40 yr of disposal).

APPENDIX F:

COMPUTER CODE FOR GROUNDWATER MODELING

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COMPUTER CODE FOR GROUNDWATER MODELING

The coupled fluid, energy, and solute transport (CFEST) computer code developed by Gupta et al. (1986) was used in this study to calculate groundwater flow and solute transport for each of the alternatives under consideration.

The CFEST code was developed to analyze coupled hydrologic, thermal, and solute transport processes in porous media. Single-phase Darcy groundwater flow in a horizontal or vertical plane, or in a fully three-dimensional space, is treated using the finite-element method. The code has capabilities for simulating continuous and discontinuous layers, time-dependent and constant sources and sinks, and both transient and steady-state groundwater flow. Aquifer systems are represented with bilinear quadrilateral elements for all two-dimensional analyses, and trilinear quadrilateral elements for three-dimensional simulations.

Under conditions of a constant fluid density (dilute solutions), CFEST solves the following partial differential equation for hydraulic head:

$$\rho K_{\alpha,\beta} \nabla^2 H - Q = \rho \frac{\partial \theta}{\partial t} \qquad \text{(F.1)}$$

where:

H = hydraulic head = $Z + P/\gamma$

K = hydraulic conductivity

P = pressure

Q = sink or source terms for the fluid

t = time

Z = elevation

α,β = indices of spatial coordinates

γ = specific weight of water

∇^2 = Laplacian operator $\left(\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}\right)$

θ = effective porosity, and

ρ = density.

Darcy's groundwater velocity (U) is obtained using the hydraulic head calculated with Eq. F.1,

$$U = - K \nabla H \tag{F.2}$$

where ∇ is the gradient operator $\left(\frac{\partial}{\partial x}\hat{i} + \frac{\partial}{\partial y}\hat{j} + \frac{\partial}{\partial z}\hat{k}\right)$.

The groundwater flow equation and the advection-dispersion equation for contaminant transport are uncoupled. Solute concentrations are thus calculated by solving the following equation:

$$\nabla \cdot \frac{D}{R} \nabla C - \frac{\nabla UC}{R} - \frac{QC'}{R} = \frac{\partial(\theta C)}{\partial t} \tag{F.3}$$

where D, R, and C represent the dispersion coefficient, the retardation factor, and the solute concentration, respectively.

The first term in Eq. F.3 represents dispersion/diffusion; the second term represents advection; the third term represents sources and sinks operating under a constant concentration equal to C'; and the last term represents time-dependent accumulation. Additional terms to simulate radioactive decay and salt dissolution are available in the CFEST, but were unnecessary for the present analyses. For simplicity, these terms were omitted from Eq. F.3.

The dispersion coefficient, D, in Eq. F.3 is assumed to be a linear function of dispersivity and velocity:

$$D_L = \varepsilon_L U \tag{F.4}$$

$$D_T = \varepsilon_T U \tag{F.5}$$

where ε is the dispersivity of the porous medium and subscripts L and T represent longitudinal and transverse direction, respectively. Diffusional effects are assumed to be negligible (Bear 1972).

Equation F.3 accounts for solute sorption through the retardation factor, R. For fast, reversible reactions, R is given by the following linear expression (Freeze and Cherry 1979):

$$R = 1 + \frac{\rho_b K_d}{\theta} \tag{F.6}$$

where K_d is a solute distribution coefficient and ρ_b is the bulk density.

Heterogeneity in aquifer permeability and porosity and anisotropy (collinear with the Cartesian coordinate system) are also accounted for in the CFEST code. Heterogeneity can be described on a layer-by-layer basis or by individual elements.

To solve Eqs. F.1 and F.3, boundary and initial conditions are required. Options are provided for constant and time-dependent Dirichlet conditions, Neumann conditions (zero flux-no flow), and Cauchy conditions (specified flux). Initial conditions can be specified for hydraulic head, concentration, and temperature.

Originally, the CFEST was developed to simulate confined aquifers; however, phreatic conditions exist at the sites under consideration. Unconfined groundwater flow solutions were obtained by iterative execution of the code and updating the top elevation of the saturated zone.

While the CFEST has an energy equation for simulating nonisothermal transport, all analyses presented in this study were done assuming a constant temperature.

The CFEST code is well-documented and has undergone extensive verification and validation (Gupta et al. 1986). CFEST is also being benchmarked, verified, and partially validated using test cases identified by HYDROCOIN (Hydrologic Code Intercomparison), an international project organized by the Swedish Nuclear Inspectorate.

The Massachusetts DEP has a set of requirements for groundwater flow and contaminant transport codes. The CFEST code, which was developed for the U.S. Department of Energy, meets these Massachusetts DEP requirements.

APPENDIX G:

SALT WATER AND FRESH WATER INTERFACE

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SALT WATER AND FRESH WATER INTERFACE

For the three areas and five wastewater disposal alternatives under consideration, salt water may underlie portions of the modeling areas. In particular, salt water may be present, to some degree, near the model boundaries along the ocean, bays, or the ponds.

As seaward-flowing fresh groundwater approaches a beach or other area of high salinity, a sharply defined interface can be formed between the fresh and salt water under steady-flow conditions. Along the interface, the pressure of the static salt water is counterbalanced by the hydraulic head of the fresh water. The fresh water leaves the groundwater system by flowing through a gap between the interface and the top of the water table. Due to the difference in density between salt and fresh water, the fresh water flows over the salt water, which acts as an impermeable boundary to vertical fluid migration.

The discrete modeling performed by the CFEST code for each of the alternative study areas incorporated the effects of an assumed salt-water/fresh-water interface along the appropriate boundaries by using the interface model of Glover (1959).

In the Glover model (1959), the interface between the fresh groundwater and the sea water is represented by the following quadratic expression:

$$Y^2 - \frac{2QX}{\gamma K} - \frac{Q^2}{\gamma^2 K^2} = 0 \qquad \text{(G.1)}$$

where:

K = hydraulic conductivity of the strata carrying the fresh water flow,

Q = fresh water flow per unit length of shore line,

X = horizontal distance landward from the shoreline,

Y = vertical distance from sea level to the interface,

γ = excess of the specific gravity of sea water over fresh water. i.e.,

$$\gamma = \frac{\gamma_S - \gamma_F}{\gamma_F}$$

γ_S = specific weight of sea water, and

γ_F = specific weight cf fresh water.

Along saline boundaries, the depth to the interface from the water table (sea level) was calculated for each of the appropriate nodes using Eq. G.1, an X-value equal to zero, and other physical parameters appropriate to conditions for Cape Cod. If the calculated depth to the interface exceeded the depth to bedrock for a given boundary node, the zero-flux impermeable bottom boundary of the model was assumed to coincide with the location of the bedrock (no salt-water/fresh-water interface). If the calculated depth of the interface was less than the depth to bedrock, the zero-flux bottom boundary of the model was assumed to coincide with the location of the interface. In addition, the depth to the interface at the nodes was evaluated using Eq. G.1. Again, if the interface was calculated to be above the top of the bedrock, the elevation of the interface was entered as the bottom of the model; otherwise, the bedrock was entered as the bottom of the model. These calculations were repeated until the interface was consistently below the bedrock.

To allow the fresh water to escape from the three-dimensional modeled region, all vertical nodes along saline boundaries above the interface were assumed to have a constant hydraulic head value equal to mean sea level.

An additional calculation was performed to determine the effect of wastewater loading on the location of the interface nodes. Under maximum loading, the additional fluid flux did not significantly affect the location of the impermeable interface boundary of the model.

APPENDIX H:

ISSUES CONSIDERED IN MODELING SPRAY IRRIGATION

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ISSUES CONSIDERED IN MODELING SPRAY IRRIGATION

Land treatment of wastewater involves the use of plants, the soil surface, and the soil matrix for contaminant removal. The three principal processes of land treatment are irrigation, rapid infiltration, and overland flow. Irrigation is the predominant land-treatment process in use today. It applies effluent to the land for treatment and thus supplies nutrients required for plant growth. The applied effluent is treated by physical, chemical, and biological processes as it seeps into the soil. Effluent can be applied to crops or vegetation either by sprinkling or by surface techniques. Table H.1 lists the expected quality of the treated water achieved using spray irrigation.

The ability of land-treatment systems to remove organic matter, nitrogen, phosphorus, exchangeable cations, trace elements, and microorganisms from applied wastewater depends on a variety of factors. Soil is a highly efficient biological-treatment system. Organic matter is filtered by grass, litter, and topsoil and is reduced by biological oxidation. Because high organic loadings can create anaerobic conditions in the soil matrix and result in the production of odors, an intermittent loading schedule is usually employed. This allows air to penetrate the soil and supply oxygen to the bacteria that oxidize the organic matter.

Nitrogen can be removed by plant uptake and harvest, denitrification, retention/storage in the soil, and ammonia volatilization. In irrigation systems, plant uptake is the main mechanism for nitrogen removal; the quantities of nitrogen uptake vary, depending on the type of plant(s) used. Table H.2 lists values of nitrogen and phosphorus removal for various crops. With proper management, the majority of the nitrates are taken up by the plants. Perennial grasses are preferred to annual crops since their root system is fully established throughout the spraying season. In a well-operated system, spray irrigation can remove at least 80% of the applied nitrogen and 90% of the phosphorus (employing crop cultivation) (Clark, Viessman, and Hammer 1977).

TABLE H.1 Expected Quality of Treated Water from Spray Irrigation

Parameter	Average (mg/L)	Expected Maximum Quality (mg/L)
Biological oxygen demand	<2	<5
Suspended solids	<1	<5
Ammonia nitrogen (as N)	<0.5	<2
Total nitrogen (as N)	<3	<8

Source: Clark, Viessman, and Hammer 1977.

TABLE H.2 Land-Treatment Removal of Nitrogen from Various Crops

Type of Vegetation	Description	Dry Matter Yield (kg/ha)	Amount Removed (kg/ha[a])
Forage crops			
Alfalfa	Perennial legume	15,770	504
Brome grass	Cool-season perennial	9,856	186
Coastal Bermuda grass	Warm-season perennial	19,712	560
Reed canary grass	Cool-season perennial	13,000	350
Rye grass	Cool-season annual or perennial	8,030	235
Sweet clover	Biennial legume	7,375	177
Tall fescue	Cool-season perennial	6,854	133
Field crops			
Barley	Winter annual	---	70
Corn	Summer annual	---	174
Cotton	Summer annual	---	74
Milomaize	Summer annual	---	91
Soybeans	Summer annual legume	---	105

[a]kg/ha x 0.8922 = lb/acre.

Source: Metcalf and Eddy 1979.

Site-selection factors and criteria affecting effluent irrigation include soil type, drainability and depth, depth to the groundwater, groundwater movement, slopes of the land, underground formations, isolation, and distance from the source of the wastewater. The total land area required for a land-irrigation system depends primarily on the application rates.

For irrigation of annual crops, wastewater application is restricted to the growing season, and storage may be required for a period of 1 to 3 mo in moderate climates and 4 to 7 mo in cold northern climates. Irrigation of perennial grasses can extend the time period for application. Periods of snow cover and subfreezing conditions may limit the period of application. Irrigation systems can usually operate successfully at temperatures below freezing. The maximum precipitation allowed depends primarily on the maximum infiltration rates at the site and on storm water runoff.

The extent of denitrification and volatilization depends on the loading rate, characteristics of the wastewater to be applied, and the microbiological conditions in the active zones of the soil. Even in aerobic soils, denitrification may account for 15 to 25% of the removal of applied nitrogen (Metcalf and Eddy 1979). Volatilization of ammonia is not significant for soils with a pH factor less than 7 or for nitrified effluents, although losses of nitrogen from volatilization can account for up to 20% of the nitrogen removed from soils with a pH factor in the range of 7.5 to 8.5 (Pettygrove and Asano 1985).

To determine which characteristics of the wastewater will be the limiting factors for irrigation, material balances should be made for water, nitrogen, phosphorus, organic matter, and other constituents of abnormally high concentration. From these balances, a loading rate can be determined for each parameter. Each loading rate should then be used to calculate its required land area. The critical loading rate corresponds to that rate requiring the largest field area.

Important aspects of crops for irrigation systems include nitrogen-removal capability, water needs and tolerances, sensitivity to wastewater constituents, public health regulations, and crop-management considerations. These criteria are best met using forage crops (grasses). Species successfully used in spray-irrigation systems include Reed canary grass, brome grass, tall fescue, perennial rye grass, and coastal Bermuda grass, due to their high nitrogen uptakes, water tolerance, and tolerance for the high percentage of dissolved solids and boron in wastewaters.

For the groundwater-flow and contaminant-transport models employed in this study, the removal of nitrogen was conservatively assumed to be approximately 40%. Nitrogen removal, using spray-irrigation techniques, is reportedly in the range of 40 to 90% (EPA 1975) and 70 to 80% for grasses and field crops (Pettygrove and Asano 1985). The 40% nitrogen removal resulted in a total nitrogen concentration of about 9 mg/L reaching the aquifer.

APPENDIX I:

COMMENTS ON THE DEIS AND RESPONSES

Part I:	LETTERS OF COMMENT	I-5
Part II:	QUESTION/RESPONSE FORMS	I-105
Part III:	QUESTIONS AND CONCERNS RAISED DURING PUBLIC HEARINGS	I-167

APPENDIX I:

COMMENTS ON THE EIS AND RESPONSES

Copies of the letters of comments received, the Question/Response Forms, and questions raised during the public hearings regarding the Draft Environmental Impact Statement (DEIS) review period are included. The comments are arranged alphabetically for the letters and forms received. Each letter has been coded, and consecutive numbers have been assigned to individual comments contained in each letter or form. For example, the comment sheet received from the Cape Cod Sierra Club has been coded as CCSC, and the individual comments are designated as CCSC-1, CCSC-2, etc. When appropriate, a written response has been provided for each comment; these responses are designated as Response to CCSC-1, Response to CCSC-2, etc. The letters/forms and responses are placed side-by-side as much as possible to enable the reader to easily locate the specific response to each comment. The codings used to identify the comments received are listed below in alphabetical order.

Code	Name	Page
APCC	Association for the Preservation of Cape Cod, Inc. (Herbert S. Elins)	I-6
AVPO	Ashumet Valley Property Owners (Albert L. Gramm)	I-107
BCC	Bourne Conservation Commission (Sue Weston)	I-110
CCPEDC	Cape Cod Planning and Economic Development Commission (Armando J. Carbonell)	I-8
CCSC	Cape Cod Sierra Club (David D. Dow)	I-15
CCSCf	Cape Cod Sierra Club - form (David D. Dow)	I-112
CCT	Cape Cod Times (A. Winfield Schley)	I-114
CMEOEA	Commonwealth of Massachusetts, Executive Office of Environmental Affairs (John DeVillars)	I-22
CMHR1	Commonwealth of Massachusetts, House of Representatives - 1 (Eric T. Turkington)	I-24
CMHR2	Commonwealth of Massachusetts, House of Representatives - 2 (Thomas S. Cahir)	I-29
CMMS	Commonwealth of Massachusetts, Massachusetts Senate (Edward P. Kirby)	I-32
CRMP	Coastal Resource Management Planning (Russ Tarbell)	I-36
CZM	Massachusetts Coastal Zone Management (Jeffrey R. Benoit)	I-42
CZMf	Massachusetts Costal Zone Management - form (David Janik)	I-116
DEM	Department of Environmental Management (Myron L. Gildesgame)	I-48
DEQE1	Department of Environmental Quality Engineering (currently the Massachusetts Department of Environmental Protection) - 1 (Cornelius J. O'Leary)	I-51
DEQE2	Department of Environmental Quality and Engineering (currently the Massachusetts Department of Environmental Protection) - 2 (Cornelius J. O'Leary)	I-55

EPA	U.S. Environmental Protection Agency, Region I (Elizabeth Higgins Congram)	I-59
GBSCC	Greater Bourne - Sandwich Chamber of Commerce (Mark A. Tirrell)	I-118
MBH	Marion Board of Health (Edwin H.B. Pratt, Jr.)	I-68
MBHf	Marion Board of Health - form (Edwin H.B. Pratt, Jr.)	I-120
MSR	Massachusetts State Representative (Thomas S. Cahir)	I-122
NEDCE	New England Division, Corps of Engineers (F.N. Ciccone)	I-70
PLO1	Private Land Owner 1 (Stefanie Adams)	I-124
PLO2	Private Land Owner 2 (Harold L. Baker, Jr.)	I-126
PLO3	Private Land Owner 3 (John P. Vidal)	I-128
PLO4	Private Land Owner 4 (James Hain)	I-130
PLO5	Private Land Owner 5 (Mr. and Mrs. Joseph P. Gerace)	I-132
PLO6	Private Land Owner 6 (Arthur K. Greenberg)	I-134
PLO7	Private Land Owner 7 (Philip E. Houde)	I-136
PLO8	Private Land Owner 8 (Mr. and Mrs. Donald E. Dupee)	I-138
TBBH	Town of Bourne Board of Health (Cynthia A. Coffin)	I-73
TBBHf	Town of Bourne Board of Health - form (Cynthia A. Coffin)	I-141
TBBS	Town of Bourne Board of Selectmen (Marie J. Oliva, Robert W. Parady, and W. Thomas Barlow)	I-79
TBBSf	Town of Bourne Board of Selectmen - form (Marie J. Oliva)	I-144
TBCC	Town of Bourne Conservation Commission (Robert M. Gray)	I-82
TBED	Town of Bourne Engineering Department (Dorothy Blickens and Michael Leitzel)	I-87
TBEDf	Town of Bourne Engineering Department - form (Dorothy Blickens)	I-146
TBPH	Town of Bourne Public Hearing (Thomas S. Cahir, William Norman, Marie J. Oliva, W. Thomas Barlow, Dorothy Blickens, Cynthia A. Coffin, Susan Weston, Floyd Forman, David Janik, Arthur K. Greenberg, and Charles Smith)	I-176
TBPO	Town of Bourne Public Official (W. Thomas Barlow)	I-148
TBTP	Town of Bourne Town Planner (Floyd Forman)	I-96
TBTPf	Town of Bourne Town Planner - form (Floyd Forman)	I-150
TFBH	Town of Falmouth Board of Health (Virginia Valiela)	I-100
TFBSf1	Town of Falmouth Board of Selectman - form 1 (Virginia Valiela)	I-153
TFBSf2	Town of Falmouth Board of Selectman - form 2 (Virginia Valiela)	I-158
TFPH	Town of Falmouth Public Hearing (Virginia Valiela, James Hain, Edwin H.B. Pratt, Jr., and David D. Dow)	I-168
USACEf1	United States Army Corps of Engineers - form 1 (William Norman)	I-160
USACEf2	United States Army Corps of Engineers - form 2 William Norman)	I-162
USS	United States Senate (Linda Teagan)	I-164

APPENDIX I: PART I

LETTERS OF COMMENT

Association for the Preservation of Cape Cod, Inc.
P. O. Box 636
Orleans, Massachusetts 02653 **508-255-4142**

August 17, 1989

Mr.Leroy Householder
ANGSC/DEV
Building 3500, Stop 18
Andrews AFB, MD 20331-6008

Dear Sir:

The Association thanks you for the opportunity to review and comment on the Draft Environmental Impact Statement for the Wastewater Treatment Facility at Otis Air National Guard Base at the Massachusetts Military Reservation.

1. The DEIS is thorough and lucid in its analysis of the five preselected alternatives.

2. It is our view that Alternative No. 4, "Construct Pipeline To Convey Treated Effluent to New MMR Infiltration Basins", is to be preferred <u>if</u> the ground discharge does not require a Massachusetts Class III Groundwater Discharge Permit. The groundwater flow and contaminant-transport modeling suggest this conclusion (Sect. 4.4.7).

3. However, there is no physical assurance that the predictions gained from the selected modeling technique will be attained. In prudence, therefore, we suggest a sixth alternative, "Construct Pipeline To Convey Effluent Treated To Remove Nitrogen To New MMR Infiltration Basins." That is, in effect combine preselected Alternatives Nos. 3 and 4. This modification significantly increases local confidence for safe disposal. (We recognize that the present worth of such a construction project may be greater than that for No. 4 alone, but we do not consider this factor limiting.) APCC-1

Thank you for your attention to these comments.

Sincerely,

Herbert S. Elins

Herbert S. Elins
President

HSE:mc

cc: Marie Oliva, Town of Bourne
Virginia Valiela, Town of Falmouth

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Response to APCC-1:

Alternative 4b results in the disposal of Class I waters (produced as a result of tertiary treatment) into sand infiltration basins near the Cape Cod Canal. See the response to Comment AVPO-1 and Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b.

CAPE COD PLANNING AND ECONOMIC DEVELOPMENT COMMISSION
1ST DISTRICT COURT HOUSE, BARNSTABLE, MASSACHUSETTS 02630
TELEPHONE: 508-362-2511

August 21, 1989

Mr. Leroy Householder
ANGSC/DEV
Bldg 3500 Stop 18
Andrews AFB, Maryland 20331-6008

Re: Otis ANG EIS

Dear Mr. Householder:

The Cape Cod Planning and Economic Development Commission (CCPEDC) has received a copy of the Draft EIS for the Otis Air National Guard Base Wastewater Treatment Facility. CCPEDC is the Regional Planning Agency for Barnstable County as well as the principal groundwater management agency on Cape Cod (author of the Final 208 Area Wide Management Plan) and should be listed with and notified of meetings in the same way as other state and county agencies. Based on staff review we offer the following comments.

The Draft EIS presents four wastewater disposal alternatives to comply with the Department of Environmental Protection's 1984 discharge permit standards for Class I groundwater. The EIS indicates that the comparable cost of each alternative is essentially the same and does not select a preferred alternative. Since the EIS does not select a single alternative based upon environmental impacts, we offer the following comments to assist in selecting a preferred alternative. Staff review is guided in part by an antidegradation policy that excludes discharges from undeveloped areas of the Cape Cod aquifer as discussed in the Final Report of the Cape Cod Aquifer Management Project (1988),p. M-4.

> Alternative one involves the transport of wastewater, under both treated and untreated wastewater scenarios, by pipe to the Falmouth wastewater facility for disposal. This alternative is not possible without the willing participation of the Town of Falmouth. The sub-alternative which results in an "impact area" outside the present Class III area is not acceptable.
>
> Alternatives two and three involve discharges at the site of the existing STP. Alternative two includes spray irrigation of the existing wastewater effluent and alternative three includes advanced treatment of the wastewater with rapid infiltration. The "impact areas" of the alternative would remain within the existing wastewater effluent plume. It is the staff opinion that

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option two is the preferred alternative because it upgrades the present level of treatment to comply with the DEP discharge permit while leaving any potential future impacts within a well-defined previously contaminated zone. A high level of treatment with a detailed quality control program is particularly justified for this option by the Town of Falmouth's plans to use this area as a future water supply .

Alternative four involves rapid infiltration of wastewater over an undeveloped portion of the Sagamore lens of the Cape Cod Aquifer. The pump test conducted at this site indicates it is a high yielding aquifer because of its high permeability. The EIS states that there are no nearby fresh water bodies and that no significant impacts would occur. This area can not be categorically dismissed as a potential future water supply site for
CCPEDC-1 the region. The Water Resources staff advocates an antidegradation policy regarding this matter. The EIS should indicate through additional analysis that the site can not or should not be considered as a potential water supply before considering it as a wastewater discharge area. This alternative must include advanced treatment if the site continues to be considered as an alternative.

The EIS analysis of these alternatives was focused on predicting an "impact area" of resulting groundwater quality degradation greater than a 10 ppm total nitrogen concentration. The "impact areas" are predicted with the use of a groundwater flow solute transport model. The following technical comments are offered.

CCPEDC-2 There are a variety of other compounds associated with wastewater effluent such as volatile organic compounds, detergents, heavy metals and phosphorous. The EIS should provide a more in-depth analysis of the resulting groundwater quality degradation from these other wastewater constituents including actual tertiary effluent analysis from an existing comparable facility.

CCPEDC-3 The element size of the finite-element mesh has a significant control on the simulated concentrations. For instance, a large element causes a greater dilution of the solute than smaller elements. To get better resolution of the "impact-area" the element size along the predicted groundwater flow path from the source area should be reduced.

CCPEDC-4 The existing wastewater plume has an average thickness of 75 feet. Over what vertically averaged thickness is the model predicting the impact area? If the concentrations are averaged over the entire permeable aquifer thickness too much dilution is being incorporated into the results. A presentation of the results in cross-section is necessary to document the methods used and the results.

Response to CCPEDC-1:

Studies for this Final Environmental Impact Statement (FEIS) conducted by Weston Geophysical, Corp., (1987, 1989) show that the site contains a large available groundwater resource. Due to the concern for discharge of Class I waters from the Otis wastewater treatment plant (WWTP), Alternative 4b has been added, with the results presented in Sec. 4.4.7.2.

Response to CCPEDC-2:

Groundwater sampled from five monitoring wells in the vicinity of the Otis WWTP were periodically analyzed during 1989 for 59 volatile organic compounds (VOCs). The results from these chemical analyses were reported to the U.S. Environmental Protection Agency (EPA). None of the compounds exceeded the Maximum Contaminant Levels (MCLs); most of the compounds were present in concentrations below the detection level. Only trichloroethylene (TCE), cis-1,2-dichloroethylene, and tetrachloroethylene were present at concentrations above nondetectable levels. The concentration of TCE ranged from not-detected to 2.0 parts per billion (ppb); the MCL for TCE was 5 micrograms per liter (μg/L). The concentrations of tetrachloroethylene and cis-1,2-dichloroethylene ranged from not-detected to 4.5 ppb and not-detected to 20 ppb, respectively; there was no MCL for these components. The presence of these particular organic compounds is probably due to household wastes at the Massachusetts Military Reservation (MMR).

Various groundwater monitoring wells were sampled downgradient of the Otis WWTP and were periodically analyzed for priority pollutants such as heavy metals and VOCs. The analysis of heavy metals included arsenic, barium, cadmium, chromium, mercury, lead, selenium, silver, iron, and manganese. Most of these metal concentrations have not been detected. None of the metals were present at concentrations exceeding the MCLs or the Recommended Maximum Contaminant Levels (RMCLs). Detergent (MBAS) concentrations ranged from less than 0.005 to 0.17 mg/L; phosphorus concentrations ranged from 0.2 to 4.6 mg/L.

Response to CCPEDC-3:

The element size of the finite-element mesh was constructed based on information in the data base developed for Cape Cod. For example, the data base consists of surface water features, sizes of the sand filter beds, sizes of the spray-irrigation areas, and field measurement locations. In addition, good finite-element grid design practices were followed in that there was not an abrupt change in the element size in the groundwater flow direction.

Response to CCPEDC-4:

The projected nitrogen concentrations in the vertical direction are addressed in Sec. 4.2.7, Groundwater-Flow and Contaminant-Transport Modeling. For further clarification, the reported concentrations were vertically averaged over a layer of approximately 10 ft in the upper part of the aquifer.

CCPEDC-5 The existing wastewater plume has impacted approximately 200 acres of aquifer over a 10 ppm nitrogen concentration as identified by LeBlanc (1984, p. 19). The no-action alternative predicts an "impacted area" of only 3.36 to 8.7 acres for a discharge of 3 to 5 hundred thousand gallons per day. Based upon this large discrepancy we conclude that the conceptualization of the model could be predicting smaller impact areas than those that would actually result. The EIS should present a discussion of this matter.

The existing Class III designation for the Falmouth municipal wastewater treatment plant is very conservative and identifies nearly the total potential downgradient groundwater quality impact area. This is a preferred approach and sets precedent for subsequent Class III designations. The predicted "impact areas" of the EIS should be delineated using a similar analysis.

Very truely yours,

Armando J. Carbonell
Executive Director

AJC:TC:bc

cc: Virginia Valiela, Sel. Town of Falmouth
Marie Oliva, Sel. Town of Bourne
Peter Lawrence, Sel. Town of Mashpee
Judith Koenig, Sel. Town of Sandwich
Martin J. Flynn, Sel. Town of Barnstable
CCPEDC Members, Towns of Falmouth, Bourne, Mashpee, Barnstable & Sandwich

Response to CCPEDC-5:

The existing wastewater plume that has affected approximately 200 acres of the sand and gravel aquifer with a nitrogen concentration of over 10 parts per million (ppm) (LeBlanc 1984) is a result of the disposal of treated sewage since 1936. More than 8 billion gallons of secondarily treated sewage (LeBlanc 1984) with an *unknown nitrogen* concentration have been discharged to the aquifer using the disposal method of rapid infiltration through sand filter beds. In addition, other nitrogen sources, such as privately owned septic systems, could also have contributed to the plume documented by LeBlanc (1984). For the FEIS, two loading rates of 300,000 and 500,000 gal/day were simulated with one initial nitrogen source of 15 mg/L for Alternative 5, the no-action alternative.

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COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME Dr. David D. Dow

ADDRESS 98 Portside Circle

East Falmouth, Ma. 02536

Check the category to which you belong:
Landowner ____ Business Person ____ Other X

Check the participant category to which you belong:
Public Official ____ Designated Representative Of Private Organization X Private Citizen ____

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ____

Check here if you wish to submit a written statement. X

Check here if you wish to receive a copy of the EIS: ____ draft
X final

Area of question or comment (please check all that apply):

Air Quality		Public Services & Facilities	
Water Quality	X	Health Hazards	X
Biological Impacts	X	Visual Impacts	
Geology/Soils		Cultural Resources	
Land Use		Other (Specify)	

Please turn in this sheet as requested by the hearing officer.

Written comments will be considered in preparation of the final EIS. You may use this sheet to submit written comments either in the space provided below, on the back, or in an attached statement. Written comments may also be submitted in a letter of other format; but regardless of format, comments must be submitted no later than August 21, 1989.

Please mail your comments to: NGB/DEV
Mail Stop 18
Andrews AFB, MD 20331-6008

COMMENTS: See enclosed letter

Statement(s) attached X Yes ____ No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Dr. David Dow
98 Portside Circle
East Falmouth, Massa. 02536
August 18, 1989

NGB/DEV
Mail Stop 18
Andrews Airforce Base, Md. 20331-6008

Dear Sir/Madam:

I am responding on behalf of the Cape Cod Group of the Sierra Club to the Draft Environmental Impact Statement for the Otis Air National Guard Base, Wastewater Treatment Facility in Massachusetts (near the towns of Sandwich and Bourne). I appreciate the fact that the Department of Defense has adopted a policy of allowing the general public to comment on developments at local military bases that may impact the environment in the adjacent civilian communities. As was brought out at the local information hearing by Falmouth selectman, Virginia Valiella, past activities at the Otis Air Force Base have resulted in the pollution of 5 million gallons of potentially potable water that would have been available to the town of Falmouth. Hopefully the present comment period will help identify potential problems, such as that cited above, before the project is implemented and allow appropriate solutions to be developed. The concerns that I will raise may not turn out to be problems, but they are areas that I feel should be studied for their potential impact.

In the public information hearing that I attended in Falmouth, Ma. the main impact evaluated from the disposal of the sewage effluent was dealing with the high nitrogen levels permitted under a Class III area permit. A number of the participants at the public meeting favored a Class I level permit condition for the effluent which seems to me to be a positive step, considering the rapid population growth in Falmouth and the direct connection between the groundwater on the cape and the sources of drinking water. Since the treated effluent will recharge the groundwater and the groundwater is directly utilized as a drinking water source for well users or indirectly by the town since groundwater fills Long Pond, the integrity of this aquifer needs to be protected, since it is our only source of drinking water. My interpretation of the National Environmental Policy Act is that it requires an EIS to address all potential human health impacts and not just the effluent levels designated in the discharge permit from the state of Massachusetts. Only concerns related to the discharge permit
CCSC-1 were addressed by the contractor (Argonne National Laboratory). I feel that two additional areas of concern are the heavy metals present in treated sewage effluent (the removal efficiency of which is uncertain in a trickling filter system) and human viruses which pass thru most secondary treatment facilities with only a 90 % removal efficiency (EPA, 1978).

A recent paper by Nriagu and Pacyna (1988) characterized domestic wastewater as being chacterized by the following concentrations of heavy metals (in parts per billion): As:20-90, Cd:2-20, Cr:90-400, Cu:50-200, Hg:0-2, Mn:200-900, Mo:0-30, Ni:100-600,
CCSC-2 Pb:10-80, Sb:0-30, Se:0-50, V:0-300, and Zn:100-500. In Table 1.1 the characteristics of the sewage plume in the groundwater of the Ashumet Valley (created by the Otis AFB Wastewater Treatment Plant in the past) reported concentrations of 639 ppb for Zn, 11 ppb for Pb, 30 ppb for Mo, 85 ppb for Cu, 29 ppb for Co, and 669 ppb for Al (plus high levels for Fe and Mn which are presumably due to natural processes). The high levels of aluminum may pose a problem to fish in the local ponds, since Al has been implicated in fish kills in ponds stressed by acid rain (which is an endemic problem in the North-
CCSC-3 east). Also the zinc and molyb denum levels in the sewage plume appear to be fairly high and other toxic heavy metals occurring in domestic wastewater such as As, Ni, Cd, Se, and Cr were not reported in the chemical analysis reported in Table 1.1 of the EIS. The potential impacts of these unanalyzed for heavy metals should be evaluated in the sewage plume. Itis not apparent to me that the sand filtration bed options for disposal of the treated sewage effluent will do much to prevent heavy metals passing into the

Response to CCSC-1:

Viruses are more resistant to treatment processes, but human health concerns are more appropriately addressed in terms of coliform bacterial levels. All proposed alternatives result in chlorination (disinfection) of the final effluent prior to disposal.

Various groundwater monitoring wells were sampled downgradient of the Otis WWTP and were periodically analyzed during 1989 for priority pollutants such as heavy metals and VOCs. The analysis of heavy metals included arsenic, barium, cadmium, chromium, mercury, lead, selenium, silver, iron, and manganese. Most of these metal concentrations have not been detected. None of the metals were present at concentrations exceeding the MCLs or the RMCLs.

Response to CCSC-2:

See the response to Comment CCSC-1. In addition, values cited in Comment CCSC-2 do not exceed the MCLs.

Response to CCSC-3:

See the response to Comment CCSC-1.

groundwater.

CCSC-4 The Environmental Protection Agency in a 1978 report found that viruses are resistant to inactivation in wastewater and surface water and may survive for months. A recent study in the marine environment reported viral survival for 17 months and viable drug resistant bacteria for up to 30 months after the cessation of sludge dumping (Goyal, 1989). The transferrable drug resistance in bacteria is related to viral genetic elements. The same paper pointed out that 110 different types of viruses may occur in sewage and that such viruses are resistant to chlorination. The EPA report stated that virus removal efficiency in secondary treatment processes was quite variable, going from 0 % to 99 %.The enteric viruses and rotaviruses that infect humans through the stomach, intestines, and pharynx cause a number of diseases and normally are waterborne infections. Recent studies in Long Island (which presumably has a similar geology to Cape Cod) has shown that viruses travel much further in groundwater than the indicator bacteria normally utilized as evidence of fecal contamination. Couple this with the fact that the minimum infectious dose for enteric viruses is 4 to 6 orders of magnitude lower than that for enteric bacteria (EPA, 1978), I feel that this potential threat should be evaluated in the final EIS. The recent paper by Snowdon and Oliver (1989) has an interesting discussion of techniques for measuring viruses in groundwater.

Even though both heavy metals and viruses are normally attached to the solid particles in the sewage treatment process and to the sediments in the environment, the continual application of sewage effluent will overcome this buffering action and will establish an equilibrium concentration in the motile phase (groundwater).

CCSC-5 Additional environmental concerns include the construction activity associated with some of the disposal options will negatively impact the deer wildlife corridors established by the town of Falmouth. At the informational hearing in Falmouth it was mentioned that the nitrogen and phosphorus in the effluent associated with option 1A could potentially impact a nearby maple wetland and Crocker Pond. The disposal of
CCSC-6 effluent into the Cape Cod Canal (option 4A) would appear to violate the Oceans Sanctuaries Act. Fred Bull, the Conservation Chair of our local Sierra Club group, is planning on writing you separately on the potential impact on endangered plants
CCSC-7 and animals on the Massachusetts list of the proposed construction activity. I would encourage you to conduct a field survey of the endangered plants and animals prior to to finalizing your construction for the chosen alternative. The upland sandpiper nests should get special attention in this regard.

I must comment that the slides that were utilized at the public information hearing left alot to be desired in regards to clarity and in illustrating where the various options were to take place. Also the presentation glossed over some fairly critical details that are not known by the general public, such as the difference between level I and level III effluent guidelines issued by the state of Massachusetts. Also the presenters went through the material too rapidly for many of us novices to really follow and didn't discuss the underlying assumptions of the groundwater modelling exercise which can be critical in evaluating the likely predictive accuracy of the results.

Thank you for your consideration in this matter.

Yours truly,

David Dow

David Dow
Acting Chair, Cape Cod Group
Sierra Club

Response to CCSC-4:

Comment noted. Viruses indeed exist in domestic wastewater. As is noted in this comment, current research addresses this aspect of wastewater treatment and disposal. However, current regulatory requirements do not include standards for viruses.

Response to CCSC-5:

For all the modeling simulations for Alternatives 1 and 1a, the maximum nitrogen concentration in the groundwater in the vicinity of Crocker Pond was 0.2 mg/L. The loading rates for this simulation included the maximum design capacity of Falmouth's WWTP (800,000 gallons per day [gal/day] with an initial nitrogen concentration of 19.7 mg/L) and maximum disposal for Alternative 1a (500,000 gal/day with an initial nitrogen concentration of 15.0 mg/L). The disposal conditions for Alternatives 1 and 1a are discussed in Sec. 4.2.7.1.

In Sec. 4.2.6, Land Use, the conditions for Maple Swamp are discussed.

Response to CCSC-6:

Comment noted. This option was included under the explicit request of the EPA, Region I (see Appendix A, pages A-79 to A-83).

Response to CCSC-7:

Consultation has been initiated with the U.S. Fish and Wildlife Service in relation to the presence of threatened or endangered species within the proposed impact areas. See Sec. 3.8, Endangered and Threatened Species.

References

Environmental Protection Agency. 1978. Human Viruses in the Aquatic Environment: A Status Report with Emphasis on the EPA Research Program. EPA-570/9-78-006. 37 pp.

Goyal, S.M. 1989. Virus Survival at Sewage-Sludge Disposal Sites. pp. 57-63 in Oceanic Processes in Marine Pollution Vol. 4 : Scientific Monitoring Strategies for Ocean Waste Disposal ed. by D.W. Hood, A. Schoener, and P. K. Park; Robert E. Krieger Publish. Co.; Malabar, Fl.

Nriagu, J.R. and J.M. Pacyna. 1988. Quantitative Assessment of Worldwide Contamination of Air, Water and Soils by Trace Metals. Nature (london) 333(6169): 134-139.

Snowdon, J.A. and D.O. Oliver. 1989. Coliphages as Indicators of Human Enteric Viruses in Groundwater. Crit. Rev. Environ. Control 19(3): 231-249.

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THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENVIRONMENTAL AFFAIRS

MICHAEL S DUKAKIS
GOVERNOR

JOHN DEVILLARS
SECRETARY

**CERTIFICATE OF THE SECRETARY OF ENVIRONMENTAL AFFAIRS
ON THE
DRAFT ENVIRONMENTAL IMPACT REPORT**

PROJECT NAME	: Otis ANG Base WW Treatment Plant
PROJECT LOCATION	: Sandwich, Bourne
EOEA NUMBER	: 7822
PROJECT PROPONENT	: MANG
DATE NOTICED IN MONITOR	: August 25, 1989

CMEOEA-1 The Secretary of Environmental Affairs herein issues a statement that the Draft Environmental Impact Report submitted on the above project adequately and properly complies with the Massachusetts Environmental Policy Act (G.L., c.30, s.61-62H) and with its implementing regulations (301 CMR 11.00).

CMEOEA-2 The FEIR shall identify a preferred alternative for disposal considering both the Sole Source Aquifer designation for Cape Cod and the Ocean Sanctuaries Act in the selection process and should clearly show why advanced wastewater treatment will not be an environmental benefit.

The attached comments raise several additional issues that must be addressed in the FEIR before an adequate determination can issue.

October 2, 1989
DATE

JOHN DeVILLARS, SECRETARY

Comments received: DEM, Bourne Shore and Harbor Committee, Bourne Selectmen, MCZM, USEPA.

JD/rf

Response to CMEOEA-1:

Comment noted. The FEIS will serve as an Environmental Impact Report (EIR).

Response to CMEOEA-2:

Comment noted. Subsequent to the public hearings, Alternative 4b was added to the alternatives being considered in the Draft Environmental Impact Statement (DEIS). Upon further consideration, Alternative 4b was chosen as the preferred alternative for discharge of treated effluent from the Otis WWTP.

The Commonwealth of Massachusetts
HOUSE OF REPRESENTATIVES
STATE HOUSE. BOSTON 02133

ERIC T. TURKINGTON
STATE REPRESENTATIVE
BARNSTABLE, DUKES & NANTUCKET DISTRICT

CHILMARK, EDGARTOWN, FALMOUTH
GAY HEAD, GOSNOLD, NANTUCKET
OAK BLUFFS, TISBURY &
WEST TISBURY

Committees on
Judiciary
Counties

ROOM 236, STATE HOUSE
TEL. (617) 722-2430

August 9, 1989

NGB/DEV
Mail Stop 18
Andrews Air Force Base, MD 20331-6008

Re: Otis Wastewater Treatment Plant

Gentlemen:

CMHR1-1 I am writing to tell you that I attended the public hearing held on July 26th and 27th regarding the Otis Wastewater Treatment Plant and that I support the position of the Falmouth Board of Selectmen enclosed.

Sincerely,

Eric T. Turkington

ETT/ko
enclosure

Response to CMHR1-1:

Comment noted. See the responses to Comments TFBH-1 through TFBH-3.

Comments on DEIS, Otis ANG Base, WWTP

The Falmouth Board of Selectmen strongly supports the efforts of the National Guard Bureau to improve the quality of the discharge from the Otis Wastewater Treatment Plant. The plume from this plant was discovered in Falmouth in 1978-1979. As a result, Falmouth lost an operating well and four more well sites, a total of five million gallons per day. Our goal has always been to recover that water supply. By the year 2020, we know we will need that water supply.

Our comments on the proposed alternatives in the DEIS are ranked according to increasing benefit to the aquifer, to the water supply, and to other water bodies:

Comment 1: We are totally opposed to Alternative 5 (No Action) because is perpetuates the loss of 5 million gallons per day; and Alternative 4a (Direct discharge to the Cape Cod Canal) because of the Ocean Sanctuaries Act.

Comment 2: We are opposed to Alternatives 1 and 1a for the following reasons:

a. This is a Class III discharge (nitrogen above 10 ppm, the Drinking Water Standard). This discharge will also enrich West Falmouth Harbor and Buzzards Bay. The existing Class III area will have to be expanded.

b. This new discharge to sand filter beds will increase the risk of shifting the landfill plume southward, threatening Long Pond, the Town's major water supply.

c. The areas proposed for Otis sand filter beds are ALREADY allocated to Falmouth Phase II spray irrigation. Also there appears to be no compensation to Falmouth for use of this land.

d. The nearby Maple Swamp will be heavily enriched in violation of the Town's wetland regulations. A down-stream fresh water pond, Crocker Pond, will also likely be enriched.

e. Downstream private wells may also be affected.

f. Construction of the sand filter beds will occur across a wildlife corridor.

Comment 3: Alternative 3 (Tertiary treatment) removes nitrogen below 10 ppm but leaves phosphorus which will continue to enrich Ashumet Pond. This pond is already heavily stressed due to phosphorus from the existing sewage plume. If this alternative is used, the sand filter beds should be as far west, away from Ashumet Pond, as possible.

Comment 4: Alternative 2 (Spray irrigation) does the next best job of renovating the effluent be removing both nitrogen and phosphorus through land treatment. Dispersal of the effluent over a wide area also reduces any possible impact of other inorganic compounds. This alternative is acceptable to Falmouth only if it is declared a Class I discharge - i.e. meets Drinking Water Standards.

Comment 5: Alternative 4 (Sand filter beds near the Cape Cod Canal) is the most beneficial alternative because it totally removes the discharge from an area of present and future water supply and places it in an area of no groundwater withdrawal. We feel this discharge to sand filter beds should have a nitrogen level below 10 ppm (Class I discharge). Since the groundwater moves so fast in this area (325 ft./day), dilution of the remaining nitrogen is a major factor in eliminating any problems in the Cape Cod Canal.

Questions:

In order for the communities of Falmouth, Bourne and Otis to choose the final alternative, several key pieces of information are needed. We are putting these questions into the formal record now even though the information may ultimately come from a state regulatory agency rather than Argonne or the Guard Bureau.

Question 1: For Alternative 4 — sand filter beds near the Canal — are there any other standards that Class I discharge must meet beyond the 10 ppm nitrogen? This question also applies to Alternatives 2 & 3 (spray irrigation and tertiary treatment).

Question 2: For Alternative 2 — spray irrigation over grasses and legumes — at which point in the process will the nitrogen concentration be measured to assume compliance with DEQE Discharge Permit? For instance, at the nozzlehead? or the groundwater under the site? or the Base boundary?

Question 3: For discharge to sand filter beds (Alternatives 1, la, 3 and 4), at what point is the nitrogen concentration measured to assure compliance with the DEQE Discharge Permit?

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The Commonwealth of Massachusetts
HOUSE OF REPRESENTATIVES
STATE HOUSE, BOSTON 02133

THOMAS S CAHIR
REPRESENTATIVE

Committee on Transportation
House Committee on Counties
House Committee on Local Affairs
ROOM 443, STATE HOUSE
TEL 722-2460

August 18, 1989

Mr. Leroy Householder
ANGB/DEV
Building 3500, Stop 18
Andrews Air Force Base
Maryland 20331-6008

Dear Mr. Householder:

I am writing in regard to the Draft Environmental Impact Statement for the Otis Air National Guard Base, Wastewater Treatment Facility. As a State Representative for all four of the towns abutting the Base, I have a great interest in this matter. I have also been quite actively involved with legislation affecting the very sensitive water supply on Cape Cod. I sit on a special legislative commission on water supply and I recently sponsored a bill establishing a water district in the Town of Mashpee. Protecting our waterways and acquifer have been one of my highest priorities during my legislative career. Needless to say, improving the quality of the discharge from the Otis treatment facility is of the utmost importance.

A plume was discovered about ten years ago which caused the loss of a well in the Town of Falmouth. It prompted many of us to become more aware of the dangers and specifics of contaminants in our water supplies. Thanks to the National Guard Bureau and Falmouth Selectwoman, Virginia Valiela, much has been done to correct some of the problems. I base my comments and suggestions on many conversations and meetings that I have had with individuals whom I consider to have particular expertise on these matters. Considering that I represent the two towns most directly affected by the treatment facility (Falmouth and Bourne), I would hope that both communities could reach an agreement which is in the best interest of all those involved.

Mr. Leroy Householder
August 18, 1989
Page 2

CMHR2-1 My feeling is that alternatives 4 and 4A are completely unacceptable as a Class III discharge. It is absolutely essential that the wastewater is treated to obtain a Class I status. In order to protect the aquifer, the most feasible output of the discharge would be the northern part of the base, thus making all other alternatives less desirable. On Cape Cod we must do everything possible to preserve not only our drinking water, but the coastal environment as well. Regardless of cost, I would hope that the suggestions provided by the local communities are seriously considered and adhered to.

Sincerely,

Thomas S. Cahir
State Representative

TSC/col

Response to CMHR2-1:

Comment noted. See the discussion of Alternative 4b in Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b.

COMMONWEALTH OF MASSACHUSETTS
MASSACHUSETTS SENATE
STATE HOUSE, BOSTON 02133

SENATOR EDWARD P. KIRBY
PLYMOUTH AND BARNSTABLE
DISTRICT
ROOM 413-H
TEL. (617) 722-1330

Committees
Ways and Means
Transportation
Criminal Justice
Energy
Judiciary

August 15, 1989

Mr. Leroy Householder
ANGSC/DEV
Building 3500, Stop 18
Andrews Air Force Base
Maryland 20331-6008

Re: Draft Environmental Impact Statement for the Otis Air National Guard Base, Wastewater Treatment Facility

Dear Mr. Householder:

CMMS-1 I wish to go on record as vigorously supporting the Town of Bourne in its opposition to Alternatives 4 and 4a: the construction by the Otis Air National Guard Base of a 50,000 foot pipeline to dispose of treated effluent from the Base directly into the Cape Cod Canal or indirectly through infiltration basins and thence into the Canal.

Bourne has been a leader in addressing problems relating to the environment. The Town has recently completed an innovative drainage project at Electric Avenue Beach that prevents surface runoff from entering the Bay.

It would be unfortunate if such thoughtful efforts by a small town were overwhelmed and negated by the discharge of up to 500,000 gallons daily of effluent into Cape Cod and Buzzards Bays via the Cape Cod Canal.

The Environmental Impact Statement lists several alternatives to disposing of the Base's effluent in the Canal. At the hearing of July 27, 1989, opposition to the Canal Alternatives (4 and 4a) by the public and Town officials was unanimous.

Response to CMMS-1:

Comment noted.

Therefore, I urge you to adopt a plan not providing for discharge of effluent into the Cape Cod Canal, and to reject Alternatives 4 and 4a.

Yours truly,

Edward P. Kirby

Edward P. Kirby
Senator

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TOWN OF BOURNE

24 Perry Avenue
BUZZARDS BAY, MASS. 02532

SHORE & HARBOR COMMITTEE
COASTAL RESOURCE MANAGEMENT PLANNING

September 18, 1989

John DeVillars, Secretary
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

Re: DEIR for the Otis Air National Guard (ANG) Base Wastewater Treatment Plant Facilities Improvements

Dear Secretary DeVillars:

The Bourne Shore and Harbor Committee has been established by direct town meeting vote since 1959. The charge given the Committee by the Town is to "initiate, encourage and carry out improvements on the land along the shores now or later owned by the Town, and in adjacent waters, all to increase the use thereof in the public interest for bathing, boating and fishing...". In addressing that continuing mandate, the Shore and Harbor Committee has reviewed the Draft Environmental Impact Report entitled "Draft Environmental Impact Statement for the Otis Air National Guard Base, Wastewater Treatment Facility" submitted by the Air National Guard in response to the scope issued by the Secretary of Environmental Affairs under the provisions of 301 CMR Section 11:00 (MEPA).

The emphasis of our review has been on the discussions and documentation submitted for Alternative 4A (pump treated effluent to Cape Cod Canal land disposal area in Bourne) and Alternative 4B (pump treated effluent to Cape Cod Canal as direct disposal). It is our opinion, based on our review of
CRMP-1 the document, that the Draft Environmental Impact Report fails to adequately address the scoping requirements relative to potential environmental impacts to surface waters, specifically Buzzards Bay. Although a limited discussion of potential impacts to the Cape Cod Canal and its flow dynamics is included as a one page summary in Appendix D, no discussion

Response to CRMP-1:

Assuming worst-case conditions of 10 mg/L using a tertiary-treatment system (under operational conditions this value will be much lower) results in the discharge of about 19 kilograms (kg) of nitrogen into the Cape Cod Canal per day, resulting in a concentration of approximately 3.3 ppb in the canal. This level will have a minimal effect and is undetectable by current analytical methods (American Public Health Association 1981). For further discussion, see Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b.

While this alternative will result in undetectable concentrations of nitrogen entering Buzzards Bay from this single source, it is recognized that the *cumulative impact of all sources* is most appropriately examined within the structure of the Buzzards Bay restoration project.

CRMP-1 is included as to the effects of the direct or indirect flow from the Canal into Buzzards Bay. Rather, it is simply stated that the net discharge of the Canal water flows westward into Buzzards Bay during each tidal cycle. In fact, the document states that computer flow simulations show that "about 4.5 billion gallons of water flow into Buzzards bay during each period of westward flow; this water does not return on the eastward flow.". So about two-thirds of the flow that passes through the western end of the canal does not re-enter the canal. This is of very great concern to our Committee and the residents of Bourne that live and use these coastal receiving waters of the Canal in this Buzzards Bay area.

CRMP-2 What are the flow dynamics at the western end of the Canal? Do the waters exiting the Canal become entrapped in the more protected coastal shoreline and embayment areas or are they carried into deeper receiving waters? Will the contaminants added to the Canal waters as direct and/or indirect discharges from Alternatives 4A and 4B accumulate/concentrate along the shoreline areas immediately adjacent to the western canal discharge area? Answers to these and other such questions are critical in understanding the real consequences of Alternatives 4A or 4B and are essential in trying to assess cumulative effects to these marine water resources. These resource areas already experience significant stress related to periodic effluent discharges from the State operated treatment facilities located at the Massachusetts Maritime Academy; stress related to stormwater runoff; stress related to onsite sewage disposal systems; etc. as discussed in studies conducted under the Buzzards Bay Project.

CRMP-3 More information is necessary. References made in the document that additional information on flow dynamics will be available in the Final EIR should not be allowed as sufficient. This information is necessary to be presented in the DEIR so as to afford commentators the opportunity to address the data and/or resultant conclusions within the appropriate processing time. Submission of this type of critical information for first time review in a Final EIR document is not appropriate and should not be allowed. Rather, this type of very necessary information should be part of the DEIR.

CRMP-4 Although we realize that the best alternative for treatment of the Base's wastewater effluent would be to require it to meet Class I standards before it left the plant, we realize that all other alternatives must be completely addressed, environmental impacts considered, and overall cost effectiveness evaluated. That is the reason for the EIR process.

Response to CRMP-2:

Turbulent conditions existing within the canal result in thorough mixing from bottom to top at the western end of the canal throughout the year. Because of this thorough mixing, mass-balance calculations are appropriate. See the response to Comment CRMP-1 for the discussion of concentrations of nitrogen entering Buzzards Bay. See also Sec. 4.4.4.3, Marine Resources.

EPA (1981) studies indicate that complex flow patterns develop as a result of tidal action in Buzzards Bay. Therefore, the extent of nitrogen entrapment along embayment areas cannot be quantified.

Response to CRMP-3:

Comment noted. See the responses to Comments CRMP-1 and CRMP-2.

Response to CRMP-4:

Alternative 4b is the preferred alternative. This alternative results in the disposal of Class I waters (produced as a result of tertiary treatment) into new sand infiltration basins near the Cape Cod Canal. See Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b.

CRMP-5 Therefore, the Bourne Shore and Harbor Committee requests that the Secretary require a Supplemental DEIR to address this glaring technical deficiency in the information presented to evaluate the potential environmental impact resulting from the implementation of either Alternative 4A or 4B. Allowing the Air National Guard to either omit entirely or submit this type of detailed new information as part of the Final EIR short circuits the purpose of the DEIR MEPA review process and should not be allowed. The Shore and Harbor Committee appreciates the opportunity to comment on the DEIR and would be happy to meet with officials from the Base or MEPA to discuss the concerns as outlined above.

Sincerely,

Russ Tarbell

Russ Tarbell, Vice Chairman
Shore and Harbor Committee

989PF8:ekd

cc: Otis Air National Guard, Attention:
Tom Cahir
Senator Kirby
Marie Oliva, Bourne Board of Selectmen
Richard Driscoll, Moderator
Hayden Coggshell, Board of Health
Pollution Task Force
Buzzards Bay Coalition
MCZM
Bourne Courier
Falmouth Enterprise
Cape Cod Times

Response to CRMP-5:

The FEIS will serve as an EIR; see the Certificate from the Secretary of Environmental Affairs dated Oct. 2, 1989.

The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, Massachusetts 02202

COASTAL ZONE MANAGEMENT

RECEIVED
SEP 8 1989
MEPA

MEMO

To: Janet McCabe, Director, MEPA
Fr: Jeffrey R. Benoit, Director, MCZM JRB
Da: September 11, 1989
Re: Comments on EOEA # 7822, Sandwich:Otis ANG Wastewater Treatment

MCZM has reviewed the Draft EIR/EIS for the Otis Air National Guard Base, Wastewater Treatment Facility and does not find it to be adequate. We, therefore, request that a Supplemental Draft EIR be required. The scope for the EIS pursuant to NEPA was not widely reviewed, and MCZM was never invited to participate in the scoping process. Despite the claims in the EIS/EIR, there has been a failure to coordinate with MCZM and it was not recognized in this EIS that a formal MCZM Federal Consistency review will be required
CZM-1 for this project. By accepting the Draft EIS as the draft EIR and by not requiring the Draft EIR to respond to comments made on the ENF, MEPA has eliminated an essential step in the public review process, since all comments now will only be addressed in the Final EIR. MCZM objects vigorously to this procedure and feels that it is most appropriate to require a Supplemental Draft rather than a Supplemental Final EIR.

CZM-2 The most serious flaw of the EIS/EIR is the failure to identify a preferred and recommended alternative for the solution to the wastewater treatment problems. The purpose of the Draft EIR should be to collect and analyze information in order to formulate a recommended plan of action. The lack of a recommended alternative would appear to indicate that, either not enough information was gathered or, that it was not adequately analyzed or both. It was indicated that all of the alternatives were similar in terms of economic costs, but there was no real analysis of comparative environmental costs which is really the purpose of
CZM-3 the Draft EIR. Therefore, it is essential that the Supplemental Draft EIR include a real environmental analysis with a clear definition of the advantages and disadvantages of each of the identified alternatives, and conclude with a recommended alternative based on the analysis. The criteria used for the decision should be identified and the process by which the final recommendation is made should also be clearly outlined.

In the discussion of the history of the project, the proponent neglected to mention that the Massachusetts Department of Environmental Protection(DEP) issued an Administrative Order to the existing facility because of its continued violation of the groundwater discharge permit. There has been a lack of cooperation

Response to CZM-1:

The FEIS will serve as an EIR; see the Certificate from the Secretary of Environmental Affairs dated Oct. 2, 1989.

Response to CZM-2:

Subsequent to the public hearings, Alternative 4b was added to the alternatives considered in the DEIS. Upon further consideration, Alternative 4b was chosen as the preferred alternative for the discharge of treated effluent from the Otis WWTP into new sand infiltration basins near the Cape Cod Canal.

Response to CZM-3:

See the response to CZM-2. See also Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b.

CZM-4 between the ANG and the State in resolving the problems. It seems important that the details of the Administrative Order, including the reasons for its issuance and other activities to date, be included. in the Supplemental Draft EIR as part of the history of the project.

CZM-5 While it appears that the wastewater treatment system is not the source of the pollutants that have contaminated the groundwater, additional information should be presented to indicate what efforts are being pursued to remediate the existing contaminant problem and to clearly demonstrate that it is an entirely separate problem.

CZM-6 Alternative 1 should include a more extensive discussion of the coordination that is necessary and likely from the Town of Falmouth. Impacts from nutrients in the plume on marine as well as freshwater resources should receive more attention, particularly in light of the research efforts of the Buzzard's Bay Project.

CZM-7 The information for Alternative 2 indicates that this option may have the added benefit of providing increased habitat for several endangered and threatened species of birds. There should be additional documentation that the spray irrigation option is compatible with the habitat requirements for these species. The survey for cultural resources should also be completed. Since there is still concern with this option's potential for nutrient loading to groundwater and subsequent impacts to nearby ponds, the feasibility of providing nutrient removal prior to spray irrigation should be examined and evaluated. It is not clear whether the modification proposed by Camp, Dresser, and McKee eliminates the concern for nutrient impact to Ashumet Pond.

CZM-8 Alternative 4 also appears to require the cooperation of the Towns of Bourne and Sandwich and this should be evaluated. It also appears that there are limitations imposed by the Ocean Sanctuaries Act which need to be examined further.

CZM-9 For Alternative 5, there appears to be the suggestion that no problem exists according to the information presented. If that were the case, there would be no need for an EIS/EIR. However, there are problems with the "no action plan" and they should be clearly described.

CZM-10 It is noted that CZM is not on the list of agencies to receive the documents for this project, and we would like to request that we be added to the distribution list in order to facilitate communication. In the discussion of the CZM policies, it appears that the proponent has identified the important policies, but
CZM-11 considerably greater analysis is needed to justify the statement in the summary that all of the alternatives are consistent with the

Response to CZM-4:

The history of the facility is described in Sec. 1.2, Facility History and Current Status. A Supplemental DEIS will not be prepared, as directed in the Certificate of the Secretary of Environmental Affairs dated Oct. 2, 1989.

Response to CZM-5:

On-going efforts not related to this FEIS address Comprehensive Environmental Response, Compensation, and Liability Act/Superfund Amendments and Reauthorization Act (CERCLA/SARA) considerations. Since the inclusion of the MMR on the National Priority List (NPL), existing contaminants have been handled under EPA regulatory control. Installation/Restoration Program (IRP) reports have been provided to the EPA and the public. The program is adequately discussed in these reports.

Response to CZM-6:

If Alternative 1 had been chosen as the preferred alternative, extensive discussions regarding land use, eminent domain, and easements would have been undertaken with public and private landowners. However, selection of Alternative 4b as the preferred alternative negates these considerations.

Response to CZM-7:

Upon further consideration, spray irrigation would not have provided habitat for the state-listed bird species. An archaeological and cultural resources survey has been completed (for Alternatives 4, 4a, and for the preferred alternative, 4b). By choosing Alternative 4b as the preferred option, Ashumet Pond will not be affected (further, see the letter from Elizabeth Higgins Congram to Mr. Gary D. Vest dated August 21, 1989).

Response to CZM-8:

Based in part on comments supplied by public agencies and concerned citizens, Alternative 4b was developed and chosen as the preferred option. Because Alternative 4b does not result in direct disposal into the Cape Cod Canal, the Ocean Sanctuaries Act is not violated.

CZM-11 CZM program. At the very least, there appear to be immediate problems with Alternative 4a due to the Ocean Sanctuaries Act.

CZM-12 Because of the extensive additional analysis that appears to be needed, CZM finds that it would be most appropriate to require a Supplemental Draft EIR for this project.

cc: Selectmen, Town of Bourne
Selectmen, Town of Sandwich
Selectmen, Town of Mashpee
Selectmen, Town of Falmouth
Joe Costa, Coordinator, Buzzard's Bay Project, MCZM
Lisa Hanscom, MCZM Cape Cod Regional Coordinator
Nancy Maciolek, Coordinator, Mass Bay Project, MCZM

Response to CZM-9:

A requirement under National Environmental Policy Act (NEPA) regulations is consideration of the no-action alternative in order to provide a baseline condition, even if it is not a viable option.

See the description of current conditions in Sec. 3, Affected Environment. Alternative 5 results in the disposal of Class III water. The current disposal permit requires an application for either Class III or Class I designation. Alternative 5 does not meet Class I designation requirements.

Response to CZM-10:

Comment noted. Massachusetts Coastal Zone Management (CZM) will be included on the distribution list for the FEIS.

Response to CZM-11:

Comment noted. See the response to Comment TBTP-1.

Response to CZM-12:

Comment noted. See the response to Comm' .it CZM-1.

Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Management

SEP 26 1989

September 22, 1989

100 Cambridge Street
Boston
Massachusetts
02202

Division of
Water Resources

Secretary John DeVillars
Executive Office of Environmental Affairs
100 Cambridge Street
Boston, MA 02202

RE: Ocean Sanctuaries Act Program comments on EOEA # 7822, Otis ANGB WW Treatment, Sandwich

Dear Secretary DeVillars,

We have the following comments on the above referenced DEIR:

DEM-1 1. Alternative 4a proposes direct disposal to the Cape Cod Canal at a discharge site located in the Cape and Islands Ocean Sanctuary. New discharges, such as those proposed in Alternative 4a, are prohibited by the Ocean Sanctuaries Act (OSA) G.L., C. 132A, s. 16 and 302 CMR 5.08(2).

DEM-2 2. Page 1-12, 1.4.2.3. states that "*The Commonwealth* of Massachusetts Ocean Sanctuaries Act has designated the coastal waters of Cape Cod as suitable for swimming and shellfishing, except for the Cape Cod Canal and Falmouth Inner Harbor, where shellfishing is restricted (CCPEDC 1978)." This is incorrect and should be changed in the FEIR. The OSA does not designate coastal waters as suitable for swimming or shellfishing.

DEM-3 3. Although Alternative 4, discharge to infiltration basins adjacent to the canal, is not in direct violation of the OSA, we are concerned with its potential negative impact on the sanctuary.

Very truly yours,

Myron L. Gildesgame
Ocean Sanctuaries Coordinator

Response to DEM-1:

Comment noted. See the response to TBTP-1.

Response to DEM-2:

Comment noted and correction made in the FEIS.

Response to DEM-3:

Comment noted. The addition of the preferred alternative, Alternative 4b, results in the discharge of Class I water into new sand infiltration basins near the Cape Cod Canal.

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The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
Division of Water Pollution Control
One Winter Street, Boston, Mass. 02108

Cornelius J. O'Leary
Acting Director
(617) 292-5647

August 1, 1989

Mr. Leroy Householder
ANGSC/DEV
Building 3500, Stop 18
Andrews A.F.B., MD 20331-6008

Dear Mr. Householder:

This office has received a copy of the Draft Environmental Impact Statement (EIS) for the Wastewater Treatment Facility (WWTF) at Otis Air National Guard Base, Cape Cod, for review and comment. The EIS contains four primary alternatives, with an option to two of them, and a no-action alternative.

Alternatives #1 and #1a involve disposal of effluent from the Otis WWTF at the Falmouth municipal facility site. In light of recent soils and hydrogeologic information developed pertaining to the site, as well as the current problems the Town has encountered in disposing of its own sewage effluent, we do not recommend either of these options.

Alternatives #2 and #3 include the disposal of treated effluent either at or in the proximity of the existing WWTP site. Since the Ashumet Valley where the discharge occurs is a source of existing and potential municipal groundwater supply to the Town of Falmouth, we do not recommend these options.

Alternative #4a is in direct conflict with the provisions of the Cape Cod Bay Ocean Sanctuary Act, (MGL Ch. 132A) which prohibits new sewage discharges to the canal. Although this alternative may be environmentally acceptable, its implementation could not be accomplished without legislative approval. Therefore this alternative cannot be recommended unless the statutory prohibition is overcome.

Alternative #5, the no-action alternative, is in direct violation of the terms of the groundwater discharge permit issued to the WWTP, as well as the Administrative Order issued by this Department, so this alternative as well, is not recommended.

DEQE
NOW
THE DEPARTMENT OF
ENVIRONMENTAL PROTECTION

DEQE1-1 We believe that a modification of Alternative #4 would provide an environmentally sound solution to the impacts of the WWTP discharge. This would include upgrading the treatment plant to Class 1 standards for groundwater discharge and disposal of treated effluent in new infiltration basins at the northern end of the Massachusetts Military Reservation (MMR) near the Cape Cod Canal area. Treatment plant improvements to meet Class 1 standards could, we believe, be achieved through the addition of tertiary treatment facilities such as an anoxic RBC unit at the existing facility, or the addition of a deep bed denitrification filter at the end of the treatment process at the plant. We feel that such modifications should be investigated certainly before further evaluation of the Bardenpho process for additional waste treatment to remove nitrogen from the effluent.

Achieving Class 1 standards for discharge would preclude the need to obtain a Class III designation at the Canal Discharge site. It would also provide the best practical treatment technology to the proposed 500,000 gallon per day effluent discharge to the groundwater, which would then be unlikely to impact the marine resources associated with the Cape Cod Canal and its environs. This alternative would remove the discharge from the Ashumet Valley and the sensitive groundwater resource; retain the discharge on the MMR site; provide treatment to Class 1 standards in conformance to Massachusetts groundwater regulations, and reduce the potential liability of the ANG for significant detrimental impacts to private or public water supply sources downgradient of the discharge.

We urge the Department of the Air Force to further evaluate this proposed alternative and to include it as the preferred alternative in the final Environmental Impact Statement.

We would be glad to discuss this matter further should you wish to do so, and appreciate the opportunity to review and comment on the draft E.I.S.

Very truly yours,

Cornelius J. O'Leary
Acting Director

CJO/CW/wo
67/householder

cc: DEQE/SERO
Marcia Sherman, Office of Legal Counsel, DEP
Board of Health, Main Street, Falmouth, MA 02540
Bob Mendoza, EPA-Groundwater Section, JFK Federal Building, Boston, MA 02203
Falmouth DPW, Town Hall, Falmouth, MA 02540
Attn: Dick Witt, Director
Lt. Col. Paul Brogna, Base Civil Engineer, Mass ANG 102nd F.I.W., Otis ANG Base, MA 02542-5001
Dick Foster, MEPA Office, EOEA, 100 Cambridge Street, Boston, MA 02202

Response to DEQE1-1:

In response to concerns related to the disposal of Class III water, the Air National Guard (ANG) has evaluated Alternative 4b (tertiary treatment to produce Class I water discharge). The initial total nitrogen concentration used in the modeling (under Alternative 4b involving tertiary treatment with disposal near the Cape Cod Canal) was conservatively estimated to be 10 mg/L. A more realistic estimate was approximately 4 mg/L (EPA 1987). See the response to Comment AVPO-1 and Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b.

Other tertiary treatment designs are available to meet Class I water discharge standards. However, the purpose of the FEIS is to investigate the impacts of various disposal alternatives rather than address different tertiary-treatment designs.

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The Commonwealth of Massachusetts
Executive Office of Environmental Affairs
Department of Environmental Quality Engineering
Division of Water Pollution Control
One Winter Street, Boston, Mass 02108

Cornelius J. O'Leary
Acting Director
(617) 292-5647

November 17, 1989

Mr. Leroy Householder
ANGSC/DEV
Building 3500 Stop 18
Andrews A.F.B., MD 20331-6008

DEQE NOW IS THE DEPARTMENT OF ENVIRONMENTAL PROTECTION

Dear Mr. Householder:

DEQE2-1 In response to a request from Ron Watson of the National Guard, and to further clarify our response to the Draft EIS for the Wastewater Treatment Facility (WWTP) at Otis Air National Guard Base on Cape Cod, we wish to forward the following comments.

As we have previously stated, we believe that an upgrade of the treatment plant that would ensure a discharge of treated effluent that meets Class I standards, together with a relocation of the discharge location to the north side of the Massachusetts Military Reservation near the Cape Cod Canal area, would be the preferable approach for the ANG to take to achieve a sound environmental solution to the problems of the WWTP. Treatment to meet Class I standards, as they presently exist under 314 CMR 5.0 and 6.0, means that the effluent would meet the following:

B.O.D. - 30 mg/l; Total Suspended Solids - 30 mg/l; Settleable Solids - 0.1 ml/l; Total Coliform Bacteria - 1000/100 ml or Fecal Coliform - 200/100 ml; Nitrate Nitrogen - 10.0 mg/l; Total Nitrogen - 10.0 mg/l; Oils and Grease - 15.0 mg/l; Fluoride - 2.4 mg/l; Chlorine Residual - 1.0 mg/l; Boron - 20.0 mg/l; Foaming Agents - 1.0 mg/l; Chlorides - 250 mg/l; Total Dissolved Solids - 1000 mg/l; pH - 6.5-8.5; Sulfate - 250 mg/l; Arsenic - 0.05 mg/l; Lead - 0.05 mg/l; Cadmium - 0.01 mg/l; Chromium 0.05 mg/l; Barium - 1.0 mg/l; Mercury - 0.002 mg/l; Total Trihalomethanes - 0.1 mg/l; Selenium - 0.01 mg/l; Silver - 0.05 mg/l; Endrin - 0.0002 mg/l; Lindane - 0.004 mg/l; Methoxychlor - 0.1 mg/l; Toxaphene - 0.005 mg/l; Chlorophenoxys - 0.1 mg/l; 2,4,5 2,4,5-TP Silver - 0.1 mg/l; Radioactivity shall not exceed the maximum radionuclide contaminant levels as stated in the National Interim Primary Drinking Water Standards. In addition, Toxic Pollutants shall not exceed Health Advisories which have been adopted by the Department and/or EPA. A toxic pollutant for which there is no available Health Advisory and for which there is not sufficient data available to the Department for the establishment of a Health Advisory will be prohibited from discharge.

DEQE2-1 The Class I discharge requirements are reflected in the groundwater discharge permit issued to the WWTP on October 10, 1984 under item 1, Special Conditions A.2. A renewal of the discharge permit for discharge to Class I groundwaters will also contain these discharge limitations "after treatment system improvements".

We hope that this will answer your questions and concerns sufficiently to finalize a solution for the Otis WWTP discharge, and if you wish to discuss the matter further, we would be glad to do so.

Very truly yours,

Cornelius J. O'Leary
Acting Director

CJO/CW/wo
73/householder

cc: DEP/SERO
Marcia Sherman, Office of Legal Counsel, DEP
Board of Health, Main Street, Falmouth, MA 02540
Ron Watson, Deputy Chief, Engineering and Services Division, (NGB/DE), National Guard Bureau, Pentagon Room ID 637, Washington, DC 20310-2500
Bob Mendoza, EPA-Groundwater Section, JFK Federal Building, Boston, MA 02203
Falmouth DPW, Town Hall, Falmouth, MA 02540
Attn: Dick Witt, Director
Lt. Col. Paul Brogna, Base Civil Engineer, Mass ANG 102nd F.I.W., Otis ANG Base, MA 02542-5001
Dick Foster, MEPA Office, EOEA, 100 Cambridge Street, Boston, MA 02202

Response to DEQE2-1:

Comment Noted.

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
J.F. KENNEDY FEDERAL BUILDING, BOSTON, MASSACHUSETTS 02203-2211

August 21, 1989

Mr. Gary D. Vest
Deputy Assistant Secretary of the Air Force
(Environmental, Safety and Occupational Health)
Department of the Air Force
Washington, D.C. 20330

RE: D-UAF-B24004-MA

Dear Mr. Vest:

In accordance with Section 309 of the Clean Air Act, Section 1424(e) of the Safe Drinking Water Act, and the National Environmental Policy Act (NEPA), we have reviewed the Draft Environmental Impact Statement (EIS) for the Otis Air National Guard Base, Waste Water Treatment Facility, located on the Massachusetts Military Reservation (MMR) in the Towns of Bourne and Sandwich, Barnstable County, Massachusetts.

The Draft EIS evaluates five alternatives for disposal of waste water from the Massachusetts Military Reservation: Alternative 1, pump untreated effluent to the Town of Falmouth Waste Water Treatment Plant (WWTP) for treatment and disposal in existing and new infiltration basins; Alternative 1a, pump treated effluent to the Town of Falmouth WWTP for disposal in existing and new infiltration basins; Alternative 2, use the existing Otis ANG WWTP and dispose of the treated effluent using spray-irrigation; Alternative 3, upgrade the existing Otis ANG WWTP to provide tertiary treatment for nitrogen removal (Bardenpho tertiary treatment process) and to dispose of the final effluent in existing infiltration basins; Alternative 4, pump treated effluent to the Cape Cod Canal area, at the northern end of the MMR, for disposal in new effluent infiltration basins; Alternative 4a, pump treated effluent to the Cape Cod area for direct disposal in the canal; and Alternative 5, the no action alternative, continue to operate the current facility Otis WWTP using its present treatment capabilities.

Since March 9, 1987 when EPA commented on the Air Force's Notice of intent to prepare an Environmental Impact Statement, and at all subsequent Otis Waste Water Treatment Plant (WWTP) EIS meetings since, EPA has stressed the importance of understanding the value of the underlying Cape Cod aquifer which was designated by EPA on July 6, 1982 as a "Sole Source Aquifer". We also indicated that the EIS would be subject to a sole source aquifer review pursuant to Section 1424(e) of the Safe Drinking Water Act. As we have discussed with members of the Air National Guard (ANG), and your EIS consultants (Argonne National Laboratories), the Cape Cod aquifer is the principal source of drinking water for Cape Cod, the contamination of which would be a significant hazard to public health. Therefore, protection of the Cape Cod aquifer must be given the highest priority, and degradation of the aquifer must be prohibited. With this goal in mind, EPA supported the Air National Guard's efforts to evaluate waste water treatment schemes that would reduce groundwater contamination caused by current land disposal of waste water at the southern boundary of Otis ANG Base (EPA's letter of March 9, 1987).

Our comments are presented below for your use in preparing the Final EIS.

EPA-1 From a groundwater and surface water perspective, and based on the information provided in the Draft EIS, we believe that Alternative 4 (pump treated effluent to the Cape Cod Canal area at the northern end of the MMR, for disposal in new effluent infiltration basins) is the most promising action. A waste water discharge to new influent infiltration basins in an area adjacent to the Cape Cod Canal would remediate the groundwater contamination problem existing at the Otis WWTP, and therefore is environmentally preferable to the continual discharge of effluent at the present location. Our conclusion is based on the following:

(A.) This alternative would lead to restoration of Falmouth's lost groundwater resources. Cessation of waste water infiltration at the present facility will allow natural dilution, attenuation and dispersal processes to occur south of the town line, which passes just 50 feet from the active infiltration beds. Although it will require decades for all remnants of the plume to migrate to Nantucket Sound, immediate cessation of infiltration will initiate cleansing of the aquifer at Otis WWTP.

(B.) The alternative would mitigate nutrient loading in Ashumet Pond and resultant algae blooms and fish kills.

(C.) It would mitigate long-term degradation of water quality at Falmouth's Great Pond and Green Pond due to plume discharge.

(D.) It would reduce risk to the aquifer due to WWTP malfunction or breakdown.

(E.) Finally, the hydrogeological conditions at the Cape Cod Canal site are suitable for waste water infiltration at the projected volume.

<u>Response to EPA-1:</u>

Comment noted.

EPA-2 We believe the Draft EIS fell short in its alternatives analysis by not vigorously exploring the environmental benefits that could be derived from implementing advanced waste water treatment to all alternatives. EPA stressed at the scoping meetings with Argonne National Laboratories and the ANG the need to evaluate advanced waste water treatment so that the effluent can meet all existing State and Federal Drinking Water Standards and all future drinking water standards.

Also, from a technical viewpoint, the Draft EIS overemphasizes the significance of nitrate-nitrogen as a primary factor in alternative selection to the detriment of other compounds (such as volatile organic compounds, phosphorus, sodium, detergents and heavy metals) that can degrade aquifer quality and affect public health. The focus of all of the alternatives evaluated in the Draft EIS appears to be the reduction of the current total nitrogen concentration of the effluent, which averages 14.5 mg/L, down to below 10 mg/L to meet
EPA-3 the 1984 discharge permit effluent limitations. In addition, the alternatives are incorrectly evaluated solely on the basis of their ability to achieve the interim and final effluent restriction criteria set forth in a 1984 Massachusetts Department of Environmental Quality Engineering [now the Massachusetts Department of Environmental Protection (DEP)] discharge permit to the Massachusetts ANG. When the permit for this facility is re-issued in the near future (the EIS should state date of permit expiration) there will be other parameters that may need to be considered other than total nitrogen. We request that the listing of discharge limitations in the 1984 discharge permit be brought up to date to ensure compliance with current federal and state water quality guidelines. For example, discharge limitations in effluent for volatile organic compounds should be included. In addition, we believe the EIS should explore the ability of the treatment alternatives to achieve future discharge limitations.

According to the Draft EIS significant levels of volatile organic compounds have been detected in the plume of altered groundwater (approximately 3,000 feet wide, 75 feet thick, and 11,000 feet long) that originates from the Otis ANG Base Waste
EPA-4 Water Treatment Facility. Table 1.1 reports maximum values ranging from 431 mg/L to 682 mg/L of volatile organic compounds. We recommend that a more comprehensive rundown of specific volatile organic compounds which have been detected in the plume be provided in the EIS. Current disposal practices at Otis according to the EIS (page 3-15) do not result in the presence of volatile organic compounds in the effluent now being generated. However, there does not appear to be any monitoring data in the Draft EIS to confirm this fact. We request that this section be expanded to justify this statement.

Response to EPA-2:

The alternatives discussed in the DEIS, were based on engineering feasibility, land ownership, and availability of suitable discharge locations. In part, because of comments received during the public hearings and public comment period, the ANG added Alternative 4b for consideration in the FEIS. Alternative 4b results in the disposal of Class I waters (produced as a result of tertiary treatment) into new sand infiltration basins near the Cape Cod Canal.

Response to EPA-3:

As stated in this FEIS, the current facility meets all Class I discharge requirements except for nitrogen. See the discussion in Sec. 1.2.2, Current Status.

Response to EPA-4:

Current monitoring requirements are done in compliance with EPA requirements. See the response to Comment CCPEDC-2.

EPA-5 The proposed Alternative 4 effluent discharge location would be entirely on federal or state controlled land, hence the EIS concludes that no private or public use of groundwater would be affected by disposal of treated effluent at Alternative 4's Cape Cod Canal sand beds. The EIS further justifies this non-impact conclusion by stating that, "There are no groundwater users located within the projected plume of altered groundwater ...," (Page S-12). We do not support such a conclusion. While there may be no existing or future users of the groundwater within the Federal/State property boundaries, the discharge of any effluent other than drinking water has the potential to degrade the underlying groundwater.

EPA-6 Discharge to new influent infiltration basins adjacent to the Cape Cod Canal will require the designation of a "Class III" area by the Massachusetts Department of Environmental Protection, a fact that is not emphasized in the Draft EIS. The Final EIS should discuss the State designation of a new Class III land-disposal area, the contaminants and limitations (current and future) of the DEP's Class III land-disposal permit, the monitoring and reporting of effluent/groundwater migrating out of the Class III area, and mechanisms to trigger additional treatment or treatment process to meet permit limits should concentrations higher than permit allowances be detected.

EPA-7 Relative to hazardous wastes and materials, Section 3.9 on page 3-23 and Section 4.1.5 on page 4-9 describe the procedures used at Otis. In light of the OTIS ANG Base having recently been proposed for inclusion on the Superfund National Priorities List (NPL), July 1989, we recommend that these two sections be expanded to briefly discuss the current and proposed clean-up activities which will address previous activities conducted at Otis. Furthermore, the possibility of remedial/ clean-up action being initiated on the Otis waste water plume under existing Department of Defense programs, the federal Superfund program, or state hazardous waste programs should be briefly discussed in the EIS.

In conclusion, based on the above comments, we have rated this Draft EIS EC-2 (Environmental Concerns -- Insufficient Information) in accordance with our national EIS rating criteria, a copy of which is enclosed.

Response to EPA-5:

Comment noted. The preferred alternative, Alternative 4b, results in the disposal of Class I waters (produced as a result of tertiary treatment) into new sand infiltration basins near the Cape Cod Canal.

Response to EPA-6:

See the responses to EPA-5 and TBPH-12.

Response to EPA-7:

IRP reports have been provided to the EPA and the public. The program is adequately discussed in these reports.

Thank you for the opportunity to review and comment on the Draft EIS. Please send five (5) copies of the Final EIS when it becomes available. If you have any questions relative to our comments, please contact Donald O. Cooke of this office at (617) 565-3414 or FTS 835-3414.

Sincerely,

Elizabeth Higgins Congram, Assistant Director
for Environmental Review
Office of Government Relations and
Environmental Review (RGR-2203)

Enclosure

cc: Leroy W. Householder, NGB Washington, D.C.
Ronald M. Watson, NGB Washington, D.C.
Lt. Col. Paul Brogna, Otis ANG
William Sullivan, Public Affairs Officer,
NGA HQ OLAA/PA, Otis ANG
Jane Alford, MA EOEA
Janet McCabe, Director, MEPA Unit, MA EOEA
Clint Watson, MA DEP, DWPA Boston
Dave Terry, MA DEP, DWS Boston

SUMMARY OF RATING DEFINITIONS AND FOLLOW-UP ACTION

Environmental Impact of the Action

LO--Lack of Objections
The EPA review has not identified any potential impacts requiring substantive changes to the proposal. The review may have disclosed opportunities for application of mitigation measures that could be accomplished with no more than minor changes to the proposal.

EC--Environmental Concerns
The EPA review has identified environmental impacts that should be avoided in order to fully protect the environment. Corrective measures may require changes to the preferred alternative or application of mitigation measures that can reduce the environmental impact. EPA would like to work with the lead agency to reduce these impacts.

EO--Environmental Objections
The EPA review has identified significant environmental impacts that must be avoided in order to provide adequate protection for the environment. Corrective measures may require substantial changes to the preferred alternative or consideration of some other project alternative (including the no action alternative or a new alternative). EPA intends to work with the lead agency to reduce these impacts.

EU--Environmentally Unsatisfactory
The EPA review has identified adverse environmental impacts that are of sufficient magnitude that they are unsatisfactory from the standpoint of public health or welfare or environmental quality. EPA intends to work with the lead agency to reduce these impacts. If the potential unsatisfactory impacts are not corrected at the final EIS stage, this proposal will be recommended for referral to the CEQ.

Adequacy of the Impact Statement

Category 1--Adequate
EPA believes that draft EIS adequately sets forth the environmental impact(s) of the preferred alternative and those of the alternatives reasonably available to the project or action. No further analysis or data collection is necessary, but the reviewer may suggest the addition of clarifying language or information.

Category 2--Insufficient Information
The draft EIS does not contain sufficient information for EPA to fully assess environmental impacts that should be avoided in order to fully protect the environment, or the EPA reviewer has identified new reasonably available alternatives that are within the spectrum of alternatives analyzed in the draft EIS, which could reduce the environmental impacts of the action. The identified additional information, data, analyses, or discussion should be included in the final EIS.

Category 3--Inadequate
EPA does not believe that the draft EIS adequately assesses potentially significant environmental impacts of the action, or the EPA reviewer has identified new, reasonably available alternatives that are outside of the spectrum of alternatives analysed in the draft EIS, which should be analyzed in order to reduce the potentially significant environmental impacts. EPA believes that the identified additional information, data, analyses, or discussions are of such a magnitude that they should have full public review at a draft stage. EPA does not believe that the draft EIS is adequate for the purposes of the NEPA and/or Section 309 review, and thus should be formally revised and made available for public comment in a supplemental or revised draft EIS. On the basis of the potential significant impacts involved, this proposal could be a candidate for referral to the CEQ.

TOWN OF MARION
2 SPRING STREET
MARION, MASSACHUSETTS 02738

August 23, 1989

Mr. Leroy Householder
ANGB
c/o DEV-BLDG, 3500, STOP 18
Andrews Air Force Base
Maryland 20331-6008

Dear Mr. Householder:

MBH-1 We are writing in response to the Draft Environmental Impact Statement for the Otis Air National Guard Wastewater Treatment Facility. We wish to go on record as being opposed to any permit that does not meet Class I discharge criteria, either for groundwater or surface water.

MBH-2 Further, as the Buzzard's Bay Project begins to develop a greater understanding of the impact of nutrients on our ecosystems and their capacity to travel significant distances in groundwater, we would urge that the design of any system for wastewater treatment at the Base exceed by orders of magnitude the Class I permit nitrogen levels.

It is essential that any facility built at Otis Air Force Base be designed to meet the needs and problems of the future - not regulations of the present. To do otherwise would be a failure to fulfill our public trust.

Sincerely yours,

Marion Board of Health

Edwin H. B. Pratt, Jr.
Chairman

EHBP/hac

Copy to: Board of Selectmen, Falmouth
Board of Selectmen, Bourne

Response to MBH-1:

Comment noted. Alternative 4b results in the disposal of Class I waters (produced as a result of tertiary treatment) into new sand infiltration beds near the Cape Cod Canal. See the discussion of Alternative 4b in Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b.

Response to MBH-2:

Comment noted. See the discussion of Alternative 4b in Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b.

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
CAPE COD CANAL FIELD OFFICE
P O BOX J, BUZZARDS BAY, MASS 02532

REPLY TO ATTENTION OF

8 August 1989

CENED-OD-C (200-1a)

Mr. Leroy Householder
ANGSC/DEV
Bldg. 3500, Stop 18
Andrews AFB, MD 20331-6008

Dear Mr. Householder:

This is a response to the May 1989 Draft Environmental Impact Statement for the Otis Air National Guard Base Wastewater Treatment Facility from the U. S. Army Corps of Engineers' Cape Cod Canal Field Office. Comments are limited to alternative 4, which involves pumping treated effluent to the Cape Cod Canal area for disposal on effluent infiltration basis, and alternative 4a, which involves pumping treated effluent to the Cape Cod Canal area for discharge in the Canal.

NEDCE-1 I believe your Agency should adopt a similiar policy to that made by the Town of Bourne in 1979 and Sandwich in 1981 concerning effluent disposal into Canal waters. In both cases use of the Canal for depositions of wastewater was rejected and other solutions were adopted. Much of the privately owned land along the north side of the Cape Cod Canal has now been subdivided, with several clustered developments proposed which would require wastewater treatment facilities relatively near the Cape Cod Canal. We believe that the Otis ANG Wastewater Treatment Facility decision making process represents an opportunity for the Federal Government to set a standard for private land owners to follow in the methods and technology utilized to solve wastewater disposal issues on the Upper Cape.

NEDCE-2 Lastly, adoption of either alternative 4 or 4a could endanger the water supply for a public recreation area operated by the Corps of Engineers on Route 6A identified as the Midway Area. Annual visitation to this area is now 133,700 visitor days per year.

For all of the above mentioned reasons, our position is that only Class I water should be allowed to be discharged.

Sincerely,

F. N. CICCONE
Engineer In Charge

Response to NEDCE-1:

Comment noted. The preferred alternative, Alternative 4b, will result in the disposal of effluent into new sand infiltration basins near the Cape Cod Canal. Prior to disposal into these infiltration basins, the wastewater will be upgraded to meet Class I standards. We (ANG) believe this is an environmentally sound solution which will be acceptable to all concerned.

Response to NEDCE-2:

The well that supplies water for the public recreation area on the south side of the canal is not located in the groundwater flow path between the proposed location of the sand infiltration basins and the canal, and is outside of the area affected by the additional wastewater. The well's capture zone is small due to its low pump rate and high formation permeability.

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TOWN OF BOURNE

BOARD OF HEALTH

BOURNE, MASS.

This letter is submitted by the Bourne Board of Health as a comment to the Draft Environmental Impact Statement for the Otis Air National Guard Base Wastewater Treatment Facility.

The Board has strong feelings against allowing a Class III discharge to the underlying waters of Bourne and is adamantly against any direct discharges to the Cape Cod Canal. The townspeople of Bourne have voted at Town Meeting against any Class III discharges to the waters of Bourne, and this Board supports that sentiment.

Since the inception of the groundwater discharge permitting process, the Board of Health has required tertiary treatment plans for discharges of over 15,000 gallons per day and recently passed a regulation whereby the Board can require such a plant for projects with discharges of over 10,000 gallons per day. Why should this projected maximum discharge of 500,000 gallons per day from the Mass Military Reservation receive any less treatment?

The Board of Health is concerned with degrading waters which might one day be used as a public or private well source. Correspondence from Weston Geophysical indicates that there are existing private wells in the vicinity. The Town of Bourne does not want to take away a possible source of drinking water and so does not feel that a Class III discharge is appropriate. In addition the Board of Health is concerned that the nitrate loading to the canal might have adverse effects on the canal itself or any adjacent waters. The study of nitrates in regard to marine effects is virtually a new science. Studies done by Frimpter have indicated that concentrations as low as .32 ppm can have a detrimental effect on marine ecosystems. Dilution is an argument inevitably used by developers, but no one seems to look at what the cumulative effect of not only this discharge, but others, in Bourne and along the canal, might be. Projects of a much lesser intensity such as Bournedale Village Farms with roughly 70,000 gpd, or the Brookside project with 60,000 gpd are both being required by the town and state to provide tertiary treatment for Class I discharge. Certainly a discharge of roughly 500,000 gpd can be seen to pose an even greater threat to our overlying and underlying waters in Bourne if it is not treated to obtain a Class I status of discharge.

The Town of Bourne has spent significant time and money to correct existing pollution problems. The town spent $40,000 on a study to confirm the effect of stormwater run-off on our shellfish beds and to offer engineering ideas for remediation. Hopefully work will continue in the areas of Hen's Cove and Barlows Landing in order to initiate these

Page 2.

remediation projects. The town has initiated wrack line clean-up projects and has enacted town by-laws to prohibit the feeding of waterfowl and the deposition of dog feces on beaches and public and private property. Last month a stormwater treatment facility was installed at Electric Avenue beach to remove approximately 20% of the contamination entering Buttermilk Bay. The Buzzards Bay Project and Buttermilk Bay project continue in their efforts to study pollution sources and offer methods of correction; and to assist towns in writing by-laws and regulations to prevent further degradation of the groundwater and coastal water resources. In the past, several direct discharges to the canal from illegal pipes have been corrected by actions from the Bourne Board of Health. In the near future, the Savery Avenue project in Sagamore will also be completed to eliminate another pollution source. The Board of Health feels it is their duty to see that no further contamination of the waters of Bourne take place and that is why we are so solidly against options 4 and 4a, as they are written, of the draft EIS.

TBBH-1 The Otis facility offers problems of not only household proportions but industrial as well. The Town of Bourne has concerns about discharges of other contaminants which might inadvertantly enter the plant. Some of these pollutants, like detergents or volatile organic compounds could seriously effect the waters and marine organisms of the canal and the surrounding waters. In addition, common viruses which exist in all effluent, if not properly treated, could cause untold damage to our fishing and shellfishing areas. The potential for viruses would be dramatically reduced with a tertiary treatment plant.

The Board of Health wishes to make it clear that it realizes the problems being faced by Otis in regard to its Wastewater Treatment Facility. However, it is important to note that documents on file indicate that the original discharge permit for this plant was Class I, and we feel this designation should be maintained regardless of where the effluent is eventually disposed of.

Cape Cod, an area of sole source aquifer designation, cannot afford to allow any contamination of its ground and surface waters. Discharge to these waters must be of a Class I status. Direct discharge to the canal appears to directly conflict with the intent of the
TBBH-2 Marine Sanctuaries Act. However, it would be accurate to state that we would entertain the idea of a Class I discharge, with tertiary treatment, to filtration beds along the canal. The Board of Health would like to see this option researched. In addition, many members feel that there are additional options for spray irrigation and land application at Otis so that not only will the effluent receive proper filtration, but it will recharge hundreds of thousands of gallons of drinking water back to the groundwater. The Board hopes that the Federal and State Government will look further into these options.

It is important to note that although we continually refer to the canal or the groundwater in the area of the filter beds along Sandwich Road as Bourne waters they are the Cape waters as well. History has shown how incidents in one town or area can adversely effect or indeed destroy drinking water sources for other towns as well, and so we must look at the whole situation. We must preserve not only drinking water sources, but the marine environment as well. The antiquated way of thinking that discharges to the canal would be diluted and solve every-

Response to TBBH-1:

The primary contaminant of concern involves nitrogen species in the form of ammonia, nitrates, nitrites, and organic nitrogen. The Otis WWTP meets all of the current discharge permit regulations and will meet all of the regulations after it has been upgraded, with the exception of nitrogen (See Sec. 1.2.2, Current Status). See also the response to Comments CCPEDC-2, CCSC-1, and CCSC-4. For further clarification concerning the applicable standards for Class I water discharge, see Comment DEQE2 (letter from Cornelius O'Leary of the Massachusetts DEP to Mr. Leroy Householder dated November 17, 1989).

Response to TBBH-2:

Alternative 4b results in the disposal of Class I waters (produced as a result of tertiary treatment) near the Cape Cod Canal. See the response to Comment AVPO-1 and Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b. Also see the response to Comment CCSC-6 regarding the Ocean Sanctuaries Act for Alternative 4a.

Page 3.

thing, as evidenced by old discharge pipes to seawalls and cross connections to storm drains, is just that - a thing of the past. Hopefully in this day of technological advancements and knowledge we will not

TBBH-3 revert to this type of thinking; certainly when there are more feasible options available. Yes, a tertiary plant and a Class I discharge is a more costly endeavor but isn't it worth it to retain the quality of our existing waters and to see that what happened to Falmouth and Sandwich does not happen again.

For the Board of Health,

Cynthia A. Coffin

Cynthia A. Coffin B.A., R.S.
Health Agent

CAC/jm

Haydon S. Coggeshall

Haydon S. Coggeshall, Chairman

Steven A. MacNally, Vice-Chairman

Thomas E. Fantozzi

Thomas E. Fantozzi, Secretary

Arthur M. Handy

Robert J. Kilduff

Robert J. Kilduff

Response to TBBH-3:

See the response to Comment TBBH-2 and Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b.

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MARIE J. OLIVA, CHAIRMAN
ROBERT W. PARADY
W. THOMAS BARLOW

TOWN OF BOURNE
Board of Selectmen
24 Perry Avenue
Buzzards Bay, Massachusetts 02532
Phone 508-759-4486 - Fax 508-759-8026

August 18, 1989

Mr. Leroy Householder.
ANGB
c/o DEV-BLDG. 3500, STOP 18
Andrews Air Force Base
Maryland 20331-6008

Dear Mr. Householder:

We are writing in response to the Draft Environmental Impact Statement for the Otis Air National Guard Wastewater Treatment Facility.

As we have communicated in the past, we remain firm in our opposition to Alternate 4 and Alternate 4A as cited in the draft report. At public hearings held on Wednesday, July 26 and Thursday, July 27, 1989, testimony in support of our position was offered by several local, state and regional officials. Further written testimony is supported by the Association for the Preservation of Cape Cod, the Cape Cod Planning & Economic Development Commission and Senator Edward P. Kirby.

We understand and appreciate the need for the Air National Guard to upgrade the existing Wastewater Treatment Plant. However, alternatives 4 and 4A are unacceptable. Our town, in conjunction with the Buzzards Bay Coalition, has been working closely as a team to protect and preserve our waterways. The Environmental Protection Agency has taken a leadership role in the funding of grants to study point and non-point sources of pollution in Buzzards Bay, specifically Buttermilk Bay in Bourne.

Our Pollution Task Force and Board of Health have spent countless hours working to help address our pollution problems. The Barnstable County Marine Water Quality Task Force, a regional body made up of representatives of the fifteen towns on the Cape, has been developing and coordinating the efforts of all Cape towns for consistent best management practices. Despite significant strides

Mr. Leroy Householder
August 18, 1989
Page 2

already taken by our town towards abating our pollution problems, many challenges still remain.

TBBS-1 The further degradation of the Cape Cod Canal would be taking a giant step backwards. We should take progressive action instead of reverting to methods outlined in Alternative 4 and 4A.

We trust our concern will be given the utmost consideration.

Very truly yours,

BOARD OF SELECTMEN

Marie J. Oliva

Robert W. Parady

W. Thomas Barlow

MJO/njs
cc: Sec. Devillars, D.E.M.
John Clarke, C.Z.M.
Armando Carbonell, CCPEDC
Rep. Thomas S. Cahir
Sen. Edward P. Kirby
Ted Pratt, Chm., Buzzards Bay Advisory Committee
Com. Daniel S. Greenbaum, D.E.P.
Bourne Planning Board
Bourne Engineering Department
Bourne Board of Health
Bourne Conservation Commission
South Sagamore Water District
Buzzards Bay Coalition
Pollution Task Force

Response to TBBS-1:

Alternative 4b results in the disposal of Class I waters (produced as a result of tertiary treatment) into sand infiltration beds near the Cape Cod Canal. Refer to the discussion of Alternative 4b in Sec. 4.4.7, Groundwater-Flow and Contaminant-Transport Modeling.

Town of Bourne
CONSERVATION COMMISSION
24 Perry Avenue
BUZZARDS BAY, MASS. 02532

Mr. Douglas C. Karson
102 FIW/PA
Otis Air National Guard Base
MA 02542-5001

August 18, 1989

RE: DEIS/Wastewater Treatment Facility/Otis Air National Guard/ May 1989

Dear Mr. Karson:

The Bourne Conservation Commission wishes to be recorded as opposed to the proposed alternatives 4 and 4a, as described within the DEIS for the Otis Air National Guard Base, Wastewater Treatment Facility, dated May 1989.

The Commission opposes BOTH alternatives for the following specific reasons:

TBCC-1 1) Effluent, whether discharged into the groundwater (via sand infiltration) or discharged directly (via culvert) into the Cape Cod Canal, will cause pollution problems resulting in the degradation of the presently rated Class A waters. These alternatives seem contrary to the Policies & Goals of the Final 208 Water Quality Management Plan/EIS for Cape Cod, Vol. 1, Sept. 1978, the State Ocean Sanctuary Act, the State Water Pollution Control Act, the State Wetlands Protection Act, the Federal designation of Buzzards Bay as an Estuary of National Significance, the recent designation of Back River Estuary as a State Area of Critical Environmental Concern (ACEC), and the State and Federally financed efforts (the Buzzards Bay Project) to clean up the waters of Buzzards Bay Estuary.

TBCC-2 2) This additional polluted effluent will be introduced into the Cape Cod Canal which is presently receiving polluted inputs from: natural run off, polluted groundwater, the Sandwich Canal Electric Generating Plant, boat traffic, legal & illegal sewage disposal, road run off including the pollutants from the Route 495 (Route 25) closed drainage system, and will likely out of necessity receive run off from the proposed Southside Connector (Route 495).

Response to TBCC-1:

Alternative 4b results in the disposal of Class I waters near the Cape Cod Canal. See Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b.

Alternative 4a was included in the options being considered for this FEIS under the explicit request of the EPA, Region I (see Appendix A, pages A-79 to A-83). See the response to Comment CCSC-6.

The ANG shares the concerns expressed. We believe that the preferred alternative (Alternative 4b) is the most environmentally sound alternative and takes into consideration the efforts and concerns of Buzzards Bay, and concerns about the Cape Cod Canal. We believe that this alternative will complement these programs rather than reverse them.

Response to TBCC-2:

It is true that the Cape Cod Canal receives both degraded surface 'd groundwater from a number of human activities. Samples of canal water collecteu oy Weston Geophysical, Corp. (1989) for use in this environmental assessment show high-quality water, except for elevated coliform counts. Given the large volume of groundwater entering the canal in the vicinity of the Alternative 4 disposal area, modeling analyses show that all regulated chemicals in groundwater near the canal under Alternative 4a, will be below current standards and criteria. Concern for degraded groundwater resulted in the addition of Alternative 4b, which results in the discharge of Class I water into the proposed infiltration basins near the Cape Cod Canal (see Sec. 4.4.7).

TBCC-3 3) These alternatives expressly disregard the will of the local people and its governing officials. On a number of occasions, through Town Meeting votes, the people of Bourne have said NO to any introduction of effluent into the Cape Cod Canal. During the past five years this community has embarked upon an aggressive campaign to identify and abate water pollution problems. This has been and is a very costly program which involves land acquisition of very sensitive areas, special zoning changes, changes in Board of Health Regulations (increasing set back distances to 150' from wetlands for leaching facilities), implementation of strict conservation standards for building within coastal areas (50' setback from wetland edges for all new habitable dwellings), strengthening the local Wetlands Protection Bylaw, appropriating money for pollution studies and money for abatement purposes.

In conclusion, for the reasons stated above the Bourne Conservation Commission urges you to give consideration to other alternatives mentioned within the DEIS and emphatically opposes alternatives 4 & 4a.

Sincerely yours,

Robert M. Gray

Robert M. Gray, R.S.
Vice Chairman
Wetland Biologist
Registered Sanitarian #669

Response to TBCC-3:

In response to comments received by the ANG on the DEIS, Alternative 4b was added to the FEIS. This alternative examines the disposal of Class I water into infiltration basins near the Cape Cod Canal (see Section 4.4.7). See also the response to Comment TBCC-1.

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ENGINEERING DEPARTMENT
TOWN OF BOURNE
24 PERRY AVENUE
MASSACHUSETTS
TEL.: (617) 759-4612

August 15, 1989

Douglas C. Karson
102 FIW/PA
Otis Air National Guard Base
Mass. 02542-5001

Dear Douglas C. Karson:

The enclosed correspondence is in response to the submitted Draft Environmental Impact Statement for the Otis Air National Guard Base, Wastewater Treatment Facility (May 1989) presented to the Town of Bourne for review and discussion. Our department, Engineering, will discuss the two alternatives proposed to the Town of Bourne. They are as follows:

"4. Pump treated effluent to the Cape Cod Canal Area, at the northern end of MMR, for disposal in new effluent infiltration basins.

4a. Pump treated effluent to the Cape Cod Canal Area for direct disposal in the Canal. (D.E.I.S. for the Otis Air National Guard Base, Wastewater Treatment Facility (May 1989) p. S-2)"

The following contains a discussion of regulations, standards, and projects currently being conducted or completed by the Town of Bourne to protect and prevent pollution of surface and groundwaters.

Bourne has and is in the process of participating in many projects to prevent and reduce pollutants in waters - including the Cape Cod Canal. It is of our opinion that to allow a direct or diffused flow of effluent into the canal would be a contradiction of the philosophy established by the town. Furthermore, a Class III effluent is a totally unacceptable solution. We agree with a letter submitted to Ronald M. Watson, Deputy Chief Engineering and services Division - Departments of the Army and the Air Force National Guard Bureau - Washington, D.C. dated December 22, 1986 from Thomas C. McMahon Director - Commonwealth of Massachusetts - Executive Office of Environmental Affairs - Department of Environmental Quality and Engineering -

Division of Water Pollution Control when he states:

> "the discharge limitations set forth in Section A-2 of the discharge permit for the Wastewater Treatment Plant do not contemplate Class III designation of the groundwater. The limitations as stated in the permit are in accordance with Class I groundwater standards, and in the event that a petition for a Class III designation is denied, the permittee will be required to comply with Class I standards contained in the permit. (D.E.I.S. for the Otis Air National Guard Base, Wastewater Treatment Facility (May 1989) p. A-75)"

Our goal, as it is of the Otis Air National Guard Base, is to prevent and/or reduce the number (amount) of pollutants entering our waters. The following paragraphs illustrate a strong desire by the town to protect and solve pollution problems.

First of all, the Town of Bourne is actively participating in the Commonwealth of Massachusetts assignment of lands as Areas of Critical Environmental Concern (A.C.E.C.). Bourne has already received A.C.E.C. approval for the Pocasset River and the Back River areas. These designations not only include the actual river - but attached and isolated wetland areas with relationships to these main river systems as well. In dealing with the Herring River, as a sensitive natural resource, the Town of Bourne has already purchased several pieces of property along the river. Previous to the October 19, 1987 Town Meeting the towns' holdings totalled 30.85 Acres - including the Carter Beal Estate. As of October 19, 1987 Special Town Meeting Article 1 the Town of Bourne purchased two abutting parcels. The first being formerly owned by Donald P. Quinn, Trustee, Monument River Realty Trust and contains 40 Acres. Secondly, a purchase of two parcels on either side of the Herring River from Donald W. Anderson et ux containing a total of 7.7 Acres. Currently a joint project is being proposed by the Town of Bourne and approaching for cooperation with the Town of Plymouth for an A.C.E.C. designation for the Herring River. Even if an agreement can not be reached - the Town of Bourne will still proceed to achieve an A.C.E.C. designation for the Herring River within her boundaries. At the present time there is an interest building up in the community to have Buzzards Bay assigned as an A.C.E.C. area. Buzzards Bay has already been assigned under state law the Ocean Sanctuary classificaiton and has also been awarded the Environmental Protection Agencys' (E.P.A.) designation of an Estuary of National Significance.

The second category involves Town Zoning. Bourne has incorporated within its Zoning Bylaw and Map as of October 30, 1980 areas known as 'Water Resource Protection Districts'. These districts were created for the sole purpose of protecting the zones of influence of the groundwater supplies to existing public wells. Specific guidelines for these districts is

> "4711. Prohibited Uses: Within Water Resource Districts the following principal uses are prohibited: sanitary landfills, junkyards, municipal sewage treatment facilities with on-site disposal of secondary treated effluent, carwashes, road salt stockpiles, and any other use which involves as a principal activity the manufacture, use, storage, transportation or disposal of toxic or hazardous materials except sale, storage, transportation of fuel oil or gasaline as allowed by Special Permit below. The following is prohibited within Water Resource Districts whether as a principal use, ancillary use, or accessory use: outdoor storage of more than 100 tons of coal.
> (Town of Bourne Zoning Bylaws p. 37)"

Even though the proposed pipeline system does not fall within these delineated districts as they currently are defined, the proposed alternatives do fall within a reasonable distance to the South Sagamore Water District (protection district as well as the actual public wells) wells sited along the Cape Cod Canal.

Further regulations are incorporated into the Town of Bourne Bylaw. Stringent regulations are outlined in our own Wetland Bylaws contained in Section 3.7 dealing with Wetland and Natural Resources Protection (pp. 33-36):

> "All wetland resource areas shall be subject to this by-law. No person shall remove, fill, dredge, or alter the following wetland resource areas except as permitted by this bylaw: any freshwater or coastal wetland resource area or within 100 feet of such resource area. This bylaw regulates activity within the A flood zone (as shown on F.I.R.M. Maps) only if the activity is within 100 feet of another Wetland Resource area.
> (Town of Bourne Bylaws p. 34)"

In addition to the above regulation, Article 4.7 (p. 45) and Section 4.7.1. states: "No construction within 50 feet of any Wetland Resource Area (wetland resource area being defined as inland and coastal wetland areas, water, and adjoining land areas). (Town of Bourne Bylaws p. 45)".
In dealing with the statement on page S-5 of the Draft Environmental Impact Statement for the Otis Air National Guard Base, Wastewater Treatment Facility (May 1989) the

following statement is made:

TBED-1 "None of the Facilities or pipelines would occupy 100-yr or 500-yr floodplains."

When one examines the Flood Insurance Rate Maps (F.I.R.M.) - one finds the one hundred year flood hazard zone A6 (elevation requirement 12') designation extending 60 to 80 feet on either side of the Cape Cod Canal as well as being the designation for this section of the Canal. (*especially important when examining Alternative #4a which is piped directly into the Cape Cod Canal) Flood hazard zone A6 (el. 12') is located on Community Panel Number 255210-0003 D June 5, 1985 for the Town of Bourne.

The above wetland regulations are used in combination with the Town of Bourne Board of Health Bylaw as of June 22, 1988 (effective date). This particular amendment deals with the following:

> "Pursuant to Chapter 111, § 31, Mass. General Laws, the Bourne Board of Health voted at its regular meeting held on June 1, 1988, to amend the 100 foot setback requirement for all loading facilities from a water course, approved October 15, 1984, to be as follows:
>
> Section 1: Having determined that containment transport rates in glacial outwash soils may be up to 2.5 feet per day (LeBlanc-U.S.G.S), a 150 foot setback will be required for all leaching facilities from the edge of a wetland resource or watercourse, as defined in 310 CMR 15.01 Title V.
>
> (Town of Bourne Board of Health Regulations, Amendment. effective date: June 22, 1988)"

As illustrated by all of the preceding regulations adopted by the Town of Bourne and Town Agencies - wetlands/surface waters and groundwater supplies are of high importance. In addition to the Bylaws adopted by the town several study projects and solution projects are currently being conducted. The major example involves the joint cooperative effort between the Town of Bourne and the Town of Wareham - Sewage Treatment Plant Expansion Project. Already past the research level - a plan has been accepted for the hooking up of Taylors Point; Buzzards Bay (Main Street Area); and Hideaway Village Condominiums (located off of Buttermilk Bay). Final stages of negotiations are nearly completed and Bourne is awaiting the final approval prior to actual construction. Total costs projected for the Town of Bourne is Ten Million Dollars and the projected cost for Wareham is Twenty Two Million Dollars for upgrading their wastewater system. This combined effort all began with the movement to preserve and clean up Buzzards Bay. These areas are within the 100 year flood hazard zones A and V on the F.I.R.M. Maps for the Town of Bourne and have also been indicated as having sewage infiltration into the Bay and the Cape Cod Canal. This project will prevent future infiltration and the sewage will be pumped to the currently existing Wareham

Response to TBED-1:

The Town of Bourne Engineering Department is correct in that the pipeline outfall at the Cape Cod Canal proposed for Alternative 4a is within the 100-yr floodplain. Alternative 4a was explicitly requested by the EPA, Region 1 (see Appendix A, pages A-79 to A-83). All other alternatives do not occur within 150 ft of any wetland resource or watercourse.

Wastewater Treatment Plant.

Next, Gale Associates, Inc. was contracted by the Town of Bourne to conduct a stormwater drainage pollution study for Hen Cove, Barlows Landing and the Pocasset River Watersheds. Included within this report was actual water quality test results mapped out on the Town Topography Maps (aerial photos flown 1972). These maps and test results were examined and the areas of highest concern were identified. Areas were prioritized and solutions were delineated. The final Stormwater Management Plan from Gale Associates, Inc. was presented to the Town of Bourne during the month of June 1989. As well as the forementioned study, the Town of Bourne is involved in the Buttermilk Bay Study Project being conducted by Horsley Witten Hegemann, Inc. Included in this study are the Towns of Wareham and Plymouth. The Buttermilk Bay Projects' main focus is to discover the location of point sources, to analyze data collected and to make conclusions while utilizing a rating system in order to make recommendations concerning Total Nitrogen Loading into Buttermilk Bay (May 1989).

One other project, that includes innovative engineering in handling stormwater drainage, is located at the Town Beach off of Electric Avenue in Buzzards Bay. As part of a project to repair and replace an existing boat ramp and dock - a new stormwater drainage system was developed and completed for the ramp and parking lot facilities (Construction completed 1989). Another cooperative project being conducted by Bourne, the Savary Avenue project located in North Sagamore, involves the cooperation from the United States Department of the Army - New England Division - Corps of Engineers. This plan involves the removal of an existing community effluent discharge pipe that was draining directly into the Cape Cod Canal and replacing it with a large community septic system. Furthermore, starting in 1982, the Town of Bourne Board of Health discovered a community located off of Sandwich Road in South Sagamore that was interconnected and discharging effluent through outfall pipes directly into the Cape Cod Canal. Each individual property owner was ordered to disconnect totally from these outfall pipes and made to upgrade each septic system to meet Massachusetts Title V. Code. These homes are no longer discharging effluent into the Cape Cod Canal by way of these outfall pipes.

Moreover, the Town of Bourne is always actively participating in the purchase of Open Space and/or Conservation Lands in order to protect natural resources. The following comprises some of the recent acquisitions in protecting the town waters. First to be examined is the acquisition of the 'Green Property'. These four parcels comprised an area of 158 Acres abutting the Pocasset River. This area was purchased by the Town of Bourne for Conservation purposes (control of property was transferred to the Conservation Commission) from A.G. Realty Corp. at the Annual Town Meeting dated May 9, 1983 Article 52. When this piece is combined with other town owned properties in the same area the total area is 173.05 Acres surrounding the Pocasset River. This area does fall within the State designation of an Area of Critical Environmental Concern (A.C.E.C.) for the Pocasset River.

Next, several parcels were acquired at the Special Town Meeting dated October 19, 1987 Article 1. Starting with an 18 Acre parcel in Cataumet purchased from Edward L. Britt, Trustee, Harbor View Village Trust. Secondly, land formerly owned by the Diocesan Land Trust comprising of two parcels located on the easterly side of Shore Road containing 43.30 Acres. Thirdly, property abutting the Back River in Monument Beach previously owned by Robert N. Walsh was purchased and contains 20 Acres. And finally, a piece of land abutting the Cape Cod Canal formerly owned by Joseph Labretto, Jr. containing 14.33 Acres.

In conclusion the Town of Bourne is actively participating in several state programs; creating municipal regulations and enforcing them; financing scientific water quality projects and purchasing Conservation Lands and Open Space property. First of all, several important water resources have received Area of Critical Environmental Concern (A.C.E.C.) designations from the Commonwealth of Massachusetts. Specifically the surrounding and inclusive wetlands of the Pocasset and Back River systems. Proposals for the Herring River and Buzzards Bay are currently under consideration. Buzzards Bay has already received the state classification of an Ocean Sanctuary and the Federal Environmental Protection Agency (E.P.A.) designation of an Estuary of National Significance. Secondly, the Town of Bourne has consistently maintained a policy which will protect the future of her natural resources. Bourne has incorporated several important regulations. For example, the 'Water Resource Protection Districts' defined in the Town of Bourne Zoning Bylaw and Map; the 'Wetland and Natural Resources Protection' section embodied into the Town of Bourne Bylaw and the Board of Health Amendment in dealing with the 150 foot setback requirement for all leaching facilities from wetland resources. Thirdly, an active role in study projects and solution programs including the Sewage Treatment Project cooperatively being conducted by the Town of Bourne and the Town of Wareham for Buzzards Bay (Main Street Area); Taylors Point and Hideaway Village Condominiums (located off of Buttermilk Bay). Bourne is also involved in research projects such as the one conducted by Gale Associates, Inc. Gale Associate, Inc. was hired by the Town of Bourne to investigate point sources of pollution from storm drainage systems located in the Barlows Landing, Hen Cove and Pocasset River Watersheds. In addition, the Town of Bourne is included in a combined effort study with the towns of Wareham and Plymouth concerning the total nitrogen loading into Buttermilk Bay. The research study is being conducted by Horsley Witten Hegemann, Inc. Construction projects - such as the storm water drainage facility at the Town Beach (located off of Electric Avenue) in Buzzards Bay, the Savary Avenue community septic system (previously piped directly into the Cape Cod Canal) and the Board of Health enforcement to upgrade several septic systems (previously piped directly into the Cape Cod Canal) located off of Sandwich Road in South Sagamore - illustrates a strong interest by the town to not only invest in research programs, but to also invest time, monies and man power in correcting identified pollution sources. Finally, the citizens of Bourne have expressed a strong concern over the environment and the protection of surface and groundwater resources. This has been accomplished by the approvals of articles at Town Meetings appropriating funds for the purchase of Conservation Lands and Open Space. Included amongst these purchases are the following: the Quinn and Anderson lands surrounding the Herring River (47.7Ac.); 'Green Property' at the Pocasset River and other related acquisitions (173.05Ac.); Britt property in Cataumet (18Ac.); the Diocesan Land Trust estate containing 43.30 Acres; land formerly owned by Robert N. Walsh abutting the Back River (20Ac.); and finally, property abutting the Cape Cod Canal previously owned by Joseph Labretto, Jr. (14.33Ac.). Therefore, in reviewing Alternatives 4 and 4a of the Draft Environmental Impact Statement for the Otis Air National Guard Base, Wastewater Treatment Facility (May 1989) this department finds them totally unacceptable to the Town of Bourne as reasonable solutions to the pollution problem occuring at the base. As illustrated above the Town of Bourne has invested large quantities of time, money and man-power inorder to correct/prevent further pollution of its' water resources. Bourne has already corrected two known sites on the Cape Cod Canal that were dumping sewage into outfall pipes running directly into the Canal. Henceforth, adding a new direct or even infiltrated sewage effluent piping systems discharging into the Cape Cod Canal would result in a contradiction of a strong policy of prevention. This department expects other proposal(s) to be presented to the Town of Bourne as realistic solutions to the problems existing at the Otis Air National Guard Base Wastewater Treatment Facility. Thank you for your time and cooperation concerning this highly sensitive issue.

Sincerely,

Dorothy Blickens
Engineering Technician I.

Michael Leitzel
Department Head
Engineering Technician II.

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TOWN OF BOURNE
Town Planner
TOWN HALL
BUZZARDS BAY, MA 02532

August 15, 1989

Douglas C. Karson
102 FIW/PA
Otis ANG Base, Ma. 02542-5001

Dear Mr. Karson,

TBTP-1 The Cape Cod Canal is located within two sections of the Commonwealth of Massachusetts Ocean Sanctuaries Act: the Cape Cod Bay Sanctuary and the Cape and Islands Sanctuary. It is certainly not the intent of this Act to have a Class III discharge, whether directly, or through infiltration beds, into a Sanctuary area.

TBTP-2 The Commonwealth of Massachusetts Department of Environmental Protection requires treatment plants on many projects with an effluent discharge of 15,000 gallons per day. The Town of Bourne Board of Health Regulations are even stricter. The Town may require sewage treatment plants when effluent discharges are over 10,000 gallons per day. 10,000 gallons represents the daily effluent from approximately 30 three bedroom dwelling units. By contrast, the approximate effluent being treated at the Otis wastewater treatment plant, 300,000 gallons per day, is greater than that from more than 900 three bedroom homes.

The Aquifer underlying Cape Cod has been designated by the Federal Government as a Sole Source Aquifer. The Town of Bourne protects the aquifer by limiting allowed uses in overlay Water Resources Districts.

An example of this concern is the Brookside development. The Town has already required the Brookside development, a multi-use project, to install a tertiary treatment facility as a condition of its approval to insure the quality of Bourne's water supply.

Response to TBTP-1:

Comment noted. The Commonwealth of Massachusetts Ocean Sanctuary Act prohibits direct ocean discharge of treated effluent. Alternative 4a was explicitly requested by the EPA, Region I (see Appendix A, pages A-79 to A-83). In addition, see Sec. 1.4.2.3, Ocean Sanctuaries.

Response to TBTP-2:

The Massachusetts ANG will meet Massachusetts DEP regulations in regard to all permits for the disposal of treated wastewater.

The Town is working with another major developer on a condominium project. This developer will also be required to install a tertiary treatment system. The Federal Government must be required to do no less. Any effluent discharge from the Otis Wastewater Treatment Plant must be a Class I discharge.

TBTP-3

Sincerely,

Floyd Forman

Floyd Forman
Town Planner

Response to TBTP-3:

Comment noted. Alternative 4b results in the disposal of Class I waters (produced as a result of tertiary treatment) into sand infiltration basins near the Cap Cod Canal. See the responses to Comments AVPO-1 and TBPH-10, and Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b.

TOWN OF FALMOUTH

SELECTMEN
ASSESSORS
BOARD OF HEALTH

59 Town Hall Square, Falmouth, Massachusetts 02540 (508) 548-7611

July 26, 1989

Comments on DEIS, Otis ANG Base, WWTP

The Falmouth Board of Selectmen strongly supports the efforts of the National Guard Bureau to improve the quality of [illegible] discharge from the Otis Wastewater Treatment Plant. The plume from this plant was discovered in Falmouth in 1978-1979. As a result, Falmouth lost an operating well and four more well sites, a total of five million gallons per day. Our goal has always been to recover that water supply. By the year 2020, we know we will need that water supply.

Our comments on the proposed alternatives in the DEIS are ranked according to increasing benefit to the aquifer, to the water supply, and to other water bodies:

Comment 1: We are totally opposed to Alternative 5 (No Action) because is perpetuates the loss of 5 million gallons per day; and Alternative 4a (Direct discharge to the Cape Cod Canal) because of the Ocean Sanctuaries Act.

Comment 2: We are opposed to Alternatives 1 and 1a for the following reasons:

a. This is a Class III discharge (nitrogen above 10 ppm, the Drinking Water Standard). This discharge will also enrich West Falmouth Harbor and Buzzards Bay. The existing Class III area will have to be expanded.

b. This new discharge to sand filter beds will increase the risk of shifting the landfill plume southward, threatening Long Pond, the Town's major water supply.

c. The areas proposed for Otis sand filter beds are ALREADY allocated to Falmouth Phase II spray irrigation. Also there appears to be no compensation to Falmouth for use of this land.

d. The nearby Maple Swamp will be heavily enriched in violation of the Town's wetland regulations. A down-stream fresh water pond, Crocker Pond, will also likely be enriched.

e. Downstream private wells may also be affected.

f. Construction of the sand filter beds will occur across a wildlife corridor.

Comment 3: Alternative 3 (Tertiary treatment) removes nitrogen below 10 ppm but leaves phosphorus which will continue to enrich Ashumet Pond. This pond is already heavily stressed due to phosphorus from the existing sewage plume. If this alternative is used, the sand filter beds should be as far west, away from Ashumet Pond, as possible.

Comment 4: Alternative 2 (Spray irrigation) does the next best job of renovating the effluent be removing both nitrogen and phosphorus through land treatment. Dispersal of the effluent over a wide area also reduces any possible impact of other inorganic compounds. This alternative is acceptable to Falmouth only if it is declared a Class I discharge - i.e. meets Drinking Water Standards.

Comment 5: Alternative 4 (Sand filter beds near the Cape Cod Canal) is the most beneficial alternative because it totally removes the discharge from an area of present and future water supply and places it in an area of no groundwater withdrawal. We feel this discharge to sand filter beds should have a nitrogen level below 10 ppm (Class I discharge). Since the groundwater moves so fast in this area (325 ft./day), dilution of the remaining nitrogen is a major factor in eliminating any problems in the Cape Cod Canal.

Questions:

In order for the communities of Falmouth, Bourne and Otis to choose the final alternative, several key pieces of information are needed. We are putting these questions into the formal record now even though the information may ultimately come from a state regulatory agency rather than Argonne or the Guard Bureau.

TFBH-1 Question 1: For Alternative 4 — sand filter beds near the Canal — are there any other standards that Class I discharge must meet beyond the 10 ppm nitrogen? This question also applies to Alternatives 2 & 3 (spray irrigation and tertiary treatment).

TFBH-2 Question 2: For Alternative 2 — spray irrigation over grasses and legumes — at which point in the process will the nitrogen concentration be measured to assume compliance with DEQE Discharge Permit? For instance at the nozzlehead? or the groundwater under the site? for the Base boundary?

TFBH-3 Question 3: For discharge to sand filter beds (Alternatives 1, la, 3 and 4), at what point is the nitrogen concentration measured to assure compliance with the DEQE Discharge Permit?

SUMMARY:

1. We wholeheartedly support the National Guard Bureau's efforts to restore the aquifer;

2. We believe the discharge, wherever it is located, must be Class I and meet Drinking Water Standards; and

3. We feel Alternative 4 as a Class I discharge is the best location.

Virginia Valiela

Response to TFBH-1:

Appendix A, Part II, contains the Massachusetts regulations for land disposal of treated wastewater. Section 5.10 of the regulations lists the chemical standards for Class I discharge (see page A-32). See also Comment DEQE2 - 1. Effluent from the Otis ANG wastewater treatment plant meets all Class I discharge standards except for total nitrogen.

Response to TFBH-2:

The Massachusetts DEP sets the criteria for discharge measurements for both location and amount.

Response to TFBH-3:

See the response to Comment TFBH-2.

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APPENDIX I: PART II

QUESTION/RESPONSE FORMS

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COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME Ashumet Valley Property Owners

ADDRESS Box 122

Mashpee MA 02649

Check the category to which you belong:
Landowners ✓ Business Person ____ Other ____

Check the participant category to which you belong:
Public Official ____ Designated Representative Of Private Organization ✓ Private Citizen ____

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ____

Check here if you wish to submit a written statement. ✓

Check here if you wish to receive a copy of the EIS: ____ draft
✓ final

Area of question or comment (please check all that apply):

Air Quality	____	Public Services & Facilities	____
Water Quality	✓	Health Hazards	____
Biological Impacts	____	Visual Impacts	____
Geology/Soils	____	Cultural Resources	____
Land Use	____	Other (Specify) ____	____

Please turn in this sheet as requested by the hearing officer.

Written comments will be considered in preparation of the final EIS. You may use this sheet to submit written comments either in the space provided below, on the back, or in an attached statement. Written comments may also be submitted in a letter of other format; but regardless of format, comments must be submitted no later than August 21, 1989.

Please mail your comments to: Douglas C. Karson
102FIW/PA
Otis ANG Base, MA 02542-5001

COMMENTS: ____

Statement(s) attached ✓ Yes ___ No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

STATEMENT

Re: Public Hearing
Otis Wastewater Treatment Draft

Date: July 26, 1989

The residents of Ashumet Valley and the Ashumet Valley Property Owners, Inc., are very much concerned about the quality of the water in Ashumet Pond.

AVPO-1 Any additional amounts of phosphorus is highly detrimental to the pond. Therefore, we recommend that any choices that are given eliminate any extra phosphorus or nitrogen to the pond.

Our recommendation is first #4 and then #1; both of which ship the effluent away from the area that would effect the pond.

We firmly believe that under no circumstances should additional phosphorus and nitrogen add to the Ashumet Pond.

Ashumet Valley
Property Owners, Inc.

Albert L. Gramm
Secretary

Response to AVPO-1:

By including advanced tertiary treatment for Alternative 3, the resulting total phosphorus and total nitrogen concentrations leaving the WWTP would typically be about 1.6 and 2.3 milligrams per liter (mg/L), respectively (EPA 1987). Alternative 2 would result in the removal of nitrogen by the vegetation, and containment of most of the phosphorus in the upper soil layers.

By including another alternative, 4b, which involves tertiary treatment with disposal of Class I water near the Cape Cod Canal, the nitrogen concentration would be reduced considerably. In addition, Alternative 4b would eliminate disposal of the effluent in the current sand infiltration basins.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME Susan Weston

ADDRESS 710 Head of the Bay Rd
Buzzards Bay MA

BCC

Check the category to which you belong:
Landowner ____ Business Person ____ Other X

Check the participant category to which you belong:
Public Official X Designated Representative Of Private Organization ____ Private Citizen ____

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. X

Check here if you wish to submit a written statement. ____

Check here if you wish to receive a copy of the EIS: ____ draft ____ final

Area of question or comment (please check all that apply):

Air Quality		Public Services & Facilities	
Water Quality	X	Health Hazards	
Biological Impacts		Visual Impacts	
Geology/Soils		Cultural Resources	
Land Use		Other (Specify)	

Please turn in this sheet as requested by the hearing officer.

Written comments will be considered in preparation of the final EIS. You may use this sheet to submit written comments either in the space provided below, on the back, or in an attached statement. Written comments may also be submitted in a letter of other format; but regardless of format, comments must be submitted no later than August 21, 1989.

Please mail your comments to: Douglas C. Karson
102FIW/PA
Otis ANG Base, MA 02542-5001

COMMENTS:

Statement(s) attached ____ Yes X No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to BCC:

Comment noted. See the response to Comment TBPH-13.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME David Dow

ADDRESS 98 Portside Circle
East Falmouth, Ma. 02536

CCSCf

Check the category to which you belong:
Landowner ______ Business Person ______ Other X

Check the participant category to which you belong:
Public Official ______ Designated Representative Of Private Organization X Private Citizen ______

Check here if you wish to ask a question during the hearing. X

Check here if you wish to offer oral comments. ______

Check here if you wish to submit a written statement. ______

Check here if you wish to receive a copy of the FIS: X draft
X final

Area of question or comment (please check all that apply):

Air Quality	X	Public Services & Facilities	
Water Quality	X	Health Hazards	X
Biological Impacts	X	Visual Impacts	
Geology/Soiis		Cultural Resources	
Land Use	X	Other (Specify)	

Please turn in this sheet as requested by the hearing officer.

Written comments will be considered in preparation of the final EIS. You may use this sheet to submit written comments either in the space provided below, on the back, or in an attached statement. Written comments may also be submitted in a letter of other format; but regardless of format, comments must be submitted no later than August 11, 1989.

Please mail your comments to: NGB/DEV
Mail Stop 18
Andrews AFB, MD 20331-6008

COMMENTS: ______

Statement(s) attached ___Yes ___No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to CCSCf:

Comment noted.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME A. Winfield Schley

ADDRESS 228 Main St. - Cape Cod Times
Falmouth, Mass. 540

CCT

Check the category to which you belong:
Landowner ____ Business Person ____ Other news ~~reporter~~

Check the participant category to which you belong:
Public Official ____ Designated Representative Of Private Organization ✓ Private Citizen ____

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ____

Check here if you wish to submit a written statement. ____

Check here if you wish to receive a copy of the EIS: ____ draft ✓ final

Area of question or comment (please check all that apply):

Air Quality	____	Public Services & Facilities	____
Water Quality	____	Health Hazards	____
Biological Impacts	____	Visual Impacts	____
Geology/Soils	____	Cultural Resources	____
Land Use	____	Other (Specify)	____

Please turn in this sheet as requested by the hearing officer.

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Please mail your comments to: NGB/DEV
Mail Stop 18
Andrews AFB, MD 20331-6008

COMMENTS: ____

Statement(s) attached ___Yes ___No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to CCT:

Comment noted.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME David Janik, Technical Assistant, Buzzards Bay Project,

ADDRESS Massachusetts Coastal Zone Management,

Marion Town House, 2 Spring Street, Marion, MA 02738

CZMf

Check the category to which you belong:
Landowner ____ Business Person ____ Other ✓

Check the participant category to which you belong:
Public ~~Official~~ Organization ✓ Designated Representative Of Private Organization ____ Private Citizen ____

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ✓

Check here if you wish to submit a written statement. ____

Check here if you wish to receive a copy of the EIS: ____ draft ____ final

Area of question or comment (please check all that apply):

Air Quality	____	Public Services & Facilities	____
Water Quality	✓	Health Hazards	____
Biological Impacts	____	Visual Impacts	____
Geology/Soils	____	Cultural Resources	____
Land Use	____	Other (Specify)	____

Please turn in this sheet as requested by the hearing officer.

Response to CZMf:

Comment noted. See the responses to Comments TBPH-15 and TBPH-16.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME MARK A. TIRRELL

ADDRESS 16 Alderberry Rd
* Buzzards Bay, MA 02532

GBSCC

Check the category to which you belong:
Landowner ____ Business Person ✓ Other ____

Check the participant category to which you belong:
Public Official ____ Designated Representative Of Private Organization ✓ Private Citizen ____ to audit

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ____

Check here if you wish to submit a written statement. ____ *

Check here if you wish to receive a copy of the EIS: ✓ draft ✓ final

to Greater Bourne-Sandwich Chamber of Commerce
P.O. Box 304
Buzzards Bay, MA 02532

Area of question or comment (please check all that apply):

Air Quality	____	Public Services & Facilities	____
Water Quality	____	Health Hazards	____
Biological Impacts	____	Visual Impacts	____
Geology/Soils	____	Cultural Resources	____
Land Use	____	Other (Specify)	____

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Please mail your comments to: Douglas C. Karson
102FIW/PA
Otis ANG Base, MA 02542-5001

COMMENTS: ____

Statement(s) attached ___Yes ___No

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Response to GBSCC:

Comment noted.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME Edwin Pratt, Jr

ADDRESS 522B Point Road

Marion Mass 02738

MBHf

Check the category to which you belong:
Landowner ____ Business Person ____ Other X

Check the participant category to which you belong:
Public Official X Designated Representative Of Private Organization X Private Citizen ____

Check here if you wish to ask a question during the hearing. X

Check here if you wish to offer oral comments. X

Check here if you wish to submit a written statement. X

Check here if you wish to receive a copy of the EIS: ____ draft ____ final

Area of question or comment (please check all that apply):

Air Quality	____	Public Services & Facilities	____
Water Quality	X	Health Hazards	X
Biological Impacts	____	Visual Impacts	____
Geology/Soils	____	Cultural Resources	____
Land Use	____	Other (Specify)	____

Please turn in this sheet as requested by the hearing officer.

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Please mail your comments to: NGB/DEV
Mail Stop 18
Andrews AFB, MD 20331-6008

COMMENTS: ____

Statement(s) attached ___Yes ___No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to MBHf:

Comment noted. See the responses to Comments TFPH-11 through TFPH-14.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME Tom Cahir – of State Representative 3rd Barnstable District

ADDRESS 3 River Rd

Pocasset Ma

MSR

Check the category to which you belong:
Landowner ____ Business Person ____ Other State Rep

Check the participant category to which you belong:
Public Official ✓ Designated Representative Of Private Organization ____ Private Citizen ____

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ✓

Check here if you wish to submit a written statement. ____

Check here if you wish to receive a copy of the EIS: ____ draft
____ final

Area of question or comment (please check all that apply):

Air Quality	____	Public Services & Facilities	____
Water Quality	____	Health Hazards	____
Biological Impacts	____	Visual Impacts	____
Geology/Soils	____	Cultural Resources	____
Land Use	____	Other (Specify)	____

Please turn in this sheet as requested by the hearing officer.

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Please mail your comments to: Douglas C. Karson
102FTW/PA
Otis ANG Base, MA 02542-5001

COMMENTS: ____

Statement(s) attached ___Yes ___No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to MSR:

Comment noted. See the responses to Comments TBPH-1 and TBPH-2.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME Stefanie Adams

ADDRESS 45 Sassafras Lane
Marstons Mills Ma 02648

PL01

Check the category to which you belong:
Landowner ✓ Business Person ____ Other ____

Check the participant category to which you belong:
Public Official ____ Designated Representative Of Private Organization ____ Private Citizen ✓

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ____

Check here if you wish to submit a written statement. ____

Check here if you wish to receive a copy of the EIS: ____ draft
✓ final

Area of question or comment (please check all that apply):

Air Quality	✓	Public Services & Facilities	✓
Water Quality	✓	Health Hazards	✓
Biological Impacts	✓	Visual Impacts	
Geology/Soils		Cultural Resources	
Land Use	✓	Other (Specify)	

Please turn in this sheet as requested by the hearing officer.

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Please mail your comments to: NGB/DEV
Mail Stop 18
Andrews AFB, MD 20331-6008

COMMENTS:

Statement(s) attached ___Yes ___No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to PLO1:

Comment noted.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME Harold L. Baker, Jr

ADDRESS PO Box 585
Falmouth, MA 02541

PL02 Check the category to which you belong:
Landowner ✓ Business Person ____ Other ____

Check the participant category to which you belong:
Public Official ____ Designated Representative Of Private Organization ____ Private Citizen ✓

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ____

Check here if you wish to submit a written statement. ____

Check here if you wish to receive a copy of the EIS: ✓ draft
✓ final

Area of question or comment (please check all that apply):

Air Quality	____	Public Services & Facilities	____
Water Quality	____	Health Hazards	____
Biological Impacts	____	Visual Impacts	____
Geology/Soils	____	Cultural Resources	____
Land Use	____	Other (Specify)	____

Please turn in this sheet as requested by the hearing officer.

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Please mail your comments to: NGB/DEV
Mail Stop 18
Andrews AFB, MD 20331-6008

COMMENTS: ____

Statement(s) attached ___Yes ___No

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Response to PLO2:

Comment noted.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME John P. Vidal

ADDRESS 22 Natal Ave. P.O. Box 659
East Falmouth, MA 02536

PL03

Check the category to which you belong:
Landowner ✓ Business Person ____ Other ____

Check the participant category to which you belong:
Public Official ✓ Designated Representative Of Private Organization ____ Private Citizen ____

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ____

Check here if you wish to submit a written statement. ____

Check here if you wish to receive a copy of the EIS: ____ draft X final

Area of question or comment (please check all that apply):

Air Quality	✓	Public Services & Facilities	
Water Quality	✓	Health Hazards	✓
Biological Impacts	✓	Visual Impacts	
Geology/Soils		Cultural Resources	
Land Use		Other (Specify)	

Please turn in this sheet as requested by the hearing officer.

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Please mail your comments to: NGB/DEV
Mail Stop 18
Andrews AFB, MD 20331-6008

COMMENTS: ____

Statement(s) attached ___Yes ___No

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Response to PLO3:

Comment noted.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME James Hain

ADDRESS 289 Hatchville Road

East Falmouth MA 02536

PL04

Check the category to which you belong:
Landowner ✓ Business Person ____ Other ____

Check the participant category to which you belong:
Public Official ____ Designated Representative Of Private Organization ____ Private Citizen ✓

Check here if you wish to ask a question during the hearing. ✓

Check here if you wish to offer oral comments. ✓

Check here if you wish to submit a written statement. maybe

Check here if you wish to receive a copy of the EIS: ____ draft ✓ final

Area of question or comment (please check all that apply):

Air Quality	____	Public Services & Facilities	____
Water Quality	____	Health Hazards	____
Biological Impacts	____	Visual Impacts	____
Geology/Soils	____	Cultural Resources	____
Land Use	____	Other (Specify)	scheduling etc.

Please turn in this sheet as requested by the hearing officer.

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Please mail your comments to: NGB/DEV
Mail Stop 18
Andrews AFB, MD 20331-6008

COMMENTS:

Statement(s) attached ___Yes ___No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to PLO4:

See the response to Comment TFPH-10.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME MR + MRS JOSEPH P. GERACE

ADDRESS 227 CLUB VALLEY DR

E. FALMOUTH MA 02536

PL05

Check the category to which you belong:
Landowner ✓ Business Person ✓ Other ____

Check the participant category to which you belong:
Public Official ____ Designated Representative Of Private Organization ____ Private Citizen ✓

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ____

Check here if you wish to submit a written statement. ____

Check here if you wish to receive a copy of the EIS: ____ draft
✓ final

Area of question or comment (please check all that apply):

Air Quality	____	Public Services & Facilities	____
Water Quality	____	Health Hazards	____
Biological Impacts	____	Visual Impacts	____
Geology/Soils	____	Cultural Resources	____
Land Use	____	Other (Specify)	____

Please turn in this sheet as requested by the hearing officer.

Response to PLO5:

Comment noted.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME DR ARTHUR K GREENBERG

ADDRESS 11 EVERETT RD
BOURNE, MA 759-4607

PL06

Check the category to which you belong:
Landowner ✓ Business Person ____ Other Professional

Check the participant category to which you belong:
Public Official ____ Designated Representative Of Private Organization ____ Private Citizen ✓

Check here if you wish to ask a question during the hearing. ✓

Check here if you wish to offer oral comments. ✓

Check here if you wish to submit a written statement. At a later time

Check here if you wish to receive a copy of the EIS: ____ draft
____ final

Area of question or comment (please check all that apply):

Air Quality		Public Services & Facilities	
Water Quality	✓	Health Hazards	
Biological Impacts	✓	Visual Impacts	
Geology/Soils		Cultural Resources	
Land Use		Other (Specify)	Town Zoning Action

Please turn in this sheet as requested by the hearing officer.

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Please mail your comments to: Douglas C. Karson
102FIW/PA
Otis ANG Base, MA 02542-5001

COMMENTS: - Questions on presentation - typical

Statement(s) attached ___Yes ___No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to PLO6:

See the responses to Comments TBPH-17 through TBPH-20.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME Philip E. Hude

ADDRESS 1 Crows Nest Dr.
Buzzards Bay MA. 02532

PL07

Check the category to which you belong:
Landowner ✓ Business Person ✓ Other ____

Check the participant category to which you belong:
Public Official ____ Designated Representative Of Private Organization ____ Private Citizen ✓

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ____

Check here if you wish to submit a written statement. ____

Check here if you wish to receive a copy of the EIS: ____ draft ____ final

Area of question or comment (please check all that apply):

Air Quality	____	Public Services & Facilities	____
Water Quality	✓	Health Hazards	✓
Biological Impacts	✓	Visual Impacts	____
Geology/Soils	____	Cultural Resources	____
Land Use	____	Other (Specify)	____

Please turn in this sheet as requested by the hearing officer.

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Please mail your comments to: Douglas C. Karson
102FIW/PA
Otis ANG Base, MA 02542-5001

COMMENTS: ____

Statement(s) attached ___Yes ___No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to PLO7:

Comment noted.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME MR and Mrs Donald E. Dupee

ADDRESS 143 Hatchville Road
E Falmouth Ma 02536

PL08-1

Check the category to which you belong:
Landowner ✓ Business Person ______ Other ______

Check the participant category to which you belong:
Public Official ______ Designated Representative Of Private Organization ✓ Private Citizen ✓

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ______

Check here if you wish to submit a written statement. ______

Check here if you wish to receive a copy of the EIS: ______ draft ✓ final

Area of question or comment (please check all that apply):

Air Quality		Public Services & Facilities	______
Water Quality	______	Health Hazards	______
Biological Impacts	______	Visual Impacts	______
Geology/Soils	______	Cultural Resources	______
Land Use	______	Other (Specify)	______

Please turn in this sheet as requested by the hearing officer.

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Please mail your comments to: NGB/DEV
Mail Stop 18
Andrews AFB, MD 20331-6008

COMMENTS. We attended the Falmouth open meeting July 26'89 + wholeheartedly support our Selectwoman Mrs. Vahlsala in her statement.
Therefore we are opposed to alternatives 1, 1A, 2, 3, 4, + 5 + approve the #4. alternative. We live on Coonamessett Pond + are wondering just how long it will be before our well is contaminated.
Yours Helen M. Dupee

Statement(s) attached ___Yes ___No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to PLO8-1:

We (Argonne staff) cannot comment on this without specific information sucn as the exact location of the well, the completion depth, and the pumping history. In addition, it is likely that there are other existing nitrogen sources near Coonamessett Pond, such as residential septic systems, that can alter the quality of groundwater.

[Page intentionally left blank.]

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME Cynthia Coffin

ADDRESS Board of Health
24 Perry Ave
Buzz. Bay, MA 02534

Check the category to which you belong:
Landowner ________ Business Person ________ Other TOWN OFFICIAL

Check the participant category to which you belong:
Public Official ✓ Designated Representative Of Private Organization ________ Private Citizen ________

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ✓

Check here if you wish to submit a written statement. at a later date

Check here if you wish to receive a copy of the EIS: ____ draft ✓ final

Area of question or comment (please check all that apply):

Air Quality	____	Public Services & Facilities	____
Water Quality	✓	Health Hazards	____
Biological Impacts	✓	Visual Impacts	____
Geology/Soils	____	Cultural Resources	____
Land Use	____	Other (Specify)	____

Please turn in this sheet as *requested by the hearing officer.*

Written comments will be considered in preparation of the final EIS. You may use this sheet to submit written comments either in the space provided below, on the back, or in an attached statement. Written comments may also be submitted in a letter of other format; but regardless of format, comments must be submitted no later than August 21, 1989.

Please mail your comments to: Douglas C. Karson
102FIW/PA
Otis ANG Base, MA 02542-5001

COMMENTS: ________

see reverse side

Statement(s) attached ✓ Yes ___ No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Speaking as the Health Agent for the Town of Bourne, I wish to make it clear that I am against any Class III discharges to the Cape Cod Canal or any

TBBHf-1 underlying waters in Bourne. All development, or continuations of developments in Bourne leading to discharges in excess of 15,000 gpd are being required to include tertiary waste-water treatment plants for that project - why should this projected maximum discharge of 500,000 gpd from the Mass Military Reservation receive any less treatment

TBBHf-2 Every developer that comes before the Board of Health for major development along the canal adamantly insists that the nitrate loadings will be taken care of by dilution in the canal - this excuse is becoming very old - Maybe dilution is a reality, but our concern is the cumulative impact of not only nitrates but viruses, possible toxics from the military reservation, and heavy metals. Why take a coastal resource where there is no apparent problem and subject it to potential pollutants. The Town of Bourne is expending large sums of money to correct direct discharges to the Canal and Storm water run-off to coastal areas. To allow alternative 4 or 4A seems to go against everything the Town of Bourne has been working so diligently for - which is to clean up our pollution problems and preserve our water resources - be they marine or fresh, for the future.

TBBHf-3 The original discharge permit from DWPC was issued for a Class I discharge and these standards should be adhered to. Why allow a Class III discharge to marine resources & or to underlying groundwaters when other alternatives are available. We strongly urge DEP to eliminate alternatives 4 + 4A as written, from consideration.

Response to TBBHf-1:

Comment noted. See Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b.

Response to TBBHf-2:

Comment noted. Refer to the response to Comment CCPEDC-2 for discussion of VOCs, heavy metals, detergents, and phosphorus. See also the response to Comments CCSC-1 and CCSC-4.

Response to TBBHf-3:

Comment noted. See the discussion of Alternative 4b in Sec. 4.4.7, Groundwater-Flow and Contaminant-Transport Modeling. See also the response to Comment TBPH-6.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME MARIE OLIVA

ADDRESS BOURNE TOWN HALL

TBBSf

Check the category to which you belong:
Landowner ____ Business Person ____ Other SELECTMAN - BOURNE

Check the participant category to which you belong:
Public Official X   Designated Representative Of Private Organization ____   Private Citizen X

Check here if you wish to ask a question during the hearing. X

Check here if you wish to offer oral comments. X

Check here if you wish to submit a written statement. will follow

Check here if you wish to receive a copy of the EIS: ____ draft ____ final

Area of question or comment (please check all that apply):

Air Quality		Public Services & Facilities	
Water Quality	X	Health Hazards	
Biological Impacts		Visual Impacts	
Geology/Soils		Cultural Resources	
Land Use		Other (Specify)	

Please turn in this sheet as requested by the hearing officer.

Written comments will be considered in preparation of the final EIS. You may use this sheet to submit written comments either in the space provided below, on the back, or in an attached statement. Written comments may also be submitted in a letter of other format; but regardless of format, comments must be submitted no later than August 21, 1989.

Please mail your comments to: Douglas C. Karson
102FIW/PA
Otis ANG Base, MA 02542-5001

COMMENTS:

Statement(s) attached ___Yes ___No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to TBBSf:

See the responses to Comments TBBS-1 and TBPH-5 through TBPH-7.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME Dorothy Blickens ; Engineering Technician I

ADDRESS Engineering Department ; Bourne Town Hall
24 Perry Avenue, Buzzards Bay, Ma 02532

TBEDf

Check the category to which you belong:
Landowner ____ Business Person ____ Other ____

Check the participant category to which you belong:
Public Official X
Designated Representative Of Private Organization ____
Private Citizen ____

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. X

Check here if you wish to submit a written statement. X at a later date

Check here if you wish to receive a copy of the EIS: ____ draft
X final

Area of question or comment (please check all that apply):

Air Quality		Public Services & Facilities	
Water Quality	X	Health Hazards	
Biological Impacts	X	Visual Impacts	
Geology/Soils		Cultural Resources	X
Land Use		Other (Specify)	

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Please mail your comments to: Douglas C. Karson
102FIW/PA
Otis ANG Base, MA 02542-5001

Dealing Art. 4 + 4A

COMMENTS: 1. Class III effluent is unacceptable to be discharged into the canal. Especially with the Town of Bourne actively participating in the cleaning of Buzzards Bay. (1) Sewage treatment project jointly participating with the Town of Wareham servicing Buzzards Bay, Taylors Point & Hideaway Village. (2) Saltberry Avenue project with the Army Corps of Engineers (3) Buttermilk Bay Study Project.
2. Disruption of Archeological sensitive areas also unacceptable.
3. Class III discharge is not allowable under Town of Bourne Subdivision Regulations for any Development submitted to the Town of Bourne.

Statement(s) attached ____ Yes ____ No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to TBEDf:

Comment noted. See the responses to Comments TBED-1, TBPH-8, and TBPH-9.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME W. THOMAS BARLOW

ADDRESS 185 PURITAN RD BUZZARDS BAY

TBPO

Check the category to which you belong:
Landowner ____ Business Person ____ Other ____

Check the participant category to which you belong:
Public Official ✓ Designated Representative Of Private Organization ____ Private Citizen ____

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ✓

Check here if you wish to submit a written statement. ____

Check here if you wish to receive a copy of the EIS: ____ draft ____ final

Area of question or comment (please check all that apply):

Air Quality	____	Public Services & Facilities	____
Water Quality	✓	Health Hazards	____
Biological Impacts	____	Visual Impacts	____
Geology/Soils	____	Cultural Resources	____
Land Use	____	Other (Specify)	____

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Please mail your comments to: Douglas C. Karson
102FIW/PA
Otis ANG Base, MA 02542-5001

COMMENTS: ____

Statement(s) attached ___Yes ___No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to TBPO:

Comment noted. See Comment TBPH-7. Alternative 4b results in the disposal of Class I waters (produced as a result of tertiary treatment) into new sand infiltration basins near the Cape Cod Canal. See the response to Comment AVPO-1 and Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME FLOYD FORMAN

ADDRESS TOWN PLANNER - TOWN of Bourne
Bourne, MA.

TBTPf

Check the category to which you belong:
Landowner ____ Business Person ____ Other ____

Check the participant category to which you belong:
Public Official ✓ Designated Representative Of Private Organization ____ Private Citizen ____

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ✓

Check here if you wish to submit a written statement. ____

Check here if you wish to receive a copy of the EIS: ____ draft ____ final

Area of question or comment (please check all that apply):

Air Quality	____	Public Services & Facilities	____
Water Quality	✓	Health Hazards	____
Biological Impacts	____	Visual Impacts	____
Geology/Soils	____	Cultural Resources	____
Land Use	✓	Other (Specify) ____	____

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Please mail your comments to: Douglas C. Karson
102FIW/PA
Otis ANG Base, MA 02542-5001

COMMENTS: ____

Statement(s) attached ___Yes ___No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to TBTPf:

Comment noted. See the response to Comment TBPH-14.

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COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME Virginia Valiela

ADDRESS Board of Selectmen

59 Town Hall Square, Falmouth MA 02540

Check the category to which you belong:
Landowner ____ Business Person ____ Other x

Check the participant category to which you belong:
Public Official x Designated Representative Of Private Organization ____ Private Citizen ____

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ____

Check here if you wish to submit a written statement. x

Check here if you wish to receive a copy of the EIS: ____ draft ____ final

Area of question or comment (please check all that apply):

Air Quality		Public Services & Facilities	
Water Quality	x	Health Hazards	
Biological Impacts		Visual Impacts	
Geology/Soils		Cultural Resources	
Land Use	x	Other (Specify)	

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Please mail your comments to: Douglas C. Karson
102FIW/PA
Otis ANG Base, MA 02542-5001

COMMENTS:

Statement(s) attached x Yes ___ No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

DRAFT ENVIRONMENTAL IMPACT STATEMENT FOR OTIS ANGB

Comments by the Town of Falmouth

Part II August 15, 1989

Question 1:

TFBSf1-1 For Alternative 4 at 500 gpd with an initial concentration of 15 mg/L total nitrogen at point of discharge to sand filter beds, what will be the concentrations of total nitrogen at each of the nodes (A-F) on the attached Figure 4.30?

Question 2:

TFBSf1-2 Could you please explain more fully why the statement on 4-72 regarding the Alt. 4 site is true?

"...the projected nitrogen concentrations did not exceed 10 mg/L, and thus did not result in a Class III area..."

Question 3:

TFBSf1-3 Alt. 1 and 1a: Why is Crocker Pond not considered a "notable fresh water resource between the site and West Falmouth Harbor" in 4.2.4.2?

Question 4:

TFBSf1-4 Nowhere in the DEIS is it acknowledged that Alt. 1 and 1a preempt land already designated for another purpose. Nor is the cost of confiscating that land addressed. The summary of impacts shown on Table S.1 under-rates the impacts of Alt. 1 and 1a for the Social/Economic and Land Use parameters.

ERRATA

TFBSf1-5	Page 2-10	Sec. 2.4	2nd para	"see Table 1.2"
TFBSf1-6	Page 3-16		2nd para	Does water from the MMR WWTP really flow "southwest towards Buzzards Bay."?
TFBSf1-7	P. 3-20	Sec. 3.7.2.1	3rd para..	"Ashumet Pond, directly southeast of the existing."
TFBSf1-8	P, 4.11	Sec. 4.2.4.2	Last sent.	"...Falmouth WWTP (see Sec. 4.5.7) projects..."

Thank you for the opportunity to comment.

Response to TFBSf1-1:

Comment noted. In response to this question, the initial conditions used in the modeling were 500,000 gal/day and 15 mg/L of total nitrogen. For the selected points in the area of the sand filter beds, the nitrogen concentration in the groundwater ranged from 5.5 to 5.7 mg/L. Downgradient from the sand filter beds, the nitrogen concentration in the groundwater ranged from 0.5 to 3.9 mg/L, with the higher numbers associated with closer proximity to the sand filter beds.

Response to TFBSf1-2:

Comment noted. In this document, the Class III area is defined by nitrogen concentrations in the groundwater exceeding 10 mg/L. The assumption is that any concentration exceeding this value will result in Class III groundwaters.

Response to TFBSf1-3:

Comment noted; correction made in Sec. 4.2.4.2, Fresh Water Resources.

Response to TFBSf1-4:

Comment noted. Alternatives 1 and 1a are not the preferred alternatives. However, if either of these alternatives is selected, the issues of confiscating the required land and the associated costs will be addressed.

Response to TFBSf1-5:

Comment noted; correction made.

Response to TFBSf1-6:

Comment noted; correction made.

Response to TFBSf1-7:

Comment noted; correction made.

Response to TFBSf1-8:

Comment noted; correction made.

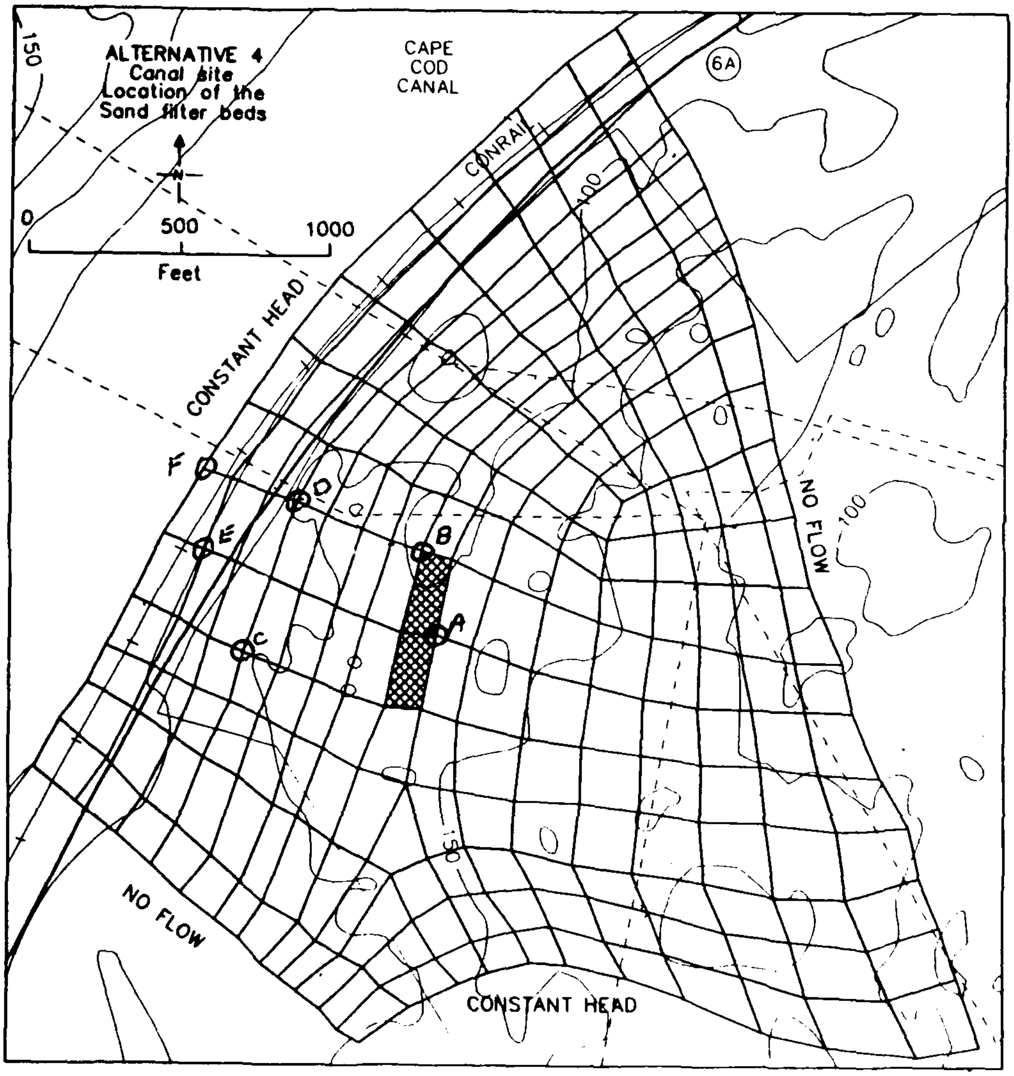

FIGURE 4.30 Approximate Location of Sand Filter Beds in Cape Cod Canal Area, Site for Alternatives 4 and 4a

4.4.7.2 Results of the Modeling

Water-table elevations (Weston Geophysical 1987) were used for the flow model calibration. Input parameters such as hydraulic conductivity and anisotropy (ratio of vertical to horizontal hydraulic conductivity) were adjusted (within reasonable limits) in the calibration process until a best match was obtained between projected and observed water-level elevations. The model-projected potentiometric surface is shown in Fig. 4.31.

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COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME Board of Selectmen - Virginia Valiela

ADDRESS 59 Town Hall Sq.
Falmouth MA

TFBSf2

Check the category to which you belong:
Landowner ______ Business Person ______ Other Government official

Check the participant category to which you belong:
Public Official ✓ Designated Representative Of Private Organization ______ Private Citizen ______

Check here if you wish to ask a question during the hearing. ✓

Check here if you wish to offer oral comments. ✓

Check here if you wish to submit a written statement. ______

Check here if you wish to receive a copy of the EIS: ______ draft
✓ final

Area of question or comment (please check all that apply):

Air Quality	______	Public Services & Facilities	✓
Water Quality	✓	Health Hazards	______
Biological Impacts	______	Visual Impacts	______
Geology/Soils	______	Cultural Resources	______
Land Use	✓	Other (Specify) ______	______

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Please mail your comments to: NGB/DEV
Mail Stop 18
Andrews AFB, MD 20331-6008

COMMENTS: ______

Statement(s) attached ✓ Yes ___ No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to TFBSf2:

See the responses to Comments TFBSf1-1 through TFBSf1-8, and Comments TFPH-1 through TFPH-9.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME WILLIAM NORMAN - U.S. ARMY CORPS OF ENGRS.

ADDRESS CAPE COD CANAL FIELD OFFICE

P.O. BOX J, BUZZ. BAY, MA.

USACEf1

Check the category to which you belong:
Landowner ____ Business Person ____ Other ____

Check the participant category to which you belong:
Public Official ✓ Designated Representative Of Private Organization ____ Private Citizen ____

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ____

Check here if you wish to submit a written statement. ____

Check here if you wish to receive a copy of the EIS: ____ draft ____ final

Area of question or comment (please check all that apply):

Air Quality	____	Public Services & Facilities	____
Water Quality	____	Health Hazards	____
Biological Impacts	____	Visual Impacts	____
Geology/Soils	____	Cultural Resources	____
Land Use	____	Other (Specify)	____

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Please mail your comments to: NGB/DEV
Mail Stop 18
Andrews AFB, MD 20331-6008

COMMENTS: Present to hear comments

Statement(s) attached ___Yes ___No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to USACEf1:

Comment noted.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME WILLIAM NORMAN   U.S. ARMY CORPS OF ENGINEERS

ADDRESS CAPE COD CANAL FIELD OFFICE
P.O. BOX J BUZZ. BAY, MA. 02532

Check the category to which you belong:
Landowner ______ Business Person ______ Other ______

Check the participant category to which you belong:
Public Official ✓ Designated Representative Of Private Organization ______ Private Citizen ______

Check here if you wish to ask a question during the hearing. ✓

Check here if you wish to offer oral comments. ______

Check here if you wish to submit a written statement. ______

Check here if you wish to receive a copy of the EIS: ______ draft ______ final

Area of question or comment (please check all that apply):

Air Quality	______	Public Services & Facilities	______
Water Quality	______	Health Hazards	______
Biological Impacts	______	Visual Impacts	______
Geology/Soils	______	Cultural Resources	______
Land Use	______	Other (Specify) ______	______

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Please mail your comments to: Douglas C. Karson
102FIW/PA
Otis ANG Base, MA 02542-5001

USACEf2-1 COMMENTS: WOULD LIKE CLARIFICATION OF HOW THE AMOUNT OF NITROGEN WAS ESTIMATED IN CASES 4 + 4a

Statement(s) attached ___Yes ___No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

Response to USACEf2-1:

Comment noted. The initial nitrogen concentrations used in the modeling simulations for Alternatives 4 and 4b are summarized in Table 1.2.

See Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b for estimated concentrations in the Cape Cod Canal. See also Comments TBPH-3 and TBPH-7 and the responses to these comments.

COMMENT SHEET*
MODIFICATION OF THE OTIS ANG BASE
WASTEWATER TREATMENT PLANT
PUBLIC HEARING
JULY 26 & 27, 1989

NAME LINDA TEAGAN

ADDRESS DISTRICT AIDE
STATE SEN EDWARD KIRBY, STATE HOUSE
RM 413 BOSTON, MASS.

USS

Check the category to which you belong:
Landowner ____ Business Person ____ Other ____

Check the participant category to which you belong:
Public Official ✓ Designated Representative Of Private Organization ____ Private Citizen ____

Check here if you wish to ask a question during the hearing. ____

Check here if you wish to offer oral comments. ____

Check here if you wish to submit a written statement. ____

Check here if you wish to receive a copy of the EIS: ____ draft
____ final

Area of question or comment (please check all that apply):

Air Quality	____	Public Services & Facilities	____
Water Quality	____	Health Hazards	____
Biological Impacts	____	Visual Impacts	____
Geology/Soils	____	Cultural Resources	____
Land Use	____	Other (Specify)	____

Please turn in this sheet as requested by the hearing officer.

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Please mail your comments to: Douglas C. Karson
102FIW/PA
Otis ANG Base, MA 02542-5001

COMMENTS: Observer

Statement(s) attached ___Yes ___No

*Filling out this form is not required, but it is recommended. The hearing officer will call first on those who have completed and turned in comment sheets before recognizing persons who did not. Thank you for your cooperation.

<u>Response to USS:</u>

Comment noted.

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APPENDIX I: PART III

QUESTIONS AND CONCERNS RAISED DURING PUBLIC HEARINGS

Questions and Concerns Raised during Public Hearing at Falmouth — July 26, 1989

Virginia Valiela:

TFPH-1 My second set of comments has to do with Alternatives 1 and 1a, which are the discharge at the Falmouth wastewater treatment plant area, either using plant facilities or in new beds near there. We have six problems with that alternative. The first is that it is a Class III discharge, and that is that the nitrogen is higher than 10 parts per million. The acreage affected may be this much acreage or that much acreage, but it is a Class III discharge and we are opposed to that. We feel that any of the discharges should be Class I. (see p. J-18)

TFPH-2 We feel that there is still some risk of having the land fill plume which flows between the two treatment plants and Long Pond being affected by additional discharge into that area, and we are just very nervous about affecting Long Pond which is our water supply. (see pp. J-18, J-19)

TFPH-3 The third is that the area that's been allocated for the Otis discharge is an area that already has been planned and allocated to Falmouth spray irrigation in Phase II. The town is partially sewered, there is a second section that is to be sewered, and the territory that has been put on the map by the Guard Bureau is land that's already on the maps for our spray irrigation system, and we find that to be an instant concern. This land also was not free; we paid for it, and there is no discussion of that either. (see p. J-19)

TFPH-4 More local impact from discharge in that area, being Class III, we'll have both nitrogen and phosphorous. There is a large maple swamp which is a wetland. We have local wetland regulations that do not allow for activities that would enrich the swamp. We feel that the swamp would be affected. There is also a very deep kettle hole downstream called Crocker Pond that is probably within the impact of this discharge as presently proposed. (see p. J-19)

Response to TFPH-1:

Comment noted. See Comment TFBSf2 and response.

Response to TFPH-2:

Comment noted. See Comment TFBSf2 and response.

Response to TFPH-3:

Comment noted. The preferred alternative, Alternative 4b, results in the disposal of Class I water into new sand infiltration basins near the Cape Cod Canal. See Comment TFBSf2 and response.

Response to TFPH-4:

Comment noted. See the response to Comment CCSC-5. See also Comment TFBSf2 and response.

TFPH-5 And lastly, very much farther downstream there are private wells, and we would question whether they also would be affected. My final concern about the Alternative 1 is that it -- again, the construction area is an area that is the Wildlife Corridor for the town. We have an overlay district for -- to protect wildlife, specifically for deer migration, and based on what I see on your maps, this goes right across that corridor. That's -- those are the comments we have in disagreement with Alternative 1 and 1a. (see p. J-19)

TFPH-6 The remaining three alternatives have positive effects on the groundwater and on the environment, and again, as I said, we're ranking them in terms of each one being more beneficial than the next. Alternative 3 is tertiary treatment. It does remove nitrogen, and it will bring the effluent below 10 parts per million in drinking water standard. However, as it is presently proposed to dispose of in those sand filter beds, it is still going to put phosphorous into Ashumet Pond. This pond is already heavily stressed with the existing sewage treatment plant plume, and this will just perpetuate it. We are very uncomfortable about that. Sand filter beds in another area that does not affect Ashumet Pond is possible, but hasn't been presented. (see p. J-19)

TFPH-7 Okay. The first question has to do with sand filter beds in either location, and that is, are there any other standards for Class I other than the nitrogen 10 parts per million that need to be met in this discharge, and DEQE is going to have to answer that. You don't have to answer that, but it is a question that has to be answered. We are unclear as to whether nitrogen is the only standard that needs to be met. (see p. J-20)

TFPH-8 The second question which has to do with spray irrigation over the grasses and the legumes, and that question is that at what point in the process is the nitrogen measured to decide whether this discharge meets DEQE discharge permit limits or not? The options are it can be measured at the nozzlehead prior to spray irrigation, it can be measured as groundwater after the land has treated it and it's -- you might say a point source right out of the site, or maybe it's measured at the boundary, the property boundary of the base. This is again a question that probably the regulatory agency has to answer, but it needs to be answered. (see p. J-20)

Response to TFPH-5:

Comment noted. We (Argonne staff) cannot comment on this without specific information such as the exact location of the wells, and their completion depths and pumping histories. See Comment TFBSf2 and response.

Response to TFPH-6:

See the response to Comment AVPO-1 and Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b. See also Comment TFBSf2 and response.

Response to TFPH-7:

Comment noted. See Comment TFBSf2 and response.

Response to TFPH-8:

Comment noted. The Massachusetts DEP sets the criteria for discharge measurements for both location and amount. See Comment TFBSf2 and response.

TFPH-9 Okay. Third question has to do with sand filter beds, and again, it's basically at what point, if you're using a sand filter bed discharge, is compliance with the permit taken? (see p. J-20)

James Hain:

TFPH-10 Sure. And my question then has to do with the alternatives, and again, maybe perhaps this was not charged to the Argonne people, but in the past I've seen, when alternatives have been listed, that there is a recommended alternative. I'm wondering if that is the case here, what is the recommended alternative, and from the people at Argonne who have had perhaps the most experience looking at this, what would that be and why is that? (see p. J-22)

Ted Pratt:

TFPH-11 I really would to say that I'm here to demonstrate that there is a regional concern about what goes on in Falmouth that extends at least as far as Westport, and really, when you consider that the Canal flows both ways, up to Boston, and that anything that is done in the treatment of the wastewater out of Otis Air Force base has an impact far greater than the maps that we saw here. Therefore, I really think that the only goal that can be shot for is a Class I literally drinking water standard discharge, that the receiving body of water, be it groundwater or ocean water, needs to be of a worse quality than the water running into it, and I think that's the only acceptable standard.

Therefore, I would strongly support the criticism and comments that Virginia made regarding the alternatives. I think you have no choice but to treat the effluent to tertiary standards, and then discharge it as Class I discharge into whatever receiving body it uses. I think any other alternative is completely unacceptable because you must extend your time line into the future indefinitely. (see p. J-23)

Response to TFPH-9:

Question noted. The Massachusetts DEP sets the criteria for discharge measurements for both location and amount. See Comment TFBSf2 and response.

Response to TFPH-10:

Comment noted. Subsequent to the public hearings, a recommended alternative, 4b, was proposed. See Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b. See also Comment PL04 and response.

Response to TFPH-11:

Comment noted. See the discussion of Alternative 4b in Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b. See also Comment MBHf and response.

TFPH-12 We would urge you to look into more of the technology, and are prepared to share with you any information that we have developed in our processes and move forward with it, and I would encourage you to explore any possible regional relationships that you might build with the many organizations around the Bay that are already doing this work. It seems foolish to reinvent the wheel; I would urge those in charge of the development of this project to reach out to the Buzzards Bay Project, and to sewer plant operators around the Bay to share information, and to do that as quickly as possible. (see p. J-23)

TFPH-13 That would be the end of my statement, but I would like to ask you just a couple of specific questions, if I might. You mentioned volatile hydrocarbon discharge; I wondered how much of that is a result of the chemicals used in treating the effluent, and how much of it was a result of the effluent itself? (p. J-24)

TFPH-14 You also, in your calculation to plant nitrogen uptake -- I'd be interested in knowing how you weighted that by season and if you have tables. I looked briefly through your analysis and there wasn't any real rigorous discussion of seasonal impacts on that, and that would be useful. (see p. J-24)

David Dow:

TFPH-15 My name is David Dow, I live at 98 Port Platte Circle, and I'm representing the Cape Cod group of the Sierra Club. The question I have was in the analysis of the potential impacts of the effluent they only dealt with the impacts of nitrogen, and I was wondering since sewage effluent contain a number of heavy metals, and also contain viruses, neither of which are effectively handled by secondary treatment, why didn't you do an analysis of the potential impacts of these factors? (see p. J-25)

Response to TFPH-12:

Comment noted. Other tertiary treatment designs are available to meet Class I water discharge standards. The purpose of the FEIS is to investigate the impacts of various disposal alternatives rather than to address different tertiary treatment designs. Prior to designing a tertiary-treatment facility, tertiary-treatment technologies both on and off Cape Cod will be explored. See Comment MBHf and response.

Response to TFPH-13:

Comment noted. See the response to Comment CCPEDC-2. See also Comment MBHf and response.

Response to TFPH-14:

A lagoon will be constructed to hold wastewater during the cold months, and irrigation will be done only when vegetation is actively growing (approximately 8 months per year). However, to determine worst-case conditions, the groundwater models assumed that irrigation occurs all year long. See also Comment MBHf and response.

Response to TFPH-15:

Comment noted. See the response to Comment CCSC-1. See also Comment CCSCf and response.

Questions and Concerns Raised during Public Hearing at Bourne/Buzzards Bay - July 27, 1989

Tom Cahir:

TBPH-1 I'd first like to say that in reviewing the alternatives I think that Alternative 1, 1a, 4a, and 5 in my opinion are completely unacceptable. And although I have an order of preference in the other three, Alternative 4, 2, and 3, I do feel strongly that they need to be modified. I think that Alternative 4 as written seems to be my preference and most acceptable. However, I think it has to be changed to a Class I discharge. I think that's essential. (see p. J-41)

TBPH-2 So certainly I will resubmit written testimony with a lot more detail by the deadline, but I feel that I've been involved in so many issues concerning coastal environmental, storm water runoff, pathogens, heavy metals being discharged into the coastal environment which around our area is very important, so I think that you have to protect the Cape Cod Canal to the utmost. So I would say my preliminary support would be to strongly urge DEQE to support Alternative 4 with modifications, and I think that along with my written testimony that the Boards of Health will be submitting a more cohesive statement as well. So with those very vague remarks, I'd like to thank you for providing this opportunity, and look forward to working with you to come to a consensus in the best interests of our very sensitive environment here on the Cape. Thank you, Colonel Howell. (see p. J-41)

William Norman:

TBPH-3 Good evening. I was at the meeting yesterday, and again tonight representing the Cape Cod Canal Field Office to listen to the presentation and your comments. One thing that I've had trouble understanding through the whole presentation is how the range of nitrogen that enters the Canal is arrived at.

Yes. The 1.12×10^{-4}, how did you come to that figure, and what does that figure mean as far as impact? (see pp. J-41, J-42)

Response to TBPH-1:

Comment noted. See the discussion on Alternative 4b in Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b. See also Comment MSR and response.

Response to TBPH-2:

Comment noted. See the discussion on Alternative 4b in Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b. See also Comment MSR and response.

Response to TBPH-3:

See the response to Comment USACEf2 and Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b.

TBPH-4 Okay. And of concern to us would be there is a well that supplies a public recreation area for the south side of Falmouth.

And I guess we're also concerned about something other than the Class I type of water coming into the Canal. (see p. J-42)

Marie Oliva:

TBPH-5 I'd like to take this opportunity on behalf of the Board of Selectmen to thank you for coming to testify. The position of the Board of Selectmen remains the same as it was back in July of 87 when we did communicate in writing to you, as well as attending a scoping session similar to this one at the Activity Center at the Base. The position of the Board of Selectmen remains the same, that being that we are adamantly opposed to Alternative #4 as proposed, and also 4a, which is the direct disposal into the Canal. So I'd like to reiterate that our position still remains the same as we have already indicated to you. (see p. J-43)

TBPH-6 I do, for the record -- would like to note that we do question the applying of the Military to the DEQE for a Class III Discharge Permit for Alternative 4 because what was stated in the past is that those alternatives are supposed to be looked at objectively and unbiasedly in line with the -- military applied for a Class III Discharge Permit for one alternative, when this study is supposed to look at all these equally. For the record, I would like to note that also. (see p. J-43, J-44)

Thomas Barlow:

TBPH-7 Alternative 4a and 4 will increase the nitrogen loading into Buzzards Bay. These alternatives are in direct conflict with the wishes of the people of the town of Bourne, Cape Cod, and southeastern Massachusetts. Thank you very much. (see p. J-44)

Response to TBPH-4:

The well that supplies water for the public recreation area for the south side of Falmouth is not located in the groundwater flow path between the proposed location of the sand infiltration basins and the canal, and is outside of the area affected by the additional wastewater. The well's capture zone is small due to its low pump rate and high formation permeability. See Comment USACEf2 and response.

Response to TBPH-5:

Comment noted. See the discussion on Alternative 4b in Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b. See also Comments TBBS and TBBSf and the responses to these comments.

Response to TBPH-6:

For Alternative 4 to be a viable alternative, a Class III discharge permit is required. An application for the permit was made because of the lead time required to obtain such a permit. See Comments TBBS and TBBSf and the responses to these comments.

Response to TBPH-7:

The ANG acknowledges that Alternatives 4 and 4b will increase the nitrogen loading into Buzzards Bay. The preferred alternative involves upgrading the effluent from the Otis WWTP to Class I standards prior to discharge into new sand infiltration basins near the canal. We believe that this is the most environmentally sound alternative and takes into consideration the efforts and concerns of Buzzards Bay, and concerns about the Cape Cod Canal. We believe that Alternative 4b will complement these programs rather than reverse them.

See Comment TBPO and response.

<u>**Dorothy Blickins:**</u>

TBPH-8 Yes, it is. Thank you very much. I am the engineering technician for the town of Bourne, in the Engineering Department, and we'd like to state, on behalf of our department, the Class III discharge is unacceptable into the Canal, as previously stated by the Board of Selectmen. Our main concern is the amount of resources, time and money that our department, in conjunction with the Selectmen, put into several projects currently undergoing in the town of Bourne to clean up Buzzards Bay. (see p. J-45)

TBPH-9 Number one is a project with the sewerage of the town of Wareham; number two is the project with the Corps of Army Engineers; number three, several projects in Buttermilk Bay; number four, the Gale Systems Project with the Cass River, the storm water system, number four, the Electric Avenue Project which was just dedicated today, the Board of Selectmen were at, controlling storm water draining into the Bay. Number two, we would like to state that any archeological damages in our area due to the installation of a pipeline would be also unacceptable. As you know, Bourne is of great history in Indian artifacts, as well as pre-revolutionary artifacts, and we would not want to lose any of that information. And that's basically what we've been able to do today based on the report that we've received this morning. That's all I have to say, unless anybody has any questions. Thank you. (see p. J-45)

<u>**Cynthia Coffin:**</u>

TBPH-10 Speaking as a health agent for the town of Bourne, I wish to make it clear that the Board of Health is against any Class III discharge into the Cape Cod Canal, or any underlying waters in Bourne. All developments and continuations of development in Bourne leading to discharge in excess of 15,000 gallons per day are being required to include tertiary wastewater treatment plants for their project. Why should this projected maximum discharge of 500,000 gallons per day from the Massachusetts Military Reservation receive any less treatment? (see p. J-45)

Response to TBPH-8:

Comment noted. See the discussion on Alternative 4b in Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b. See also Comment TBEDf and response.

Response to TBPH-9:

The ANG conducted a survey of all the areas that would be affected under Alternative 4. The survey plans have been approved by the Massachusetts State Historic Preservation Office. This survey is being performed to comply with the requirements of the Cultural Resources Act. If any archaeological/cultural resources are discovered, they will be taken into account in the design of the pipeline. The pipeline will be designed to avoid these areas. See Comment TBEDf and response.

Response to TBPH-10:

The preferred alternative, Alternative 4b, results in the disposal of Class I water into new sand infiltration basins near the Cape Cod Canal. This alternative involves tertiary treatment at the Otis WWTP prior to disposal, and therefore, is in line with the Town of Bourne's continuing efforts. See Comment TBBHf and response.

TBPH-11 Every developer that comes before the Board of Health for major developments along the Cape Cod Canal adamantly insists that the nitrate water can be taken care of by the dilution in the Canal. This excuse has become very old. Maybe dilution is a reality, but our concern is the cumulative impact, not only nitrates, but viruses, possible toxins from the Military Reservation, and heavy metals. Why take a coastal resource where there is no apparent problem and subject it to potential pollutants? The town of Bourne has been spending large sums of money to correct direct discharges to the Canal and storm water runoff to coastal areas. To allow either 4 or 4a seems to go against everything the town of Bourne has been working so diligently for, which is to clear up our pollution problems and preserve our water resources, be they marine or fresh, for the future. (see p. J-45)

TBPH-12 The original Discharge Permit from the DWPC was issued for a Class I discharge, and these standards have been adhered to. Why allow a Class III discharge to marine resources or to underlying groundwaters when other alternatives are available? We strongly urge DEP to eliminate Alternatives 4 and 4a as they are presently written from consideration. Thank you very much. (see p. J-46)

Susan Weston:

TBPH-13 Susan Weston, of 710 Head of the Bay Road, Buzzards Bay, and I'm representing the Bourne Conservation Commission. Bourne Conversation Commission wishes to be recorded as opposed to Alternatives 4 and 4a. The Commission opposes both alternatives for the following reasons. (see p. J-46)

Floyd Forman:

TBPH-14 The town has already required the Brookside Project, a multiuse project, to install a tertiary treatment facility as part of its approval to ensure the quality of our water. The town is presently working with another major developer on a condominium project. This developer will also be required to install a tertiary treatment system. Should we not require the same commitment from the federal government and require a Class I discharge? (see p. J-47)

Response to TBPH-11:

Comment noted. See the response to Comments CCSC-1 and CCSC-4. See also Comment TBBHf and response.

Response to TBPH-12:

Comment noted. The Class III permits are issued by the DEP. In addition, Alternative 4b, the preferred alternative, does not require a Class III permit. See Comment TBBHf and response.

Response to TBPH-13:

Comment noted. See the discussion on Alternative 4b in Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b. See also the response to Comment TBPH-7. See Comment BCC and response.

Response to TBPH-14:

Comment noted. See the response to Comment TBPH-10. See also Comment TBTPf and response.

David Janik:

TBPH-15 Research to date has shown that nitrogen loading into the present coastal ecosystems is now a problem in many parts of Buzzards Bay. Therefore, we feel that new septic treatment facilities should employ modern day technology to reduce nitrogen in the effluent and receiving waters to the lowest possible concentration. This is imperative because nitrates are not attenuated in groundwater to any significant degree, and even a small increase in the nitrogen concentration of the coastal waters will result in profound changes in marine ecosystems. (see p. J-47)

TBPH-16 We further believe that the Department of Defense should use the highest possible standards in designing and constructing this facility to serve as an example to the local communities in the proper treatment, disposal -- treatment and disposal of the wastewater, particularly in that estuary of national concern. We'll be submitting more detail and comments prior to the deadline. (see p. J-47)

Arthur Greenberg:

TBPH-17 I'd like to thank you for the opportunity to speak this evening. Just a few preliminary comments. One, we have the Ocean Sanctuary Act, which seems to be given little credence to at this time. It seems that 4 and 4a, the proposal to dump sewerage directly into the Canal, or a sand filter near the Canal are a violation of the Act itself, or the spirit of it. And so I don't think that that really should be pursued because I feel that the National Guard people responsible for this type of proposal, if it goes forward, will be setting themselves up for regular legal involvement and suits, and I think that's just a waste of everybody's money and time and it doesn't resolve the issue. (see p. J-47)

TBPH-18 Two, I have to say frankly that I would have been more impressed with the presentation by Argonne Laboratories, instead of them citing various modeling approaches, and simulations, and computer projections, if they had pointed to the particular facility that was -- where they used this modeling and what the result was after the project was completed, and a year or two later whether that compared favorably with what their projections were, and for -- related to us in real life situations instead of projections of their computer. That doesn't impress me at all. I'm more impressed with the -- with what occurs in our daily life than statements like that. (see p. J-47, J-48)

Response to TBPH-15:

Comment noted. See the discussion of Alternative 4b in Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b. See also Comment CZMf and response.

Response to TBPH-16:

Comment noted. See the discussion of Alternative 4b in Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b. See also Comment CZMf and response.

Response to TBPH-17:

Comment noted. The preferred alternative, Alternative 4b, results in the disposal of Class I water into new sand infiltration beds near the Cape Cod Canal. See Comment PLO-6 and response.

Response to TBPH-18:

The goal of the modeling effort was to define or project the lateral extent of groundwater alteration for each of the alternatives. To give the model projections validity, the model was calibrated (by adjusting the input parameters within a reasonable range) until the model projected water-level elevations favorably comparable to those measured in the field.

Verification tests have been performed for the major processes of the Coupled Fluid, Energy, and Solute-Transport Computer (CFEST) code. CFEST and the groundwater flow portion of the code (FE3DGW) have been applied to national and international field problems. In addition, the CFEST code is also being benchmarked, verified, and partially validated using test cases identified by HYDROCOIN (Hydrologic Code Intercomparison), an international project organized by the Swedish Nuclear Inspectorate.

See Comment PLO-6 and response.

TBPH-19 What the resolution says was whereas the Environmental Impact Statement, such as has been conducted by the Massachusetts National Guard for the purpose of establishing a method of disposal for the Otis Air Force Base wastewater, requires citizen participation and requests citizen comment, I'm aware that the town of Bourne on several previous occasions through Town Meeting vote with the citizens action have expressed a concern for the quality of drinking water in or near the Cape Cod Canal. Therefore, we, the citizens of the town of Bourne, resolve to instruct our Selectmen to indicate to the appropriate governmental authorities that the town of Bourne disapproves of any attempt to utilize the Cape Cod Canal as a dumping ground for wastewater from Otis Air Force Base, and will strongly resist through legal, legislative, and other means any attempt to dispose of the water through the Cape Cod Canal. And there was not one dissenting voice in the entire town meeting. (see p. J-48)

TBPH-20 But in spite of the assurances by engineers, I am concerned, as I'm sure you are, that any miscalculation or omissions of times, inadequacy of construction, lack of maintenance or lack of funding, we constantly monitor the water from the treatment plant, or any accidental dumping of toxic materials into the system would have a devastating effect given the volume of waters from Otis Air Force Base. The waters of the Cape Cod Canal, Buzzards Bay and the Cape Cod Bay would require enormous sums of money to correct any contamination of those waters. Who would deny that the pollution of the Canal, Buzzards Bay and Cape Cod Bay would have a devastating effect on our commercial, recreational, fishing and boating industry, summer home, retirement home, construction, throughout the general tourist economy of the area, as well as reduce the quality of life for everyone living on the Cape. (see p. J-49)

Charles Smith:

TBPH-21 I'm Charles Smith with the Paine-Smith and Company Consultants to the town of Bourne invited consultants, and I'd like to say that I fully support their endeavors for a Class I that might expose an aquifer, that the discharge, anything other than a Class I in this area would be not consistent with the direction the DEQE has been going for all discharges. Thank you. (see p. J-50)

Response to TBPH-19:

Comment noted. See comment PLO-6 and response.

Response to TBPH-20:

Comment noted. See the responses to Comments CCSC-1 and TBBH-1. See also Comment PLO-6 and response.

Response to TBPH-21:

Comment noted. See the discussion of Alternative 4b in Sec. 4.4.7.2, Results of the Modeling - Alternatives 4 and 4b.

APPENDIX J:

PUBLIC HEARING TRANSCRIPTS

Part I: PUBLIC HEARING AT FALMOUTH, JULY 26, 1989 .... J-5

Part II: PUBLIC HEARING AT BOURNE/BUZZARDS BAY, JULY 27, 1989 .... J-27

APPENDIX J: PUBLIC HEARING TRANSCRIPTS

Two public hearings were held in response to the Draft Environmental Impact Statement (DEIS) for the Otis Air National Guard Base Wastewater Treatment Facility. The first public hearing was held in the Falmouth High School Auditorium on July 26, 1989; the second was held in the Bourne Community Building Center on July 27, 1989. The proceedings of the hearings were recorded by the Court Reporter, Mr. Tarbox. Transcripts were provided on computer diskette by Arlington Typing and Mailing of Arlington, Massachusetts.

APPENDIX J: PART I

PUBLIC HEARING TRANSCRIPT FOR FALMOUTH

Public Hearing Transcript: Falmouth — July 26, 1989

Colonel Howell: Ladies and gentlemen, shall we get started? The National Environmental Policy Act and the implementing regulations require federal agencies to carefully analyze the potential environmental impacts of proposed actions, and to use those analyses in arriving at decisions or recommendations as to whether, and how, to proceed with those actions. The Air Force has prepared and distributed, in accordance with applicable regulations, a Draft Environmental Impact Statement -- and I believe there was a copy out front that you could get a copy of -- and that Impact Statement addresses a proposal to modify the Wastewater Treatment Plant at Otis Air National Guard Base.

My name is Colonel John Howell, and I am a full time military trial judge for Air Force courts martial. I have been designated by the Office of the Judge Advocate General in Washington as Presiding Officer for tonight's public hearing on the Draft Environmental Impact Statement. I am not here as an expert on this proposal, nor have I had any connection with its development. I am not here to act as a legal advisor to the Air Force experts who will address this proposal. My purpose is simply to ensure that we have a fair, orderly hearing, and that all who wish to be heard have a fair chance to be heard.

Let me take just a moment to explain how tonight's hearing will proceed. This isn't going to a debate, nor a referendum, nor a vote upon the proposal itself. With your cooperation, there will be no demonstrations, nor should you signify your agreement or disagreement with a speaker's position by applause or other expressions of approval or disapproval. That adds nothing to the hearing record, it simply wastes your valuable time. This may be, in fact, the only time available for your personal input to the government's decision making process.

What this informal hearing is intended to provide is a public forum for two-way communications with a view to improvement of the overall decision making process. You notice I said two-way communications. Part one of that calls for you to listen carefully to what the Air Force experts say as you are briefed on the proposal and its anticipated environmental consequences. After the briefing, we will take a short recess, and then you will be able to ask questions to clarify, in your mind, any points made in the briefing or in the Draft Environmental Impact Statement.

Part two of this process is for you to tell the Air Force experts what you think, and to give the Air Force decision makers the benefit of your knowledge of the local area affected by the proposal, and any environmental hazards that you perceive.

I'd like to emphasize that this is a proposal and not something that's already been decided, approved, or funded. Our hearing is not for the purpose of justifying anything, but rather to identify and assess pertinent impacts, including your personal perspective as to those impacts.

Take notes as you choose during the briefing, and please fill out one of our Comment Sheets which we had distributed at the door, and I believe Mr. Karson in the back has more Comment Sheets if you require them. You may indicate on the Comment Sheet if you wish to ask a question or make a statement. Right after our recess, and after I've had a chance to collect these cards, I will recognize members of the public for the purpose of putting a question to the Air Force experts, or making a statement about the proposal. Don't be shy or hesitant to ask a question or make a statement. This is an informal hearing, and there are no dumb questions.

I want to help ensure that all who wish to speak have a fair chance to be heard, so please help me enforce the following ground rules. First, speak only after I recognize you, and please address your remarks to me. Second, speak clearly and slowly, starting out with your full name, address, and the capacity in which you appear, that is, as a public official, a designated representative of a private association, or a person speaking solely in his or her individual capacity so that our Court Reporter, Mr. Tarbox, who has to make a verbatim record of these proceedings, can do his job professionally.

Third, if you have questions for the panel, please ask one question at a time. I will allow a reasonable number of questions.

Fourth, statements will be limited to five minutes for persons speaking in their individual capacity, and ten minutes for representatives of the groups. I believe that was the figure that was announced in our public announcement. That includes -- the public officials and designated spokespersons of private groups will have ten minutes, and private citizens will have five.

Fifth, please honor any request from me that you stop speaking.

Sixth, please do not speak while another is speaking. Only one person will be recognized at a time. And finally, I have been advised that this is a No Smoking area, and I would appreciate your cooperation with that rule.

Now it is possible that there will be questions that the Air Force representatives are unable to answer here tonight. That could occur for one of two reasons. First, even though a good deal of expertise is assembled here, our experts will not attempt to answer questions tonight unless they are confident they can do so accurately and completely. Second, there may be questions having national security implications, and if there are, these must be reviewed before answers can be provided. If this should occur, and if the answer -- if the question is relevant, I can assure you that it will be addressed in the final document which you may request a copy of. And there is a line on that Comment Sheet which you may request a copy of the Draft or the Final Environmental Impact Statement.

Now, if we run out of time and I -- with the size of the audience I don't expect that will happen -- but if we run out of time, you are invited to fill out the Comment Sheet, and you can note the Comment Sheet can be submitted at any time prior to 11 August -- the 11th of August, 1989, by mailing them to the National Guard Bureau, and that address is on the form. It's NGB/DEV, Mail Stop 18, Andrews Air Force Base, Maryland.

Regardless of whether you read your statement on the record tonight or mail it in later, it will be carefully considered and made part of the record of these proceedings. It will have equal weight and receive the same careful consideration whether made during tonight's hearing or afterwards.

I would like to thank everyone who turned out tonight on a warm summer night in Cape Cod. Your presence here is commendable in that it reflects a great interest in your community and in those things that are important to it. Let me assure you that your interest is the primary reason for us being here tonight.

Now first, I would like to introduce LTC Keating, the Otis Installation Commander, who has a few comments for you.

Colonel Keating: Thank you, Colonel Howell. And it is probably the case, the best night of the year, we don't have many like this though. For everybody that is here tonight, being at this hearing tells us very clearly that you have a very, very strong interest in a very important subject, and of course, that is the environment. And we are of course here in town tonight, and I'd like to thank Falmouth officials, and all the other officials in the state legislature, as well as the federal population that supports us in this effort so much.

I would like very much to remind you that this EIS is extremely important to us. We do not have a position --we do not have a singular position at the base on which way to go. That is the purpose of the hearing tonight. Your input is extremely important, and it's very much invited, and we need your help in order to arrive at the very best solution. So I encourage your comments, and please take all the time necessary that you need tonight to get this matter resolved. It's extremely important to us. Thank you very much, Colonel Howell.

Colonel Howell: Thank you, Colonel Keating. Now I'd like to introduce Dr. Krummel, from the Argonne National Laboratory, who will brief the proposal tonight. Then we will take a short recess, and just prior to the start of the question period we will introduce other members of the Air Force team. Dr. Krummel?

Dr. Krummel: Thank you, Colonel Howell. Before I start, I would like to introduce two of my colleagues from Argonne who are here tonight. Sitting down there, Lisa Durham, who was one of the hydrologists that worked on this project, and Dr. Robert Peters, who is an environmental systems engineer, and is a P.E. in Indiana and Illinois.

What we would like to do is briefly go over some of the major findings, and I will give the first part of the talk, and Lisa will give the part of the talk that has to do with the groundwater hydrology and monitoring. So if I could have the lights and the first slide.

Again, this is an Environmental Impact Statement for the Otis Air National Guard Wastewater Treatment Plant. It is being conducted for the Massachusetts Air National Guard, and it was done by staff at the Argonne National Laboratory. Briefly, Argonne is located outside Chicago, approximately 30 miles southwest of the city. It is owned by the Department of Energy and operated by the University of Chicago. There are 4,000 people that work at the lab. Approximately 2,500 are technical scientists; of those, about 90% have advanced degrees.

We have been involved in EIS work for a number of years now. Current major EIS's that we are doing -- I've listed four up here -- the U.S. Department of Energy Superconducting Super Collider in Texas, the U.S. Department of Energy Advanced Petroleum Removal Project at the Naval Petroleum Reserve in California. We are working on EIS's for the U.S. Air Force Base Closings in realignment in California, New Mexico and Washington, and a very big project, the U.S. Department of Energy New Production Reactor, which will be located in either South Carolina, Idaho or Washington. So we have been involved in this process for a long time, and that just summarizes some of the major work that we are now doing.

In the presentation today -- tonight -- it's divided into an overview and introduction, we go into the major environmental impacts, and then we · to an area that is of concern to most people here, the description of the groundwater model, and the groundwater modeling results. Finally, briefly we go into the summary of some overall results, and then talk about the projected environmental impacts for each alternative.

This is an aerial photograph of the Otis Wastewater Treatment Plant, taken about 1982. I don't have a pointer, but of importance to this project, the sand filter beds that are currently being used are the middle ones, the bright light ones due south of the treatment plant. Those and the ones located down on the slide were rehabilitated in 1982, and that is where the final effluent is disposed of.

The alternatives that were considered in this EIS were originally looked at by CDM as far as their engineering feasibility, and we have been following those based on the scoping meetings and other input throughout this EIS process.

Alternative 1 is to pump untreated effluent to the town of Falmouth wastewater treatment plant for treatment and disposal in existing or new sand filter beds. Alternative 1a, a variation of that, is to do the same thing, but treat the effluent first, and then dispose of it.

Alternative 2 is to use the existing Otis wastewater treatment plant and dispose of the final effluent via spray irrigation of grasses -- on grasses.

Alternative 3 is to upgrade the existing wastewater treatment plant using the Bardenpho process to provide tertiary treatment to remove nitrogen from the final effluent, and dispose of this effluent in the existing infiltration basins or sand filter beds at the facility.

Alternative 4 is to pump the treated effluent up to a site near the Cape Cod Canal and dispose of it in infiltration basins. A variation on this alternative, which was suggested by the U.S. EPA, was to dispose of this effluent directly via pipe into the Cape Cod Canal, so we investigated that also.

Finally, which is required in an EIS, we look at Alternative 5, which is continue to operate the current facility using the present treatment system, and this is the no action alternative. So that alternative is to operate as is.

Briefly, this is a map of the Inner Cape. It shows the areas that will be involved; the Falmouth treatment plant, the current wastewater treatment plant, and then at the top of this slide you see the small rectangle, that is the area under consideration for Alternative 4 and 4a. So there are three major areas involved in this analysis of alternatives; the Falmouth facility, the current wastewater facility, and the area located at the very northern end of the Massachusetts Military Reservation next to the Cape Cod Canal.

Our technical approach used to determine the environmental impacts is rather straightforward. First, we consider what the baseline environment is, what the existing environment is. For example, what is the current groundwater quality at the sites, what is the air quality --background air quality that we're looking at, what are the land use patterns.

Secondly, we want to identify and evaluate the types of impacts that exists for each alternative; how much land would be disturbed, what would be the disposal conditions, where are they located, etc.

Thirdly, we want to determine the level of impact for each alternative. That essentially means we want to quantify what is going to happen if that alternative takes place.

Finally, we look at what we have quantified and determine the significance of the impact based on that analysis. Now significant can be based on regulatory criteria, we can compare it with the current existing environment, or we can refer to other studies or other scientific results that show us what may happen if that action occurs. So there's a number of ways to determine the significance of impacts, and you'll find that EIS's use all of these for some, depending on what they're looking at.

The EIS is constrained, or looked at, based on the conditions regulated by a 1984 Discharge Permit issued by the Department of Environmental Quality and Engineering in the state of Massachusetts. This is an interim Discharge Permit, and it is to be followed until the facility is upgraded. As of now, the treatment plant is meeting all of the interim Discharge Permit conditions.

The final discharge conditions are based on these parameters. Of concern in the EIS, since the facility is meeting these except for nitrogen, is the focus on nitrogen as a parameter of concern to analyze all of the alternatives. So when Lisa talks a little bit later on the groundwater modeling, we focus on nitrogen and the movement of nitrogen within groundwater at all the facilities.

And the reason we're doing that is based on this data right here, which shows the current operating conditions of the facility, the influent and the effluent, and where we got those numbers from. Right now the facility is averaging well under 300,000 gallons of influent per day. I'll get into it a little bit later, but all the alternatives looked at disposal rates of either 300,000 gallons, or 500,000 gallons per day. The 300,000 gallons was the base number used, and that was used because the records indicate that the facility on average never has exceeded 300,000 gallons in the recent operation of the plant. Even during periods of high training on the Massachusetts Military Reservation, flows can approach 270,000 gallons per day, but have not reached 300,000 gallons. So to be conservative we use 300,000 gallons as the baseline.

One of the things I do want to point out is that the Otis Air National Guard Base is in charge of the utilities for all of Massachusetts Military Reservation, the electrical facilities, and, as a part of that, the wastewater treatment plant. So Otis treats the Army National Guard, the Coast Guard, and any other tenants that are working or training on the Massachusetts Military Reservation, in addition to the Air National Guard.

Finally, I want to say that Argonne was involved in a facility optimization program, and currently we're removing close to over 50% of the nitrogen that is coming into the facility. But as you can see, it still exceeds 10, and it is the parameter of concern as far as the groundwater quality in this EIS.

Now, to briefly go through some of the major impact areas, and not take up too much of your time because this is your public meeting, I want to first talk a little bit about air quality. And related to air quality we looked at ozone, because all of Massachusetts, including Cape Cod, is in nonattainment status for ozone. And so therefore we looked at the contribution that volatile hydrocarbons emitted by the facility -- what they might do to impact the environment in terms of ozone formation, since those are some of the precursors to ozone formation.

We looked at four methods, and we took a worst-case analysis based on data that Oak Ridge National Laboratory gathered at the facility, and what these methods tell us to do in terms of calculating emissions to the air. Under the 300,000 gallons per day alternative we come up with a number of approximately six tons per year. Under the 500,000 gallons per day effluent scenario -- and let me backtrack.

Five hundred thousand gallons per day is our worst-case analysis, assuming that these -- that the sewage treatment plant may be treating more effluent in the future. We don't know if that's true, but because there are a number of tenants involved, we needed to bracket both the current condition and a possible worst-case condition. Under the worst case condition we found approximately one ton per year of volatile hydrocarbon emissions per year coming from the plant.

This is a rather insignificant contribution to possible ozone formation. To put that in something that you may understand, this is equivalent to about 75 autos operating per year on the Cape, and if you look at the volatile hydrocarbon emissions from a normal gasoline station, they average in excess of five tons per year. So this is a very small contribution of volatile hydrocarbons.

Threatened and endangered species. In October of 1988, the U.S. Fish and Wildlife Service declared the Sandplain gerardia to be a threatened species on Cape

Cod. When we found that out we began consultations with the U.S. Fish and Wildlife Service to determine if any of the alternatives under consideration could impact this species. We received written response from them that none of the areas that we are considering are near any of the known populations. They will not release the information to the public on where those known populations are to protect this plant species, but they have written to us that there are no Sandplain gerardia populations anywhere near either the pipeline or the sand filter beds.

There are two state-listed moths on the Inner Cape, and again, based on our consultations with the state, none of them are found near any of the construction right-of-ways or the areas that contain sand filter beds or potential spray irrigation areas.

There are also three state-listed bird species on Otis, that is the Upland Sandpiper, the Northern Harrier, and the Grasshopper Sparrow. The Air National Guard has implemented, based on a study conducted by the Massachusetts Natural Heritage Foundation, a bird management program to protect these species. Alternatives 2 and 3 would not affect these at all because none are located near the Otis wastewater treatment plant.

Construction and excavation activities under any of the alternatives do not occur where the Northern Harrier or Grasshopper Sparrow is found on the base. And finally, the pipeline, if it is constructed somewhere near the Base Civil Engineering buildings, would not result in any long term impact to the Sandpiper because the construction period would be very short, the disturbance area very small to the area that this species uses, and it would not affect any nesting activities of this bird species.

Finally, I want to talk a little bit about human health. I know it is a concern to people on the Inner Cape. We did not personally investigate human health issues, we relied on the information we received from the Massachusetts Department of Public Health, and these are their findings from their most recent study. Now I know there is another study ongoing by Boston University that's about six months into a two year planned study.

Those results are not available, but based on this completed Massachusetts Department of Public Health study, it was determined that elevated levels of age-adjusted mortality for some causes of death determined for Upper Cape residents are elevated for compared to the rest of Massachusetts. However, there is no significant correlation with distance from the MMR, and because of the nature of the study it was very, very hard to statistically relate those deaths, because of the small number of deaths. Finally, there was no causal relationship determined for any of the agents originating from the MMR.

Now quickly, I just want to run through some preliminary estimates of the areas disturbed based on the preliminary engineering designs that CDM completed. For Alternative 1 and 1a, what I want you to focus on is both for the 300,000 and 500,000 gallons, the total area that may be disturbed if these are implemented. As you can see, the acreage is rather small. For 1 and 1a it ranges from eight to 17 acres.

For spray irrigation, because of the area that would need to be cleared and turned to grassland, we have the largest acreage disturbed. Most of this is now a forest and it would be converted to grassland. For number 3 it would be extremely minimal since all of the construction would occur at the facility. And finally, for 4 and 4a, there would be some disturbance, some small amount of disturbance to completing the pipeline.

The pipeline will follow -- all the pipelines follow either existing roads or transmission line easements, so there is no -- there would be minimal disturbance around any areas that are natural in any sense. For the sand filter beds there would be some disturbance of natural areas, but again, the acreage is rather small. I just wanted to state that except for the spray irrigation areas, most of the other acreage is under 20 acres for all the other alternatives. Again, these are preliminary designs, and they would be updated if final design plans came in. But we feel they're very close to what the final would find.

I would now like to turn the talk over to Lisa Durham, who is going to explain some of the groundwater modeling studies and results that we conducted.

Ms. Durham: Okay. First of all I'm going to break my talk into two parts. The first part I'm going to show you a little bit about the objective and the modeling process that we use at Argonne; and in the second part I show you some of the results.

The procedure was to define the areal extent of groundwater that contains 10 milligrams per liter or greater nitrogen concentration for each alternative. Now as John said, the 10 milligrams per liter was the focus, because this is what you find in most of the area.

Okay, in the procedure, first of all you develop a conceptual groundwater flow and solute transport model, and this is just a mental picture. And the second, we select a groundwater flow and solute transport model that's capable of performing the required calculations that we needed for the EIS.

Okay, the major input parameters for the flow models -- stratigraphy, hydraulic conductivity, recharge, boundary and initial conditions.

This is just a schematic picture of the Cape showing just the different geological materials. So you can see up by the Cape Cod Canal the Sandwich Moraine. That is the material that we used to define the products that went to the model, so just an example.

These are the surface water features, and we incorporated these into the model also.

For the transport part of the simulations, dispersivity, effective porosity, retardation, and the source concentration and loading rate. Now this is just like the 300,000 gallons per day initial nitrogen concentration. These are the major input parameters for the transport part of the model.

The model that Argonne used is called CFEST. This is a model that was developed by S. Gupta, Charlie Cole, and Battelle Northwest Laboratory for the

Department of Energy. CFEST is a finite-element model. It is three dimensional, in other words, both aerial and then in a vertical direction. And it simulated the things that we need for the transport part, and is very well documented, verified and validated, and it is available in the open literature, it's not a proprietary code. And I should mention -- the well documented part -- that DEQE did give its approval.

CFEST has been widely used. It's been used at Sutter Basin, and it's been used in Long Island, New York. Also the flow part of CFEST was used in evaluating salt repositories. These are several other places where the model has been applied.

So once you sort of have a mental picture, in other words, you know the geology, the recharge on the Cape, you've selected your model, this is the modeling process. You develop a grid, input your parameters, you perform a steady-state flow simulation. In other words, you want your model -- in the calibration process you want the predicted water levels to match what's measured out in the field, the observed water level elevations that USGS and E.C. Jordan and a lot of people have collected here on the Cape. Then you input your transport parameters, perform simulations, and then do a sensitivity analysis.

Colonel Howell: Excuse me, Lisa, could you slow down just a little bit for our reporter?

Ms. Durham: Okay, I'm sorry. This is a figure showing the groundwater elevations on the Cape. It's in 10 foot contour intervals. The arrows here indicate the direction of groundwater flow, so you can see in the area of the wastewater treatment plant the groundwater flows to the south. In the area of Falmouth wastewater treatment plant the flow is to the east and to the southeast. And then up near the Canal the water is towards -- flows towards the northwest.

This is the finite-element grid that I spoke about. This is in the area of the Falmouth wastewater treatment plant. This grid was used to simulate the alternatives 1 and 1a for the EIS, and you can see the area of the Falmouth wastewater treatment plant. That's where the quadrilaterals get quite small because we use that to simulate the disposal beds, and also the spray irrigation area. I'll also point out along the grid the Constant Head boundary, which is to my right. This goes along the Coonamesset Pond and the Coonamesset River, and this is where the model terminates.

This is the potential metric surface. In other words, it's just another way of saying these are the elevations of the groundwater above mean sea level. This is the actual measure in the field, and these are five foot contour intervals. And this is the model predicted. So like I said, in the calibration process that's how you validate your model. You want to make sure what you -- what your model predicts is what you measure -- it matches what's measured in the field.

This is the disposal location. This is a blow-up of the figure that John showed. This shows the location of the sand filter beds, disposal location for Alternative 1a. And then just south of that is disposal location for Alternative 1, and then the current disposal location that Falmouth is using. And then in the area around that is the spray irrigation area that Falmouth uses.

Okay, this table shows you the results of the simulations. The first four columns, if you focus on those, those are the input parameters. So for example, look at Alternative 1, we did two level rates, 300,000 gallons per day and 500,000. And then in conjunction with that, we also simulated what Falmouth disposed of, their current disposal rate, and this was measured between September 87 and October of 88. They disposed, on the average, 300,000 gallons per day, where 28% or 80,000 gallons per day was disposed of by sand filter beds, and 72% or 224,000 gallons per day was disposed of by spray irrigation.

The nitrogen concentration, the 19.7 milligrams per liter, that was what was measured from -- the average concentration that was measured from the effluent from September 87 through October 88. If you look at the fourth column, the 19.7 milligrams per liter, is the nitrogen concentration that's disposed of -- or the nitrogen concentration in the wastewater that is disposed of into the effluent.

The 15 milligrams per liter, this is the concentration that was spray irrigated. In other words, we assumed that 25% of the nitrogen would be uptaken by the plants. So the concentration of the water -- it reaches the water table that was spray irrigated was 15 milligrams per liter. And in the last three columns are the results, the acres, this is the area where the groundwater has a concentration 10 milligrams per liter or greater, the maximum water levels just amounting as a result of the additional wastewater, and then the maximum concentration of nitrogen, and this right at the point source.

So let me show you -- these figures are all in your books. This is Alternative 1, disposing of 300,000 gallons per day at Falmouth, and then 300,000 gallons per day from Otis. You can see the 10 milligram per liter area, that's just the area that was -- where the groundwater has a concentration of 10 milligrams per liter or greater. And the other two lines on this figure, the kind of the jagged one, this is the current permitted Class III area at the Falmouth wastewater treatment plant, and then the thing extending from the landfill. This was worked on by CDM in 1983, and this is the projected flow of ground water from the landfill.

Alternative 1a, this is the same disposal rates, although the concentration is different because the 15 milligrams per liter is -- was the average concentration of nitrogen in the effluent discharged at Otis. Here you can see the 10 milligram per liter area lies outside the current Class III area. When we were doing our work we thought well maybe this is a function of the location sand filter beds, because if you remember from the previous slide, the sand filter beds for Alternative 1a are further north. So what we did is we ran four other simulations using sand filter beds for Alternative 1, in other words, we used the sand filter beds further to the south. And as we expected, the almost 10 milligram per liter area with the same disposal rate does lie within the Class III area, the permanent Class III area.

So this sort of concludes the modeling work that we did for Falmouth. We then looked at the out for Alternatives 2 and 3 and the no action Alternative, Alternative 2 being spray irrigation, and Alternative 3 being the Bardenpho, and this is the area that Tom helped me model. This is about a 10,000 acre area.

For this model the boundaries were Coonamessett Pond and the Coonamessett River and the Childs River. And one again, the area close -- or the area of the Otis wastewater treatment plant, the quadrilaterals get small. This is where we were simulating the infiltration from the sand filter beds and the spray irrigation.

Okay, this is the model predicted groundwater surface, or elevations of the groundwater. And as you can see, water flows from a high elevation to a low elevation, groundwater flows to the south, and this is similar to what you saw on the other slide.

This is the finite-element grid for the area near the Canal. In this area there wasn't a lot of data at first, and in the area bound and the Falmouth wastewater treatment plant CDM, USGS, and E.C. Jordan did a lot of field measurement work. So Weston Geophysical did both the Phase I and the Phase II study. They did two studies to determine sort of the groundwater elevations, and also to get some parameters on the aquifer they did some pump tests and some slug tests, and in this area those reports are available too, I think, in your libraries.

Now this is the potentiometric surface, in other words, this is the groundwater elevations in this area of the Canal the model predicted. So the results for these simulations, 2, 3 and 4, once again we used 300,000 gallons per day and 500,000 gallons per day as our loading rate. The initial nitrogen concentration for Alternative 2, which was spray irrigation, was nine milligrams per liter, and in this -- in this scenario we used 40% of nitrogen and 40% --I mean 15 milligrams to nine milligrams would be reduced by plant uptake, and this is a conservative estimate.

We used 40% at Otis and 25% at Falmouth, two different percentages, because at Falmouth is a wooded area, whereas in the Otis area it's more grasses. The maximum water level, that's the mounding, and the maximum concentration of nitrogen, that's right at the point source.

Alternative 3, we used an initial nitrogen concentration of 10 milligrams per liter, and this is once again a conservative estimate of the Bardenpho process. And I think Bob Peters says that you can get the nitrogen concentration much lower than 10. In the 15 milligrams per liter this is what was measured from the plant, and this is the Canal area, and you can see the maximum water level and the maximum concentration of the Canal, 3.5 and 45.5 milligrams per liter.

This is the no action alternative, Alternative 5. This was at the Otis ?? for disposing of 300,000 gallons per day and an initial nitrogen concentration of 15 milligrams per liter. Here we have an area affected of about 3.3 acres, and I'll show you some of the slides in just a minute.

This is the same scenario except we increased the loading rate to 500,000 gallons per day, so a tabular form, the two loading rates, the initial nitrogen concentration, the area that was affected, the maximum water level about a half a foot and a foot for loading rates of 300,000 and 500,000 gallons per day respectively, and with a maximum nitrogen concentration which is right there at the point source.

So in summary, only Alternatives 1, 1a and 5 had groundwater nitrogen concentrations greater than 10 milligrams per liter. Altered groundwater in the vicinity of Ashumet Pond was a result from Alternatives 2, 3 and 5. Groundwater flow in the vicinity of Long Pond was unaffected, and I should mention that when we do the simulations for Alternatives 1 and 1a, we had a pumping well in Long Pond, which is what we used, and we simulated maximum pumping rate like at four million gallons a day, with maximum disposal to see if there would be any effect on the groundwater flow, and we saw minimal, very little effect, and this was the same result that CDM found there in doing their work.

And finally, the mass balance analysis shows that nitrogen concentrations in the Cape Cod Canal will be less than 2×10^{-4} milligrams per liter, this is .0002, and this is because of the dilution effect of the flushing of the Canal.

Dr. Krummel: To wrap this up, I just briefly want to show you what we have ranked as the environmental impacts for first, the short term impacts related to the construction activities that would occur. We ranked them from zero to four, zero being absolutely no impact, one being very, very minor and not requiring mitigation, two and three, two being low, three being a little bit more severe, but both of those could be mitigated by some action or actions, and four, an impact so high that no matter what anybody did, if those alternatives were implemented there would be major environmental problems.

First of all, let me say that you will find tables like this in every Environmental Impact Statement. CEQ regulations require that there be a table to rank some relative way of all the impacts of all the alternatives, including the no action alternative.

And secondly, again the long term impacts for the environment. This has to do with the operation, the long term operation of any of the alternatives. The same relative ranking was used. Both of these are available and explained in the EIS. So if you have comments and would like to talk about these tables, they are in the EIS.

This is all we have to say as far as the technical briefing. Let me reiterate again that the Weston Geophysical reports on the geohydrology work at the Cape Cod Canal are available in all the local libraries. And finally, if not everybody could see the maps and would like to look at them and inspect them more closely, we did bring posters of all the maps, so if you would like to see those, stop by and talk to Lisa or myself, and you're happy to look at them in detail. Thank you.

Colonel Howell: May we have the lights, please? Thank you Dr. Krummel. Dr. Durham -- do you have a doctorate? You should have, you should have. But thank you anyway, both of you.

Let me just go over procedures for a moment for the benefit of those of you who may have come in after we started. You were invited to fill out an Attendance Card or Comment Sheet when you arrived. If you have not filled out your sheet as yet, please do so during the break. Regarding a making of a statement tonight, elected public officials will be called upon first to make statements. For those others who indicate a desire to make a statement, your cards will be randomly selected. Statements should be limited to five minutes, or 10 minutes for public officials.

If you do not wish to make a public statement, or if we run out of time, and I don't think that's likely, or if you have additional comments beyond those you are able to make within your allotted time, you may turn in written comments after this meeting, or send them to the address provided on the handout at Andrews Air Force Base.

I recognize that some people may wish to make statements on defense policy, nuclear weapons, arms controls, fiscal policy, anything of that sort at this meeting, but I would suggest that your comments are best directed to your Congressman and Senators. Please limit your comments here to the environmental issues that we're dealing with.

Finally, I'll just reiterate my comment about refraining from public demonstrations against or for statements made, as this merely subtracts from the time available to us.

Okay, if you all would fill out your Comment Sheets and give them to Mr. Karson or to me, and let's take a 10 minute break, and we will be back at 8 o'clock for first questions and then comments. I believe there are public restrooms right behind this area. Is that right, Mr. Karson?

Our 10 minutes are up for the recess. Do I have all of the Comment Sheets for the people wishing to ask questions or make statements? I've received a total of six, three of whom -- okay, good, here's some -- what, one, two, three more.

All right, let's turn to the question and answer period of this public hearing. Now this time is set aside to allow you to ask questions about the content of the briefing and the Draft Environmental Impact Statement, and once recognized by me, please step to the microphone since we want to be able to first hear all of your question or statement, and second, so that we can record it for the record for Mr. Tarbox's tape recorder.

Please state your name and affiliation or address, and ask your question or make your statement. If you read from a prepared statement which you would like to have entered into the record, please give that to Mr. Karson, or leave it on the table where the slide projector is located, or give it to me.

Okay. First, from the Board of Selectmen, Virginia Valiela, is that correct? Almost. And your question, please?

Ms. Valiela: I'm Virginia Valiela, I'm Chairman of the Board of Health, and I'm also a member of the Board of Selectmen, which is the same thing in the town of Falmouth, and I would like to speak on behalf of the Board of Selectmen.

Colonel Howell: Do you have a question first?

Ms. Valiela: I have a statement, and then I have three questions.

Colonel Howell: Okay. You prefer to do the statement first?

Ms. Valiela: Yes, I do.

Colonel Howell: Okay, go right ahead.

Ms. Valiela: We have been concerned about this discharge from the wastewater treatment plant since its discovery 10 years ago, and it caused the closing of a well in the town of Falmouth, and it also caused us to lose four identified million gallon a day well sites, for a total of 5 million gallons a day of water supply that the town had been counting on. Our goal has always been to recover that aquifer, and so we wholeheartedly support the efforts now being made by the National Guard Bureau to solve this contamination problem and to bring this plant into compliance.

We have given a great deal of thought to the Draft EIS, and we have specific comments on each one of the alternatives. What we have done is to discuss the alternatives in terms of increasing aid -- benefit to the environment, to our water supply, to the other water bodies in the area which have recreational value, and as I say, to what would be most beneficial to the aquifer, which is a regional aquifer.

So I will start first with those alternatives that we are opposed to, because we see them as no benefit at all. Obviously Alternative 5, which is no action, leaves us with the status quo in the five lost wells, and so we are very much opposed to that. We are also opposed to Alternative 4a, which is the pipeline into the Cape Cod Canal, which is against everything that the Cape has fought for in terms of improving its water quality around the Cape and it's fisheries, and it's against the Ocean Sanctuaries Act.

My second set of comments has to do with Alternatives 1 and 1a, which are the discharge at the Falmouth wastewater treatment plant area, either using plant facilities or in new beds near there. We have six problems with that alternative. The first is that it is a Class III discharge, and that is that the nitrogen is higher than 10 parts per million. The acreage affected may be this much acreage or that much acreage, but it is a Class III discharge and we are opposed to that. We feel that any of the discharges should be Class I.

This Class III discharge will ultimately enrich West Falmouth Harbor and Buzzards Bay. There is a very strong coalition of towns from Falmouth to New Bedford that is trying to protect and restore Buzzards Bay, and this would be in the opposite direction to that.

We feel that there is still some risk of having the land fill plume which flows between the two treatment plants and Long Pond being affected by additional discharge into that area, and we are just very nervous about affecting Long Pond which is our water supply.

The third is that the area that's been allocated for the Otis discharge is an area that already has been planned and allocated to Falmouth spray irrigation in Phase II. The town is partially sewered, there is a second section that is to be sewered, and the territory that has been put on the map by the Guard Bureau is land that's already on the maps for our spray irrigation system, and we find that to be an instant concern. This land also was not free; we paid for it, and there is no discussion of that either.

More local impact from discharge in that area, being Class III, we'll have both nitrogen and phosphorous. There is a large maple swamp which is a wetland. We have local wetland regulations that do not allow for activities that would enrich the swamp. We feel that the swamp would be affected. There is also a very deep kettle hole downstream called Crocker Pond that is probably within the impact of this discharge as presently proposed.

And lastly, very much farther downstream there are private wells, and we would question whether they also would be affected. My final concern about the Alternative 1 is that it -- again, the construction area is an area that is the Wildlife Corridor for the town. We have an overlay district for -- to protect wildlife, specifically for deer migration, and based on what I see on your maps, this goes right across that corridor. That's -- those are the comments we have in disagreement with Alternative 1 and 1a.

Colonel Howell: Okay.

Ms. Valiela: Of the remaining three -- I know, I have 10 minutes, right?

Colonel Howell: Yes, Ma'am.

Ms. Valiela: The remaining three alternatives have positive effects on the groundwater and on the environment, and again, as I said, we're ranking them in terms of each one being more beneficial than the next. Alternative 3 is tertiary treatment. It does remove nitrogen, and it will bring the effluent below 10 parts per million in drinking water standard. However, as it is presently proposed to dispose of in those sand filter beds, it is still going to put phosphorous into Ashumet Pond. This pond is already heavily stressed with the existing sewage treatment plant plume, and this will just perpetuate it. We are very uncomfortable about that. Sand filter beds in another area that does not affect Ashumet Pond is possible, but hasn't been presented.

Next best is Alternative 2, which is spray irrigation. This removes both the phosphorous and the nitrogen. It's in an area where there are no ponds within a mile, and it sprays the effluent over a large area, roughly 70 acres, and therefore the inorganic chemicals in the plume would be dispersed over that area, and I believe there would be minimal impact. So we feel reasonably comfortable with that alternative.

And the best alternative in terms of maximizing water supply and minimizing impact to human receptors or fresh water life is the one that locates the beds at the north side of the Base. We support this alternative, however, with the clear understanding that it should be a Class I discharge. You still need to remove the nitrogen prior to entering the salt water body, which is the Canal. We recognize that there is significant dilution in the groundwater which is fast in that area and in the Canal, but we're supporting Alternative 4 with the statement that it should be a Class I discharge.

Okay, my question. These questions may not be answerable by your technical staff. They may ultimately need to come from a regulatory agency, but we feel they're important. We want this process to go forward, and we want these questions to be raised and answered so that this whole thing doesn't get stuck.

Okay. The first question has to do with sand filter beds in either location, and that is, are there any other standards for Class I other than the nitrogen 10 parts per million that need to be met in this discharge, and DEQE is going to have to answer that. You don't have to answer that, but it is a question that has to be answered. We are unclear as to whether nitrogen is the only standard that needs to be met.

The second question which has to do with spray irrigation over the grasses and the legumes, and that question is that at what point in the process is the nitrogen measured to decide whether this discharge meets DEQE discharge permit limits or not? The options are it can be measured at the nozzlehead prior to spray irrigation, it can be measured as groundwater after the land has treated it and it's -- you might say a point source right out of the site, or maybe it's measured at the boundary, the property boundary of the base. This is again a question that probably the regulatory agency has to answer, but it needs to be answered.

Colonel Howell: Dr. Krummel, are you able to answer that question?

Dr. Krummel: No. We have to defer to DEQE for answers as far as monitoring and/or regulatory criteria.

Ms. Valiela: Your discharge permit says at -- it must be whatever number, and the question I'm asking is where in the system is that number?

Okay. Third question has to do with sand filter beds, and again, it's basically at what point, if you're using a sand filter bed discharge, is compliance with the permit taken?

Dr. Krummel: I would answer the way I answered before. Those have to be specified in regulations so that they can be issued in a permit for compliance.

Ms. Valiela: Okay. We obviously want compliance. We also need to know what we're dealing with, that's why I raise the question.

The summary is that we wholeheartedly support the effort that's being done by the Guard Bureau. We believe that a discharge, wherever it's located, should be Class I, and we feel Alternative 4 with a Class I discharge -- Class I treatment is the best of the alternatives that have been presented. And I thank you for your time.

Colonel Howell: Thank you. Next for a question, Mr. James Hain. Is that right, Mr. Hain? Sir? And I note that you have both a question and a comment. Would you prefer your question or your comment to come first?

Mr. Hain: I have two comments and a question, and it can come either way.

Colonel Howell: Since we have so few speaking tonight, whichever way you prefer.

Mr. Hain: I'm James Hain, of 289 Hatchboro Road. And my first comment is related to the technical presentation, and I see that you will be giving the same presentation tomorrow evening and I politely suggest that -- for people in the room who are very much of this information for the first time, that you have skipped some steps.

For example, you haven't defined your terms as carefully as you might. What is a Class III, why is 10 milligrams per liter important, etc., etc. Secondly, my next comment has to do with the time line that has been set by the Air National Guard, or whoever, and I see that you're receiving your comments by August 11th, and my opinion is that this is inappropriate for those in the room who are reading the EIS for the first time this evening. And my experience is that very often there's a 30-day response period at the least for these kind of things, and given that this is a fairly complex issue where several factors come into play, I would suggest that this might be reconsidered.

Colonel Howell: Well, Mr. Hain, we were discussing that in recess, and our regulation from which I took that time limit indicates two weeks. And Mr. Masse, you were saying that you wanted to extend it to the 21st?

Mr. Masse: Well, the official comment period when the comments close in the Federal Register calls for a 45-day period, which terminates at 21 August.

Colonel Howell: Okay. Then I think if it's in by the 21st of August that's certainly well within the Federal Register comment time.

Mr. Hain: Again, my experiences of 30-day period is typical. We're all in agreement on that.

Colonel Howell: Yes. That was initially drafted out of our regulation, which said two weeks is normal.

Mr. Hain: Sure. And my question then has to do with the alternatives, and again, maybe perhaps this was not charged to the Argonne people, but in the past I've seen, when alternatives have been listed, that there is a recommended alternative. I'm wondering if that is the case here, what is the recommended alternative, and from the people at Argonne who have had perhaps the most experience looking at this, what would that be and why is that?

Colonel Howell: Mr. Krummel, are you --

Dr. Krummel: I'll answer very briefly. Not all EIS's have recommended alternatives, and at this point there is no recommended alternative by Argonne or the Air National Guard.

Colonel Howell: Mr. Edwin Pratt, Jr., of Marion, Mass., you'd like to make a comment, Sir?

Mr. Pratt: And some questions.

Colonel Howell: Okay. I'll add questions.

Mr. Pratt: My name's Ted Pratt, and I'm the Chairman of Marion Board of Health, and I'm a member of the Marion Board of Selectmen. Like our colleagues in Falmouth we are both. I am also Chairman of the Buzzards Bay Advisory Committee, which is a committee made up of 15 municipalities around Buzzards Bay. I'm also a member of the Management Committee for the Buzzards Bay Project, and I'm also here as a member of the Board of Directors of the Buzzards Bay Coalition.

I'd like to commend the National Guard for its new approach. In the past we have felt sometimes that they've been more like an occupying than defending army, and I think the new attitude taken by the current folks in charge is very encouraging for those of us who have been very distressed by the environmental issues that have arisen around mismanagement of the Base's landfill and wastewater treatment plant.

I really would to s.y that I'm here to demonstrate that there is a regional concern about what goes on in Falmouth that extends at least as far as Westport, and really, when you consider that the Canal flows both ways, up to Boston, and that anything that is done in the treatment of the wastewater out of Otis Air Force base has an impact far greater than the maps that we saw here. Therefore, I really think that the only goal that can be shot for is a Class I literally drinking water standard discharge, that the receiving body of water, be it groundwater or ocean water, needs to be of a worse quality than the water running into it, and I think that's the only acceptable standard.

Therefore, I would strongly support the criticism and comments that Virginia made regarding the alternatives. I think you have no choice but to treat the effluent to tertiary standards, and then discharge it as Class I discharge into whatever receiving body it uses. I think any other alternative is completely unacceptable because you must extend your time line into the future indefinitely.

Increasing studies in the Buzzards Bay Project, especially in Buttermilk Bay, indicate that the major villain for at least near-coastal water pollution is nitrogen nutrients, which change the biological processes in the water and essentially destroy existing life forms through the removal of oxygen. And therefore, the Class III levels of nitrogen in the discharge waters are simply not acceptable because in time the nitrogen will eventually end up in the Bay or in the Sound and add to the degradation. That admittedly, far greater sources of nitrogen already occur right now.

The town of Marion has a sewer plant that processes under a 300,000 gallon a day discharge, and we handle up to 500,000 gallons a day and are currently under administrative order. But we have a Class I discharge. We use stabilization lagoons and sand filters. We are exploring aggressively alternate technology, including Solar Aquatic technology, and believe that we can achieve a coliform level that allows us to use UV radiation, and a BOD and a nitrogen loading level that essentially meets drinking water standards without any mechanical process.

We would urge you to look into more of the technology, and are prepared to share with you any information that we have developed in our processes and move forward with it, and I would encourage you to explore any possible regional relationships that you might build with the many organizations around the Bay that are already doing this work. It seems foolish to reinvent the wheel; I would urge those in charge of the development of this project to reach out to the Buzzards Bay Project, and to sewer plant operators around the Bay to share information, and to do that as quickly as possible.

I guess finally I would just comment that it seems really important to start setting some standards, and if the federal government can't do it, then I don't know who can. You folks should be leading this because you represent all of us, not just a small constituency. You are the country embodied. Therefore, you should be urging us to the highest standards, which has been the traditional role of the federal government in other areas of endeavor.

I think it's unfortunate that typically it's been local voices that have been working so hard, and in the past, but thankfully not now, reaching a stone wall in dealing with federal installations, especially DOD installations where essentially we've been told we've been interfering with the defense of the country, which in some cases has been our very lives which we have been defending. So I urge you to reach for the very best standards, to extend your time line rather than to lower your sights.

That would be the end of my statement, but I would like to ask you just a couple of specific questions, if I might. You mentioned volatile hydrocarbon discharge; I wondered how much of that is a result of the chemicals used in treating the effluent, and how much of it was a result of the effluent itself?

Dr. Krummel: I don't want to put you off, but I would have to look at the data. The data came from a sample that Oak Ridge National Laboratory took, and I don't believe the chemicals came from the actual facility itself. However, I would defer to look at it more closely and answer your comment with the data that we have.

Mr. Pratt: Because I know some of the modern chemical denitrification plants are very nasty animals.

Dr. Krummel: This facility is not a chemical facility, in it's a treatment process.

Mr. Pratt: You also, in your calculation to plant nitrogen uptake -- I'd be interested in knowing how you weighted that by season and if you have tables. I looked briefly through your analysis and there wasn't any real rigorous discussion of seasonal impacts on that, and that would be useful.

Dr. Krummel: We did use a yearly average, I can tell you that much. Your comment is noted that there are seasonal variations.

Mr. Pratt: I would make the observation that averages are good for oversight, but one of the most important aspects, as anybody who's in charge of a sewer plant knows, is how you operate it, and operational activities go day to day. So therefore, any useful analysis needs to take that into consideration. Thank you.

Colonel Howell: Thank you, Mr. Pratt. Okay. The other forms, Mr. David Dow, do you wish to ask a question, Sir?

Mr. Dow: Yes.

Colonel Howell: Would you like to use the microphone, please?

Mr. Dow: My name is David Dow, I live at 98 Port Platte Circle, and I'm representing the Cape Cod group of the Sierra Club. The question I have was in the analysis of the potential impacts of the effluent they only dealt with the impacts of nitrogen, and I was wondering since sewage effluent contain a number of heavy metals, and also contain viruses, neither of which are effectively handled by secondary treatment, why didn't you do an analysis of the potential impacts of these factors?

Colonel Howell: Are you able to respond to that, Mr. Krummel?

Dr. Krummel: I don't want to put you off, but that response would take more than several sentences. It is noted, and will be responded to. I can say that a driving force in this was DEQE regulations related to Class III water, and how it was defined currently. But I do note your comment that there are many other constituents to waste water.

Colonel Howell: Do I understand you'll be responded to directly, and then also in the EIS, or --

Dr. Krummel: Let me just clarify that. The EIS process requires written responses to every comment, and whether those comments are sent directly to the Air National Guard or are delivered here at the public meeting, it's really the same, so you will see your comment written down with the written response in the final document.

Mr. Dow: Thank you.

Colonel Howell: Yes, Sir, Mr. Dow. Thank you. The other forms I have do not request questions or statements. Is there anyone else who wishes to be heard or to ask a question at this time? Yes, Sir? Please?

Mr. Whalen: Thank you. My name is Christopher Whalen, I'm the Executive Secretary to the Board of Selectmen in Sandwich. And I'm here to speak on behalf of the Board of Selectmen to express their concern which Virginia Valiela spoke to concerning Canal discharge.

The people of Sandwich, in large measure, defeated a proposal to have their own treatment plant discharged to the Canal back in 1981. The residents of the community felt that was an unacceptable arrangement. There were other factors involved in the decision, but that was very much a factor in the town people's rejection of the proposal to have the town municipal wastewater treatment facility discharged into the Canal.

Since then I understand the Ocean Sanctuaries Act has been amended to include the Canal, and I think that that would be a major concern -- any type of Canal discharge, be it direct discharge into the Canal or proximate discharge into the Canal, would be of concern to the residents of Sandwich. And although we may not be directly affected in terms of construction or location of the site, as a proximate community Sandwich would be very concerned about this.

And that would be the comment that I'd like to make. And for my own clarification and for the other members of our Boards in town, the comment period, the 21st -- if our Water Quality Review Committee wanted to submit written comments for the Board of Health, do they have until the 21st, or the 11th, as indicated on the sheet?

Dr. Krummel: The 21st is the correct date. Yes, you have till the 21st.

Mr. Whalen: Thank you.

Colonel Howell: Thank you, Sir. Are there any --is there anyone else who wishes to be heard or ask a question? Yes, Ma'am?

Ms. Shambaugh: My name is Claudia Shambaugh, I'm a resident of Marion, Massachusetts, and also a Project Planner of the Coastal Zone Management Program in Massachusetts. And I'm not speaking for the program, but with the background of the program it's abundantly clear to me that there's been a tremendous investment in the -- in improving a resource in the Buzzards Bay vicinity.

That --it's not just the federal level, but the state and the local governments as well, and so I think that to back up what Ted and Virginia were both saying, that a great deal of attention should be given to the importance of the Class I discharge, that it would be really an inconsistent direction to take to consider less than that classification, when we look at the tremendous investment made on all these levels of government. Thank you.

Colonel Howell: Thank you. Is there anyone else who wishes to be heard? Apparently not. We'll conclude these proceedings at this time, then, and I would remind you that our revised date is the 21st of August to submit written materials to be included in the transcript of the hearing, and those written statements will be fully considered and addressed in the Final Environmental Impact Statement, as Dr. Krummel has indicated.

Once again, oral and written statements or comments will be afforded equal weight. Officials of the Air Force and the National Guard Bureau appreciate your efforts for coming out tonight and contributing your views to this public hearing. We thank you for your courteous attention. Please be assured that the Air Force decision-makers will carefully consider each viewpoint raised here tonight when deciding the ultimate course in this proposal. Thank you again, and this public hearing is adjourned at 8:30.

APPENDIX J: PART II

PUBLIC HEARING TRANSCRIPT FOR BOURNE/BUZZARDS BAY

Public Hearing Transcript: Bourne/Buzzards Bay — July 27, 1989

Colonel Howell: Good evening, ladies and gentlemen. Let's please take our seats. The National Environmental Policy Act, and the implementing regulations, require federal agencies to carefully analyze the potential environmental impacts of proposed actions, and to use those analyses in arriving at decisions or recommendations on whether, and how, to proceed with those actions.

The Air Force has prepared and distributed, in accordance with applicable regulations, a Draft Environmental Impact Statement addressing a proposal to modify the wastewater treatment plant at the Otis Air National Guard Base, and I believe there are copies of the Draft back on the table. Is that right, Mr. Masse?

Mr. Masse: Yes.

Colonel Howell: Right, thank you. My name is Colonel John Howell, and I am a full time military trial judge for Air Force courts martial. I have been designated by the Office of the Judge Advocate General in Washington as Presiding Officer for tonight's public hearing on the Draft Environmental Impact Statement.

I am not here as an expert on this proposal, nor have I had any connection with its development. I am not here to act as a legal advisor to the Air Force experts, or to address this proposal. My purpose is simply to ensure that we have a fair, orderly hearing, and that all who wish to be heard have a fair chance to speak.

Let me take just a moment to explain how tonight's hearing will proceed. This isn't going to be a debate, nor a referendum, or a vote on the proposal itself. With your cooperation, there will be no demonstrations, nor should you signify your agreement or disagreement with a speaker's position by applause or other expressions of approval or disapproval. This adds nothing to the hearing record, but simply wastes your valuable time. This may be, in fact, the only time available for your personal input to our government's decision making process.

What this informal hearing is intended to provide is a public forum for two-way communications, with a view to improvement of the overall decision making process. You notice that I said two-way communications. Part one of that calls for you to listen carefully to what the Air Force experts say as you are briefed on the proposal and its anticipated environmental consequences. After the briefing, we will take a short recess, and then you will be able to ask questions to clarify in your mind any points made in the briefing or in the Draft Environmental Impact Statement.

Part two of this process is for you to tell the Air Force --Air Force experts what you think, and to give the Air Force decision makers the benefit of your knowledge of the local area affected by the proposal, and any environmental hazards that you perceive.

I'd like to emphasize that this is a proposal, and not something that's already been decided, approved, or funded. Our hearing is not for the purpose of justifying anything, but rather to identify and assess pertinent impacts, including your personal perspective as to those impacts.

Take notes as you choose during the briefing, and please fill out one of our Comment Cards. You may indicate on the Comment Card if you wish to ask a question or make a statement. Right after the recess, and after I've had a chance to collect all the cards, I will recognize members of the public for purposes of putting a question to the Air Force experts, or making a statement about the proposal. Don't be shy or hesitant to ask a question or make a statement. This is an informal hearing, and there are no dumb questions.

I want to help ensure that all who wish to speak have a fair chance to be heard, so please help me enforce the following ground rules. First, please speak only after I recognize you, and please address your remarks to me.

Second, speak clearly and slowly, starting out with your full name, address, and the capacity in which you appear, that is, as a public official, a designated representative of a private association, or a person speaking solely in his or her individual capacity so our Court Reporter, Mr. Tarbox, who has to make a verbatim record of these proceedings, can do his job professionally.

Third, if you have questions for the panel, please ask one question at a time. I will certainly allow a reasonable number of questions.

Fourth, statements will be limited to five minutes for each individual person, and 10 minutes for public representatives. I believe that was the number that was advertised, is that correct? That includes, as I said, the public officials.

Please honor any requests from me that you stop speaking.

Sixth, please do not speak while another is speaking. Only one person will be recognized at a time. And finally, I have been advised that this is a No Smoking area -- I believe it's posted rather prominently here -- and I would appreciate your cooperation with that rule.

Now it is possible that there will be questions that the Air Force representatives are unable to answer. This could occur for one of two reasons. First, even though a good deal of expertise is assembled here tonight, they will not attempt to answer questions unless they are confident that they can do so accurately. Second, there may be questions that have national security implications, and these must be reviewed before further answers can be provided. If that should occur, and under the circumstances I really don't anticipate it, but if that should occur and that the question is relevant, I can assure you that it will be addressed in the final document, which you may request a copy of.

You'll note that statements can be submitted at any time prior to the 21st of August of this year, and the address for you to submit them is on our Comment Sheet, and you'll notice that the address is at the Otis Air National Guard Base here in Massachusetts. Regardless of whether you read your statement on the record tonight or mail it in later, it will be carefully considered and made part of the record of these proceedings. It will have equal weight, and receive the same careful consideration, whether made during tonight's hearings or afterwards.

I would like to thank everyone who turned out here tonight. Your presence here is commendable in that it reflects a great interest in your community and in the things that are important to it. Let me assure you that your interest is the primary purpose for us being here.

Now before proceeding any further, I'd like to introduce LTC Keating, who is the Otis Installation Commander. Colonel Keating?

Colonel Keating: I'd like to thank everybody, particularly the town of Bourne, for having us here tonight, and in particular Marie Oliva and Tom Barlow. Also, the state representatives, Mr. Turkington who was with us last night, and Tom Cahir who is with us this evening. Of particular thanks, I would like very much to tell you that Congressman Studds has done a great job in supporting us in this area, the representatives here tonight, Mark Forest and also Senator Kennedy, who really support us, and I would be remiss not to mention this to you tonight. I would like to tell you also that the officials at the base do not have a position on the options. Though the options have been reviewed, we do not have any particular one, and therefore, your input is very critical to us. We invite a lot of thought on this. Take your time to answer by the date that has been allotted to us. It is important to us to have your input.

I'd like to mention also that Mr. Dave Dow from the Sierra Club and Selectman Eddie Pratt of the Buzzards Bay Advisory Committee offered valuable questions and answers, and also offered us particular comments of assistance. We really invite that kind of pressure. We'll take all the assistance we can get, and in particular, I'd also like to include a special thanks to the Association for the Preservation of Cape Cod, an organization that we have worked with and talked to in the past. So please be advised, we welcome all the input we can get from the advisory groups, and particularly your questions tonight. Thank you very much.

Colonel Howell: Thank you, Sir. It's now my pleasure to introduce Dr. John Krummel from the Argonne National Laboratory, who will brief our proposal tonight. And then after the recess, and just prior to the question period, then we will introduce the rest of this team, and we will get ready for your questions. Dr. Krummel?

Dr. Krummel: Thank you very much, Colonel. Before I start, I would like to introduce two of my colleagues from Argonne who are here tonight to help out, Lisa Durham, who is one of the staff hydrologists on the project, and Dr. Robert Peters, an environmental systems engineer who is a P.E. in Indiana and Illinois.

If I could have the lights I'd like to run through some slides. Can everyone see those okay? As the Colonel mentioned, this is a public meeting to consider a Draft Environmental Impact Statement for the Massachusetts Air National Guard. Argonne National Laboratory staff are the technical consultants who wrote the document for the Air National Guard.

Argonne is located about 30 miles south west of Chicago. There are approximately 4,000 people that work at Argonne, and of those, about 2,500 are technical staff, and 90% of those 2,500 hold advanced degrees. We have a rather large environmental group that works for a number of government agencies.

Just to list some of our current EIS experience, we're doing the EIS for the U.S. Department of Energy Superconducting Super Collider in Texas; a major U.S. Department of Energy and Chevron Oil Project at the Naval Petroleum Reserve in California. This area pumps oil and adds about $1 billion a year to the U.S. Treasury. The U.S. Air Force Base Closings that some of you might know about and the realignments in California, New Mexico and Washington; and the U.S. Department of Energy New Production Defense Reactor that will be located in either South Carolina, Idaho, or the state of Washington.

This presentation has six parts to it. The first is a general overview and introduction; the second, I will talk a bit about some of the major environmental impacts; third, we go into a description of the groundwater models and groundwater modeling results that are really the heart of this whole analysis; fifth, the summary of the results; and sixth, the projected environmental impacts for each alternative. Lisa Durham will be providing most of the insights into the groundwater modeling and the results later in the talk.

This is a 1982 aerial photograph of the Otis wastewater treatment plant. I just want to point out a few things to you. The plant was rehabilitated in 1982. Currently, the disposal of the treated effluent occurs in these four sand filter beds. All eight of these were rehabilitated, but to move the effluent as far away from Ashumet Pond as possible only these plants are currently being used. Some of the main features, the effluent comes in, goes through a partial plume through an aeration unit, into the interlock tanks located up here, and then it is sent to the trickling filters, it is chlorinated, that unit has recently been installed, and from there the treated effluent is put into the sand filter beds, the sludge is put in these lined sludge drying beds.

There were five alternatives considered in this EIS, and right now I'd like to briefly run through those. For each alternative, both 300,000 gallons and 500,000 gallons of effluent disposed in various ways were considered.

For Alternative 1, we looked at pumping untreated effluent to the town of Falmouth wastewater treatment plant for treatment and disposal in existing and new infiltration basins. Alternative 1a was similar to that, although the effluent would be treated at the Otis wastewater treatment plant and then sent to the Falmouth wastewater treatment plant.

Under Alternative 2, we would use the existing Otis wastewater treatment plant and dispose of the effluent via spray irrigation.

Under Alternative 3, the plant would be upgraded, most likely with a Bardenpho process, to provide tertiary treatment for nitrogen removal and the effluent would be disposed of in the existing infiltration basins.

Alternative 4 was to pump treated effluent to the Cape Cod Canal area at the northern end of the Massachusetts Military Reservation, and there it would be disposed of in new infiltration basins that would be constructed. Alternative 4a was introduced at the request of the U.S. EPA, who wanted the Air National Guard to look at the alternative of pumping the effluent directly into the Cape Code Canal.

Alternative 5 is the no action alternative. It merely involves continuing as is, with nothing new done to the facility.

For this slide I just briefly want to point out the areas that are affected by each alternative. Here we have the Falmouth wastewater treatment plant, the land owned by the town of Falmouth. This area is currently the location of the town of Falmouth's sand filter beds. Anyway, this is -- this is the current Otis wastewater treatment plant, this being the Massachusetts Military Reservation. Here is the Otis Air National Guard wastewater treatment plant. And finally, up in that rectangle, the Cape Cod Canal flowing along there, the very northern end of the Massachusetts Military Reservation is the proposed area for Alternative 4 disposal of the treated effluent. So there are three areas that are affected down here considering all the alternatives. The town of Falmouth wastewater treatment plant, Otis wastewater treatment plant, and the area north along the Cape Cod Canal. The lines that we see connecting up there are the proposed pipeline routes. For the most part, they follow existing roadways and transmission line easements.

Our technical approach used to determine environmental impacts is rather straightforward. First, we want to define the existing conditions for baseline requirements. For example, what is the current groundwater quality, what is the current air quality, what are the land use patterns at each site. Secondly, we had to identify and evaluate what types of impacts will occur for each alternative at each site, how much land will be disturbed, how will the effluent be disposed of, etc. Thirdly, we had to quantify the level of impact for each alternative at each site. And finally, we want to determine the significance of the impacts for each alternative.

Now those impacts would be evaluated via regulatory concerns, comparing what is projected to occur with what is already at the site, or if those aren't able to be done we will look at other studies in similar situations and project those findings for the alternatives.

Briefly I just want to talk about the current regulatory constraints for the Otis wastewater treatment plant. The plant is now operated under an interim 1984 Discharge Permit. These are the parameters that the plant's now operating under, flow, biological oxygen demand, suspended solids, and settleable solids. The plant currently meets all of those standards.

Now this standard is enforced until the facility is upgraded. Once the facility is upgraded according to DEQE, the facility must meet the following standards, and they're listed there. The concern in this EIS is nitrogen. Nitrogen being 10 milligrams per liter, according to the information we have received from DEQE, this is the primary method to determine Class I and Class III areas, and so this was the parameter of concern in our groundwater modeling defining what areas would lie in Class I or Class III groundwater conditions, and what those boundaries would look like. Lisa Durham will get into more details as far as the groundwater is concerned in our evaluation of nitrogen.

About a year ago, I think I'm correct in saying that the base began to chlorinate the effluent, so both coliform is now in compliance. The one that is not is nitrogen. Now these conditions would exist back in the facility and would be upgraded.

Just a little bit of information on the current average operating conditions. The average flow rate break is a bit over 200,000 gallons per day. It fluctuates depending on training operations during the summer, or other conditions that may exist at the facility. What I want to point out to everybody is that the Otis Air National Guard facility on the base supports the utility operations of the entire Massachusetts Military Reservation. They supply the electrical power, and also provide wastewater treatment for the entire base, and that includes the Army, National Guard, Coast Guard, and any other tenant or operation that occurs in the Massachusetts Military Reservation. So these are combined flows for the entire Massachusetts Military Reservation.

Right now with an optimization program we are dealing fairly well with nitrogen removal. You can see the influent and the effluent, and currently the facility is removing in excess of 50% of the nitrogen primarily by putting the Imhoff tanks in an anaerobic condition and using the trickling filters to strip off the ammonia.

Now I'm briefly going to go over some of the major areas of concern, the first one being air quality. Both Cape Cod and the entire state of Massachusetts is in nonattainment for ozone, and as we heard the EPA announce recently the U.S. had its worst -- one of its worst years as far as ozone problems last summer. So because of the nonattainment status we looked at the effect of the facility on ozone formation, and the way we did that was to analyze the emissions of volatile hydrocarbons that could be coming from the plant.

We looked at four methods and took a worst case method, and using data that the Oak Ridge National Laboratory had collected from the site we evaluated the total tonnage of volatile hydrocarbons coming out of the facility under the 300,000 gallons per day scenario or the 500,000 gallons per day scenario. Under the 300,000 gallons a day scenario approximately .6 tons per year are -- volatile hydrocarbons are emitted. Under the 500,000 gallons we see it's about a ton. This is an insignificant contribution. To put that into perspective, this equals approximately 75 automobiles operating on Cape Cod per year. One gasoline station which pumps, let's say, an average of 50,000 gallons of gas per month would emit, according to EPA calculations, about five to six tons per year, so that would be one gas station. In comparison to those figures this is a rather insignificant contribution.

Another concern came up in October of last year when the U.S. Fish and Wildlife Service listed the Sandplain gerardia as an endangered species on Cape Cod. This is a small plant that is primarily visible in late fall on the Cape. We consulted with the U.S. Fish and Wildlife Service by sending them information on the proposed pipeline routes and where any construction activity would occur at the three sites. They sent us back a letter saying that none of their known populations occur near any of the activities. And we will most likely continue to consult with them on the status of this species on the Cape as this progress continues.

There are also two state-listed moths that are of concern. They are found near Alternative 1 and 4 pipeline routes, but are not found near any of the construction that would occur. Again, this is in consultation with the Massachusetts Natural Heritage Foundation. There are also three state-listed bird species that occur near the Otis Air National Guard Base -- the Northern Harrier, the Upland Sandpiper, and the Grasshopper Sparrow.

A study was done on the base in about 1984, I believe, done by the state, and they looked at these three species. And out of that study Otis developed a Bird Management Plan that is now being followed. We looked at the effects of this -- of these alternatives on these species. We can see that Alternative 2 and 3 would not affect any of them because none are near the wastewater treatment plant at Otis.

Construction and excavation activities on any of the other alternatives away from the facility occur in areas not used by the Northern Harrier or Grasshopper Sparrow. And finally, with the small amount of construction related to trenching and putting pipelines in, we don't believe there would be any impacts, or very, very minor impacts, on the Upland Sandpiper. The construction would not occur during the nesting season, it would be of short duration, and the area can be returned to grassy condition rather rapidly.

Another point of concern that came out in the scoping process in this EIS was human health. We have relied on the Massachusetts Department of Public Health to look at this, and in their latest study that was recently completed, I would just like to highlight three points. First of all, elevated levels of age-adjusted mortality for some causes of death are higher for Upper Cape residents compared to the rest of Massachusetts. Secondly, this study found no significant correlation with distance from the Massachusetts Military Reservation. And finally, there was no causal relationship determined for any agents that could be originated from the MMR.

Now I know most of you know that there is another study ongoing by Boston University that is about six months into the start. It's a three year study and those results are not available, in fact there are no results yet from that study. But those will also be considered if there is something we can use as this process continues.

And quickly, there's a lot of numbers on this slide, but I just want you to focus on several of them. This table is in the EIS. We list here .8 because if you notice in the current operating permit there is a .8 as the maximum amount of effluent that can be discharged. However, our analyses did not consider .8, but focused on .3 and .5. And what this looks at is the total land area that would be disturbed under the construction and operation of any of the alternatives.

Here under Alternatives 1 and 1a we see that, depending on the amount of disposal, there is a rather small amount of acreage disturbed, under 20 acres. And for example, under 10 acres if you look at .3, or 300,000 gallons of effluent per day, even smaller acreage if one looks at Alternative 1a's pipeline route.

Spray irrigation has by far the largest area disturbed. The proposed area for the spray irrigation is now a forested area; this would have to be cleared and planted with grass and lichens to achieve maximum efficiency of nitrogen and phosphorous removal. So this area would have the largest land impact associated with it. Number 3 would be trivial because it would involve merely an upgrade at the facility, which is already heavily disturbed from previous construction.

And finally, if we look at Alternative 4 and 4a, again rather negligible amounts of total land disturbed, primarily because of the length of the pipeline. And again, the proposed areas for sand filter beds, if they were to be constructed in this location, would occur in a forested area and would disturb approximately three to five acres of land.

Again, these are based on preliminary designs done by Camp, Dresser and McKee, who completed our preliminary engineering feasibility study that looked at the possibility, or the engineering feasibility of these different alternatives, and that study was published in 1984.

I would now like to turn the groundwater part of this talk over to Lisa Durham.

Ms. Durham: I and -- Christine Eddy and I are the primary hydrologists for this project. We did the groundwater modeling for the EIS. Okay. In my presentation it's going to be sort of in two parts. The first part I'm going to tell you a little bit about the model, how we chose the model, and the types of input parameters that we used. And in the second part of the presentation I'll discuss the results.

The objective of the modeling was to define the areal extent of groundwater that contains 10 milligrams per liter or greater nitrogen concentration for each of the alternatives. Now the 10 milligram per liter concentration was chosen because this is what defines the Class III area groundwater, and as John mentioned, we were using nitrogen because this was the parameter that did not meet the standards.

The modeling procedure is two-fold. First of all we develop a conceptual groundwater flow and solute transport model for the disposal sites and the surrounding vicinity using geologic and hydrologic information. And the second is select a groundwater flow and solute transport model that's capable of performing the necessary calculations. Now a conceptual model is just a mental picture, and this is formulated by looking at the geology of the Cape, looking at annual recharge, looking at how the aquifer -- how well it can conduct fluid flow.

Most of these parameters are measured, and were measured in the field. The United States Geological Survey, Dennis LeBlanc, Camp, Dresser and McKee, E.C. Jordan, these people have been working on the Cape. We used field measured parameters when they were available. And this is a schematic picture of the Cape. So for example, the Canal area that John showed in the previous picture, this is looking at the Sandwich plant, the area for Alternatives 1 and 1a, the Falmouth wastewater treatment plant. It's pretty much in this area. Here we have three different geological materials, the Buzzards Bay Outwash, the Buzzards Bay Moraine, then you have the Mashpee Pitted Outwash Plain.

This figure shows you the surface water pictures, the primary surface water picture on the Cape. Coonamessett Pond and the Coonamessett River, Johns Pond and the Childs River. There's Long Pond. Now on the Cape the groundwater is hydraulically connected to the surface water. In other words, these surface water features are where the ground water intercepts the land surface. So they provide boundaries for our model areas because they were places where we knew the natural water elevations.

So now that we have our conceptual model, we've chosen one to do the work, CFEST, which is a coupled fluid, energy and solute transport model. It was written by Gupta et al., Battelle Northwest Laboratory. CFEST is a finite-element model. It simulates hydrologic flow and solute transport, and this is in three dimensions, an aerial direction, and a vertical direction. It's, like I said, three-dimensional, it's transient or steady-state, constant or time dependent sources and sinks. Now here the sources and sinks would be parking well, would be a sink and the source would be simulated, the effluent from the wastewater treatment plant at the sand filter beds.

These charts, if you care to identify in the document -- these are transport terms, advection, dispersion, and these are needed in transport compilations. The model is very well documented and verified by David, and it's a very available in the open literature. In other words, it is not a proprietary code. Now CFEST -- it's not shown on this slide, but it was approved by the DEQE. It's been used -- since its development in 84, it's been used widely, in the States and internationally. These show its use in the Southern Basin. It was used to monitor large flows on Long Island for a wastewater supply and action based water treatment plant. It was used to -- this is just another form of the CFEST Code. It was used to model a salt repository. It was also used at a granite repository, several repositories that are listed here, and ranking by the EPA also documented verified qualities.

And then these are two other listings where the EPA has used it, and here electrical power research . I might say that I've been using the model since I've been at CFEST, and I'm using it on two other projects currently.

So once you have a conceptual picture and you've selected your model, this is the process that we went through at Argonne. First of all, we developed a grid based on our mental picture. Then we put in the boundary conditions, head estimates, meaning just to the water elevations that we do, and then several other hydrogeologic parameters like precipitation, etc.

Then we performed the steady-state flow simulations. So in modeling it's a two-part process. First of all you do the field work, and you want your field -- you want your model predicted water elevations to match what's measured in the field, and that's how you get a confidence in your model. So once it's calibrated, then you put the input transport parameters, and then we performed the steady-state conditions for the transport part of the process.

Now this figure shows you the water elevations on the Cape. This is like 60 feet, 50 feet, with your elevations above mean sea level --these are water elevations. The arrows indicate the direction of groundwater flow. So for example, in the area of the MMR, groundwater flow is to the south, in the area of the Falmouth wastewater treatment plant groundwater flow is to the east and to the southeast. And then up in the Cape Cod Canal area groundwater flow is to northwest. This is -- these are average flow levels, and this was done by LeBlanc and USGS.

So now I'm going to go through the three areas that we modeled at Argonne. This is the area for Alternatives 1 and 1a, Falmouth wastewater treatment plant. As I mentioned earlier, this is the Coonamessett Pond and the Coonamessett River which are boundaries. These quadrilaterals get quite small in this area because this is the Falmouth wastewater treatment plant. The small elements represent the sand filter bed locations, and then also the spray irrigation area. And you can see that this is an outlying loll font, so these are areas below the actual water level.

So as I mentioned, in the modeling process this is the actual potentiometric surface, or that's another way of saying the actual water level elevations. This is just a blowup of the previous slide. And these are my model predicted groundwater elevations, so you can see what I did was I adjusted the hydraulic parameters until I got the best match. This should be saved for the next few slides. This is the current Class III permitted boundary at the Falmouth wastewater treatment plant.

Just to reiterate, I'm going to point out these disposal locations. This area is the current disposal location that the town of Falmouth is using for their sand filter beds. These are the disposal locations for Alternative 1, and disposal location for Alternative 1a.

Now this table is in your EIS. Let me try and point out a few things here. First of all, these first four columns are input parameters. The 300,000 and 500,000 gallons per day are what we simulated from the Otis wastewater treatment plant. The 19.7, this is the initial nitrogen concentration of the influent that we're loading into the model. Now this number was determined from September of 87 to October of 88 at Falmouth. This was the concentration of nitrogen that was coming in the treatment effluent. So for Alternative 1 this is what we've used as our initial nitrogen concentration.

Now, along with simulating the loading rates for Otis, we also modeled the Falmouth disposal conditions. You see there are two numbers here, 80,000 gallons per day, and 224,000. This is 300,000 gallons per day. This was the current disposal rate at the Falmouth wastewater treatment plant and was measured from September 87 through October of 1988. Twenty eight percent of that 300,000 gallons per day was disposed of in the sand filter beds. Two hundred and twenty four thousand gallons per day were disposed of by spray irrigation. The 19.7 here is that one that I told you about earlier, and the 15 milligrams per liter for the spray irrigation.

Now this number is estimated because we assumed that the plants at Falmouth would remove 25% of the nitrogen before it reached the water table, so that's why the concentration is pretty small. This -- these numbers are the maximum permitted loading rate that's allowed for the Falmouth wastewater treatment plant, that's 800,000 gallons per day. Now we didn't have any figures about how much we could spray irrigate and how much would be disposed of by sand filter infiltration, so we used the same percentages, 28% and 72%.

This is the area where the groundwater has a concentration of 10 milligrams per liter or greater, so these are my model projections. So for example, for Alternative 1 there is a seven-acre area. The maximum water level, this is mounding, so there is about a foot increase in the water levels as a result of disposal. And then the maximum concentration of nitrogen, 17.7, which is probably right at the point source.

Alternative 1a, the same exercise was conducted. The only thing that's different between the top 4 and the bottom 4 is the initial nitrogen concentration. We saw 14.5. This was the average concentration of nitrogen from the effluent at the Otis wastewater treatment plant. Now I have figures in the past for all the simulations, but I'd like to show you this curve.

This is Alternative 1 where we dispose of 300,000 gallons per day at Falmouth, and then 300,000 gallons per day from the Otis wastewater treatment plant. So here you can see the area that's affected, this was the seven-acre area, where the groundwater has a concentration of 10 milligrams per liter or greater. Once again, this boundary is the current permitted Class III area. And this line down the Falmouth landfill, this was worked on by Camp, Dresser and McKee in 1983 and they projected -- this reflects -- this is the model projection of the direction of the groundwater flow from the landfill.

This is Alternative 1a. The only thing different here is that the initial nitrogen concentration is 15 milligrams per liter, and the location of the sand filter beds, which remember in the previous slide it's further north. And you can see that now this 10 milligram per liter or greater area was outside the current Class III area. So we thought this was possibly a function of the location of the sand filter beds, and so we ran four additional simulations using the southern sand filter beds. And that's what you see here, and like I said, this was in your document. So this is once again the area at the groundwater that has a concentration of 10 milligrams per liter or greater. And as we expected, by using the sand filter beds for Alternative 1, we now are within the Class III area.

So the second area that we modeled was just south of the Otis wastewater treatment plant. This was used to simulate Alternative 2, which was spray irrigation, Alternative 3, which was the Bardenpho, and Alternative 5, which was the no-action alternative. So you can see the boundary conditions here, the Childs River and the Coonamessett River. Once again, in the area of the treatment plant the elements are small, and simulate sand infiltration and spray irrigation. The spray irrigation area is about 60 acres. And then this would be our model projected groundwater elevations.

Now for Alternatives 2 and 3 -- I'll show you in tabular form in just a moment -- there were no areas where the groundwater exceeded 10 milligrams. For Alternative 4, which was disposing near the Canal -- this is our finite-element grid, and these two elements represent the approximate location -- of the proposed approximate location of the sand filter beds. Now this area, there wasn't a lot of hydrologic data, so Weston Geophysical did two -- two studies for us to determine the groundwater elevations in this area, in other words they put several wells in, and then they also did some pump tests to determine how conductive the aquifer is of being able to -- let me restate that, about how well the aquifer is to conduct the flow. So we did quite a bit of work in the area of the Canal. You notice the documents, if you are interested, are available in your libraries.

This is the model predicted for potentiometric surfaces, and I'll show you the regional slide. Once again, groundwater flow here, according to the arrows on the slide, is to the northwest. So in tabular form, once again the same level rates would be used for the spray irrigation, the Bardenpho, and Alternative 4 for the Canal. Now the initial nitrogen concentrations here are different, 9 milligrams as opposed to 15, because we're assuming that the plants are going to uptake 40% of the nitrogen. This is a very conservative estimate. Maximum water levels, now .2 feet to .35 feet, and the maximum concentration of nitrogen of 1.7 and 2.4 for spray irrigation.

For Alternative 3, which was the tertiary treatment, initial nitrogen concentration of 10 milligrams per liter, about a half a foot an hour mounding, and then about a foot for 500,000 gallons a day. And we have slightly more mounding in this alternative, the mounding meaning that the water rises because you're -- you're disposing in a smaller area for sand filter beds as opposed to spray irrigation when you dispose of the treated wastewater in a larger area. And then these are the maximum concentrations of nitrogen. The Canal, 15 milligrams per liter, once again, .7 and 1.1 was the amount, and then these are the maximum concentrations of nitrogen.

And then this is Alternative 5, the no-action alternative. We had -- we did have a very small area that the concentration of groundwater exceeded 10 milligrams per liter, and I think that's about seven acres. And this was the same exercise, except here we loaded at 500,000 gallons per day at an initial nitrogen concentration of 15. So in tabular form, once again the two loading rates, the areas of 3.3 and about 9 acres, half a foot of mounding with a maximum concentration right at the source of this.

So in summary of the groundwater aspect of the EIS, there were only three alternatives, Alternatives 1, 1a, and 5 that have groundwater nitrogen concentrations greater than 10 milligrams per liter, and I should say equal to or greater than. The altered groundwater in the vicinity of Ashumet Pond under Alternatives 2, 3 and 5. Groundwater flow in the vicinity of Long Pond is unaffected by Alternatives 1 and 1a. And I was very concerned about this and I did do some extra simulations where I disposed of maximum disposals. And then I pumped over four million gallons out of Long Pond to make sure that the groundwater flow would not change. And like I say here, it did seem to be unaffected. I think Camp -- I'm sure Camp, Dresser and McKee did the study and found the same results. Finally, the mass balance analysis shows that nitrogen concentrations in the Cape Cod Canal will be less than .0002 milligrams per liter.

Dr. Krummel: To wrap up this briefing I'd just like to put out a couple of tables that are required by CEQ regulations for all EIS's, and that's the range of relative environmental impacts of all the alternatives with the various attributes of interest. These tables are in your document and are easily referred to. Let me just state that our ranging went from 0 to 4, 0 being absolutely nothing would happen; and 1 being very small and most likely not requiring any mitigation; 2 and 3, low and moderate, but probably able to be mitigated under our edict, something that the Air Guard could undertake; 4 being so high that if the alternative was put in place there would be severe environmental impact with no possibility of mitigating them. And that was for the short term, now for the long term, the short term being primarily construction impacts, and the long term would be the operation of any of those alternatives. Again, the same sort of table that ranks the various alternatives by the attributes. And that wraps up our briefing, so I will turn it back over to Colonel Howell.

Colonel Howell: Well thank you Dr. Krummel and Ms. Durham. Let us go over some procedures again just briefly, for the benefit of those that came in after we started. You were invited to fill out an Attendance Card/Comment Sheet when you arrived. If you've not filled out such a card yet, please do so during the break.

Regarding the making of a statement tonight, the elected public officials will be called upon first with their statements, and then for those others who indicated a desire to make a statement, the cards will be randomly ordered. Your statement should be limited to five minutes, or in the case of representatives of groups, ten minutes.

Let's take our break now. Or I should say if you do not wish to make a public statement or if we run out of time, or if you have additional comments beyond those you are able to make in the allotted time, you may turn in your written comments after this meeting, or send them to the address provided in the handout.

I recognize that some people may wish to make statements on defense policy, fiscal policy, or whatever, but I suggest that such comments are best directed to your Congressmen and your Senators. Please limit your comments here tonight to environmental issues.

Please refrain from a public demonstration either for or against statements, since this merely subtracts from the time available for others to make statements or ask questions. And each person should be given a respectful hearing, even if his or her views differ from your own.

I think we have light. Let us take a ten minute break now. I have five minutes to eight; let's come back at ten minutes after eight, and I understand there are restrooms right outside and in the back. And may I have your Comment Sheets, or Mr. Karson will take them also.

Dr. Krummel: Can I further note, your written comments or any public comments given here tonight are treated equally. They will be responded to in writing, both by letter and in the final document.

Colonel Howell: Okay. Are we prepared? All right, let's now turn to the question and answer period of this public hearing. This is the time set aside to allow you to ask questions about the content of the briefing and the draft Environmental Impact

Statement. Once you've been recognized by me, please step to our microphone here in front since we all want to be able to hear your question or statement, and it must also be recorded for the record.

Please state your name and affiliation or address, and ask your question or make your statement. If you read from a prepared statement which you would like to have entered into the record, please give it to Mr. Karson back there, or please leave it with me.

All right, let's begin with Mr. Tom Cahn, State Representative. Mr. Cahn? Oh, there you are. Is that the correct pronunciation of C-A-H-N?

Mr. Cahir: No, it's not. But my penmanship was pretty fast.

Colonel Howell: C-A-H-N is what I have here.

Mr. Cahir: C-A-H-I-R. That's pronounced Cahir.

Colonel Howell: Oh, I'm sorry. Please.

Mr. Cahir: Thank you very much, Colonel Howell. And I'd first like to thank you for providing us the opportunity for input, and it's very much appreciated. I've had the opportunity to represent the four towns abutting the base for five years in the legislature, and I am very concerned on this matter and I appreciate you coming out to the community for input.

I've also been very much involved in a number of water related issues. During that time I asked to sit on a special commission, special legislative commission on water supply, I've filed legislation to establish a water district in the town of Mashpee, and almost every piece of legislation that has come to the floor to us in the Massachusetts House relative to Cape Cod's environment was stressing the importance of protecting the single source aquifer that was designated by the EPA. So I think it's of the utmost importance to improve the quality of discharge from the Otis wastewater treatment plant.

As you know, a decade or so ago the problem in Falmouth where we lost a well, the plume was identified, and in the last five years where I've been involved a tremendous amount has been done in terms of educating the public and educating us as to what this plume means, and the contents of the plume, and thanks to the Guard Bureau, and particularly Virginia Valiela and others, we've addressed some of the major problems in Falmouth.

I base my comments and suggestions tonight on the many conversations that I've had with people that I consider to have a particular expertise on these matters, and also representing the two towns that I feel are most impacted by any decisions on the treatment plant, Bourne and Falmouth. I've tried to stress the continued dialogue between those two towns, and I know that that has been taking place over the last few years because I have been involved in some of those conversations and meetings.

I'd first like to say that in reviewing the alternatives I think that Alternative 1, 1a, 4a, and 5 in my opinion are completely unacceptable. And although I have an order of preference in the other three, Alternative 4, 2, and 3, I do feel strongly that they need to be modified. I think that Alternative 4 as written seems to be my preference and most acceptable. However, I think it has to be changed to a Class I discharge. I think that's essential.

In discussions that I had -- and I'd like to reiterate that I don't have particular technical expertise on this matter -- I have discussed this with a number of people that I do feel have that, and we discussed it with Bourne and Falmouth people, and there seems to be a real consensus that the nitrogen level has to be reduced to a Class I treatment.

So certainly I will resubmit written testimony with a lot more detail by the deadline, but I feel that I've been involved in so many issues concerning coastal environmental, storm water runoff, pathogens, heavy metals being discharged into the coastal environment which around our area is very important, so I think that you have to protect the Cape Cod Canal to the utmost. So I would say my preliminary support would be to strongly urge DEQE to support Alternative 4 with modifications, and I think that along with my written testimony that the Boards of Health will be submitting a more cohesive statement as well. So with those very vague remarks, I'd like to thank you for providing this opportunity, and look forward to working with you to come to a consensus in the best interests of our very sensitive environment here on the Cape. Thank you, Colonel Howell.

Colonel Howell: Thank you, Mr. Cahir. I didn't realize that was Irish. Howell is Welsh, you know.

Mr. Cahir: Oh, really.

Colonel Howell: Mr. William Norman, please, from the Cape Cod Canal Field Office of the Army Corps of Engineers.

Mr. Norman: Good evening. I was at the meeting yesterday, and again tonight representing the Cape Cod Canal Field Office to listen to the presentation and your comments. One thing that I've had trouble understanding through the whole presentation is how the range of nitrogen that enters the Canal is arrived at.

Colonel Howell: Mr. Krummel -- Dr. Krummel?

Dr. Krummel: Could you clarify that?

Mr. Norman: Yes. The 1.12 x 10^{-4}, how did you come to that figure, and what does that figure mean as far as impact?

Dr. Krummel: I don't want to put you off, and I would like to supply a written response to that, but it would take perhaps a bit longer than we have regulated to this meeting, since we're only supposed to answer briefly to that. There were -- but I can say there were two calculations made, one for the groundwater discharge of nitrogen, and the other concerned the pipeline going directly into the Canal. And I believe the number you're referring to refers to the groundwater.

Mr. Norman: Correct.

Dr. Krummel: And that was calculated based on the elements that exist along the Cape Cod Canal, and what was going out at each element based under simulation.

Now I can give you an answer in more detail, but we need to, I think, provide you with a written response to that comment.

Mr. Norman: Okay. And of concern to us would be there is a well that supplies a public recreation area for the south side of Falmouth.

Dr. Krummel: We've aware of the problem, correct.

Mr. Norman: And I guess we're also concerned about something other than the Class I type of water coming into the Canal.

Dr. Krummel: You comment is noted. Thank you.

Mr. Norman: Thank you.

Colonel Howell: Thank you, Mr. Norman. Ms. Marie Olivia? Is that the correct pronunciation?

Ms. Oliva: Close -- Oliva.

Colonel Howell: Oliva -- thank you.

Ms. Oliva: That's Italian.

Colonel Howell: I'm sorry?

Ms. Oliva: That's Italian.

Colonel Howell: I'm still Welsh, I'm sorry, I don't do Italian.

Ms. Oliva: I'd like to take this opportunity on behalf of the Board of Selectmen to thank you for coming to testify. The position of the Board of Selectmen remains the same as it was back in July of 87 when we did communicate in writing to you, as well as attending a scoping session similar to this one at the Activity Center at the Base. The position of the Board of Selectmen remains the same, that being that we are adamantly opposed to Alternative #4 as proposed, and also 4a, which is the direct disposal into the Canal. So I'd like to reiterate that our position still remains the same as we have already indicated to you.

We do support and appreciate the need to have the operating facility, the wastewater treatment facility at the Air National Guard. However, we have great concerns about that particular alternative. In our town our pollution task force is working in conjunction with the Buzzards Bay Coalition. If we can continue to protect and preserve our waterways, and the EPA at the federal level has taken a leadership role in funding and grants to study point and non point sources of pollution in Buzzards Bay, specifically Buttermilk Bay in our town.

So again, also our Board of Health has spent countless hours addressing pollution problems in our town. At the regional level we have the Barnstable County Marine Water Quality Task Force which works with state and federal agencies for support in abating some of our pollution problems. So we feel collectively that all these boards, agencies, and committees have made significant strides towards abating the pollution problems in our towns and on the Cape and we still have many challenges ahead of us, but we feel the premise for further degradation of the Cape Cod Canal quite frankly is taking a step backwards.

So to reiterate we have local, regional, state and federal support for many of our programs, and we should be continuing in the same vein of taking progressive action instead of diverting to the methods outlined in Alternatives 4 and 4a. Thank you very much.

I do, for the record -- would like to note that we do question the applying of the Military to the DEQE for a Class III Discharge Permit for Alternative 4 because what was stated in the past is that those alternatives are supposed to be looked at objectively and unbiasedly in line with the -- military applied for a Class III Discharge Permit for one alternative, when this study is supposed to look at all these equally. For the record, I would like to note that also.

Colonel Howell: Thank you, Ms. Oliva.

Ms. Oliva: Thank you.

Colonel Howell: I had Italian tonight, it was really excellent. Mr. Thomas Barlow, please.

Mr. Barlow: Good evening. Thank you for this opportunity to present my viewpoint. My name is W. Thomas Barlow. I live at 985 Puritan Road, Buzzards Bay. I'm a member of the Bourne Board of Selectmen, Chairman of the Bourne Board of Sewer Commissioner, and Vice Chairman of the Buzzards Bay Advisory Committee, the town of Bourne's representative in the Marine Quality Task Force, and the town of Bourne's representative of the Coastal Zone Management Advisory Committee, the former Chairman of the Bourne Shore and Harbor Committee, and commercial shell fisherman. For ten generations my family has earned its income from the sea.

I would like to speak in opposition to Alternatives 4 and 4a because they are pennywise and millions of dollars foolish. The federal, state and local officials are currently spending hundreds of millions of dollars to clean up Buzzards Bay. That includes the Super Fund Site in New Bedford, which is approximately $200 million, the New Bedford sewage facility which is estimated at over $500 million, the EPA Buzzards Bay Program which is putting in almost $4 million, the Buzzards Bay Project, the sewering and grading of Buzzards Bay which comes to $10 million.

Towns are working together to reduce the nitrogen loading in Buzzards Bay. Nitrogen loading by-laws, county by-laws, town by-laws, Board of Health regulations are being reviewed to reduce the existing nitrogen flowing into Buzzards Bay. The towns are trying -- funding engineering studies to reduce storm water runoff and nitrogen. The desire of residents from along Pleasant Bay in Cape Cod is to reopen closed shellfish and swimming areas by improving fecal coliform levels and nitrogen loading levels. We want to pass on Buzzards Bay as a beautiful natural resource to our children and grandchildren in a useable condition.

Alternative 4a and 4 will increase the nitrogen loading into Buzzards Bay. These alternatives are in direct conflict with the wishes of the people of the town of Bourne, Cape Cod, and southeastern Massachusetts. Thank you very much.

Colonel Howell: Thank you, Mr. Barlow. Could we have Ms. Dorothy Blickins, is that right? Is Blickins correct?

Ms. Blickins: Yes, it is. Thank you very much. I am the engineering technician for the town of Bourne, in the Engineering Department, and we'd like to state, on behalf of our department, the Class III discharge is unacceptable into the Canal, as previously stated by the Board of Selectmen. Our main concern is the amount of resources, time and money that our department, in conjunction with the Selectmen, put into several projects currently undergoing in the town of Bourne to clean up Buzzards Bay.

Number one is a project with the sewerage of the town of Wareham; number two is the project with the Corps of Army Engineers; number three, several projects in Buttermilk Bay; number four, the Gale Systems Project with the Cass River, the storm water system, number four, the Electric Avenue Project which was just dedicated today, the Board of Selectmen were at, controlling storm water draining into the Bay. Number two, we would like to state that any archeological damages in our area due to the installation of a pipeline would be also unacceptable. As you know, Bourne is of great history in Indian artifacts, as well as pre-revolutionary artifacts, and we would not want to lose any of that information. And that's basically what we've been able to do today based on the report that we've received this morning. That's all I have to say, unless anybody has any questions. Thank you.

Colonel Howell: Thank you very much. Ms. Cynthia Coffin, is that correct?

Ms. Coffin: Cynthia Coffin for the Bourne Board of Health. I'd like to preface my comments by stating that the full report was not received by the Board of Health until yesterday, so my comments might be very brief and very general. The Board of Health will prepare a more technical response before the August 21st response date.

Speaking as a health agent for the town of Bourne, I wish to make it clear that the Board of Health is against any Class III discharge into the Cape Cod Canal, or any underlying waters in Bourne. All developments and continuations of development in Bourne leading to discharge in excess of 15,000 gallons per day are being required to include tertiary wastewater treatment plants for their project. Why should this projected maximum discharge of 500,000 gallons per day from the Mass Military Reservation receive any less treatment?

Every developer that comes before the Board of Health for major developments along the Cape Cod Canal adamantly insists that the nitrate water can be taken care of by the dilution in the Canal. This excuse has become very old. Maybe dilution is a reality, but our concern is the cumulative impact, not only nitrates, but viruses, possible toxins from the Military Reservation, and heavy metals. Why take a coastal resource where there is no apparent problem and subject it to potential pollutants? The town of Bourne has been spending large sums of money to correct direct discharges to the Canal and storm water runoff to coastal areas. To allow either 4 or 4a seems to go against everything the town of Bourne has been working so diligently for, which is to clear up our pollution problems and preserve our water resources, be they marine or fresh, for the future.

The original Discharge Permit from the DWPC was issued for a Class I discharge, and these standards have been adhered to. Why allow a Class III discharge to marine resources or to underlying groundwaters when other alternatives are available? We strongly urge DEP to eliminate Alternatives 4 and 4a as they are presently written from consideration. Thank you very much.

Colonel Howell: Thank you, Ms. Coffin. I have, just to note for the record, both Ms. Blickins and Ms. Coffin had submitted written statements as part of their Comment Sheet, and they'll be attached to the record.

Ms. Susan Weston, is that right?

Ms. Weston: Susan Weston, of 710 Head of the Bay Road, Buzzards Bay, and I'm representing the Bourne Conservation Commission. Bourne Conversation Commission wishes to be recorded as opposed to Alternatives 4 and 4a. The Commission opposes both alternatives for the following reasons.

Effluent, whether discharged into the groundwater or discharged directly into the Cape Cod Canal, will cause pollution problems. These alternatives seem to be contrary to the policies and goals of the Final 208 Water Quality Management Plan Environmental Impact Statement for Cape Cod, Volume I, September of 78. This additional polluted effluent will be introduced into the Cape Cod Canal which is presently receiving pollutant inputs from natural runoff, polluted groundwater, the Sandwich Electric Generator Plant, boat traffic, legal and illegal sewage disposal, road runoff, including improvements from the Route 495 drainage system, and will likely, out of necessity, see runoff in the proposed Southside Connector.

We believe these alternatives violate the intent and purposes of the State Ocean Sanctuary Act and the federal designation of Buzzards Bay as an estuary of national significance. Furthermore, these alternatives expressly disregard the will of the local people and its government officials. On a number of occasions, through the town meeting votes, the people of Bourne have said no to any introduction of effluent into the Cape Cod Canal. Thank you.

Colonel Howell: Thank you, Ms. Weston. Mr. Floyd Forman, please.

Mr. Forman: Thank you, Colonel. My name is Floyd Forman, I'm the Bourne Town Planner. The state DEQE, newly named state DEP, requires that treatment plants on any project with an effluent discharge of 15,000 gallons a day. The town of Bourne requires even stricter regulations than the state does, and they require treatment plants on effluent discharges of 10,000 gallons per day. By contrast, the present effluent flows treated at that Otis wastewater treatment plant are approximately 300,000 gallons per day and would represent approximately the flows of 900 single-family homes.

The town has already required the Brookside Project, a multiuse project, to install a tertiary treatment facility as part of its approval to ensure the quality of our water. The town is presently working with another major developer on a condominium project. This developer will also be required to install a tertiary treatment system. Should we not require the same commitment from the federal government and require a Class I discharge?

Colonel Howell: Thank you, Mr. Forman. Mr. David Janik, is that correct, Sir?

Mr. Janik: Yes. Thank you for this opportunity to speak. My name is David Janik, and I am a Technical Assistant to the Buzzards Bay Project. Buzzards Bay was designated by the United States Congress as an estuary of national significance in 1984. Since that time, the Buzzards Bay Project has invested millions of dollars successfully characterizing the many pollution sources in Buzzards Bay. The Buzzards Bay Project is working with federal, state, and local governments to develop a master plan to protect and improve the water quality and living resources of the Bay.

Research to date has shown that nitrogen loading into the present coastal ecosystems is now a problem in many parts of Buzzards Bay. Therefore, we feel that new septic treatment facilities should employ modern day technology to reduce nitrogen in the effluent and receiving waters to the lowest possible concentration. This is imperative because nitrates are not attenuated in groundwater to any significant degree, and even a small increase in the nitrogen concentration of the coastal waters will result in profound changes in marine ecosystems.

We further believe that the Department of Defense should use the highest possible standards in designing and constructing this facility to serve as an example to the local communities in the proper treatment, disposal -- treatment and disposal of the wastewater, particularly in that estuary of national concern. We'll be submitting more detail and comments prior to the deadline.

Colonel Howell: Thank you, Mr. Janik. Dr. Arthur Greenberg, please.

Dr. Greenberg: I'd like to thank you for the opportunity to speak this evening. Just a few preliminary comments. One, we have the Ocean Sanctuary Act, which seems to be given little credence to at this time. It seems that 4 and 4a, the proposal to dump sewerage directly into the Canal, or a sand filter near the Canal are a violation of the Act itself, or the spirit of it. And so I don't think that that really should be pursued because I feel that the National Guard people responsible for this type of proposal, if it goes forward, will be setting themselves up for regular legal involvement and suits, and I think that's just a waste of everybody's money and time and it doesn't resolve the issue.

Two, I have to say frankly that I would have been more impressed with the presentation by Argonne Laboratories, instead of them citing various modeling approaches, and simulations, and computer projections, if they had pointed to the particular facility that was -- where they used this modeling and what the result was after the project was completed, and a year or two later whether that compared favorably with what their projections were, and for -- related to us in real life situations instead of projections of their computer. That doesn't impress me at all. I'm more impressed with the -- with what occurs in our daily life than statements like that.

With regard to the idea of great volumes of water going through the sand filter and filtering out the nitrogen, you only have to look to Buttermilk Bay as a practical example, where that did not take place and we had extensive pollution in that area. So you don't have to go very far to show that this, in fact -- the solution that they're offering can, in fact, produce serious pollution in the Cape Cod Canal.

I'd like to read to you, and I think that it has not been mentioned, by the way. I have to say that I support everything that has been previously said by the town official. But one thing that has been omitted frankly is the fact that on three separate occasions the town of Bourne has voted overwhelmingly to reject any proposal for dumping any waste water into the Canal, and the last proposal which received unanimous support was a resolution which I introduced, and I'm going to read this again, I think that the comments are still pertinent two years later. Nothing has changed, we're still grappling the same ballfield, trying to argue about the same things, which is a puzzle also to me. Why are we here tonight when the same thing was presented two years ago and was rejected then so vehemently by the town of Bourne?

What the resolution says was whereas the Environmental Impact Statement, such as has been conducted by the *Massachusetts National Guard for the purpose* of establishing a method of disposal for the Otis Air Force Base wastewater, requires citizen participation and requests citizen comment, I'm aware that the town of Bourne on several previous occasions through Town Meeting vote with the citizens action have expressed a concern for the quality of drinking water in or near the Cape Cod Canal. Therefore, we, the citizens of the town of Bourne, resolve to instruct our Selectmen to indicate to the appropriate governmental authorities that the town of Bourne disapproves of any attempt to utilize the Cape Cod Canal as a dumping ground for wastewater from Otis Air Force Base, and will strongly resist through legal, legislative, and other means any attempt to dispose of the water through the Cape Cod Canal. And there was not one dissenting voice in the entire town meeting.

I'd just like to read to you just as a comment, if you will, with regard to the things we know. We know that the proposed treatment plant is trying to dump one third of a million gallons a day into the Canal. We know that wastewater treatment facilities have ways of breaking down, whether it be at the Maritime Academy, Wareham, Falcon Cove, or perhaps the present Otis wastewater facility which allow hazardous waste chemicals into the aquifer, thus causing considerable contamination to the water in the Ashumet section of Falmouth. This has caused considerable anxiety and concern, and resulted in considerable cost to the federal government through an EPA complaint a year ago. We know that from Boston Harbor, the New Bedford Harbor, and Falmouth pollution problem that once an area is polluted it is difficult technically to resolve the problem, and the cost is usually enormous. We now know, because of the Safe Drinking Act recently enacted by Congress, the standard of what constitutes safe drinking water, and the standards include over 80 contaminants. We also note that recently that the state has been supplying sufficient -- has not been supplying sufficient funding to test our waterways and in fact to test sufficiently the water quality of our wells, and also that Otis military base, that base creating hazardous waste materials, that they have had a very bad environmental safety record. But in spite of the assurances by engineers, I am concerned, as I'm sure you are, that any miscalculation or omissions of times, inadequacy of construction, lack of maintenance or lack of funding, we constantly monitor the water from the treatment plant, or any accidental dumping of toxic materials into the system would have a devastating effect given the volume of waters from Otis Air Force Base. The waters of the Cape Cod Canal, Buzzards Bay and the Cape Cod Bay would require enormous sums of money to correct any contamination of those waters. Who would deny that the pollution of the Canal, Buzzards Bay and Cape Cod Bay would have a devastating effect on our commercial, recreational, fishing and boating industry, summer home, retirement home, construction, throughout the general tourist economy of the area, as well as reduce the quality of life for everyone living on the Cape.

Colonel Howell: I think those are very adequately covered at this time, Dr. Greenberg.

Mr. Greenberg: I would just like to add one quick comment, and that is that if I understand your proposals properly, you're really not spending the money to upgrade the facility that you presently have as one of the options, 4 or 4a, just to ship it through the Canal and hope that the sea will cover up the nitrogen. Now it seems to me in this day of advancing technology that it makes more practical sense for us to have a plant that has the latest in technology to filter out all the contaminants, and in fact where those contaminants -- those filters, various approaches to filtering out additional contaminants that is by in the future. You would be a lot typically easier to resolve that issue in a modular type of structure planned for an add on, so that the latest technology can be brought to course in a single wastewater treatment plant.

So I'm personally in favor of a solution for upgrading the facility at the Otis Air Force Base with the latest technology, with the ability to improve that technology as the technical advances occur.

Colonel Howell: Thank you, Dr. Greenberg. Would you like to attach your paper to your presentation, or --

Dr. Greenberg: What, this?

Colonel Howell: Yes.

Dr. Greenberg: Should I ?? ?

Colonel Howell: It's up to you.

Dr. Greenberg: I'll save it ??

Colonel Howell: You also indicated, Sir, you had a question. Did you wish to ask a question?

Dr. Greenberg: No.

Colonel Howell: I have no other Comment Sheets from persons wishing to speak or question. Is there anyone else who wishes to speak or be heard at this time and ask a question? Yes?

Mr. Smith: I'm Charles Smith with the Paine-Smith and Company Consultants to the town of Bourne invited consultants, and I'd like to say that I fully support their endeavors for a Class I that might expose an aquifer, that the discharge, anything other than a Class I in this area would be not consistent with the direction the DEQE has been going for all discharges. Thank you.

Colonel Howell: Thank you, Sir. Does anyone else wish to speak, ask a question, or make a comment? Apparently not. We will conclude the proceedings at this time. Please remember that you have until the 21st of August to submit written materials to be included in the transcript of the hearing, and those statements will be fully considered and addressed in the Final Environmental Impact Statement. Once again, oral and written statements or comments will be afforded equal weight.

Officials of the National Guard Bureau and the Air Force appreciate your effort to come out tonight and contribute your views to the public hearing. We thank you for your courteous attention. Please be assured that the Air Force decision-makers will carefully consider each viewpoint raised here tonight in deciding the ultimate course of action on this proposal. This public hearing is adjourned at 8:40.

APPENDIX K:

GLOSSARY

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GLOSSARY

***Absorption*:** the physical uptake of matter in bulk by other matter, such as the dissolving of a gas in a liquid

***Activated sludge process*:** a sewage-treatment process in which the sludge in the secondary stage is put into aeration tanks to enhance aerobic decomposition by microorganisms

***Adsorption*:** the surface attraction and retention of solid, liquid, or gas molecules; atoms; or ions by a solid or a liquid

***Aerobic*:** physical or biological processes that occur in the presence of oxygen

***Anaerobic*:** physical or biological processes that occur in the absence of free oxygen

***Anisotropy*:** variation in hydraulic conductivity with the direction of measurement at a point within a geologic formation

***Anoxic*:** treatment conditions in the absence of uncombined oxygen

***Bioacclimation*:** microbial adaptation to a changed environment

***Biodegradation*:** the process by which a substance can be broken down by microorganisms

***Biological absorption*:** the uptake of matter by microorganisms

***Biological oxygen demand*:** the amount of dissolved oxygen required to meet the metabolic needs of anaerobic microorganisms in water laden with sewage

***Biological transformation*:** a change in the microbial community

***Cantonment*:** assignment of troops to temporary quarters

***Chemical precipitation*:** the process of producing a separable solid phase in a liquid medium from dissolved materials

***Chlorination*:** disinfection of water by chlorine gas

***Clarifier*:** a device for separating out solids from water; sometimes called a sedimentation basin

***Coagulation*:** the separation of colloidal particles from water due to coalescence, forming larger particles

Coliform bacteria: simple, rod-shaped microorganisms (called colon bacilli)

Comminutor: a machine that breaks up solids

Constant flux: a condition for which the volumetric flow per unit area through a porous medium does not change with time

Constant head: a condition for which the sum of the fluid pressure and elevation in a porous medium does not change with time

Contaminant transport: the movement of deleterious materials through a porous medium

Darcy flow: the movement of groundwater described by the product of hydraulic conductivity, the change in hydraulic head per unit length along the path, and the cross-sectional area of a porous medium perpendicular to the direction of fluid motion

Denitrification: the reduction of nitrate or nitrite to gaseous products (such as nitrogen, nitrous oxide, and nitric oxide) brought about by denitrifying bacteria

Diffusion: the movement of a solute through a porous medium due to spatial differences in solute concentration

Digestion: the anaerobic decomposition of organic matter

Dilution: the change in concentration of a solute due to changes in the volume of the solvent

Disinfection: the process of destroying microorganisms generally accomplished by the addition of chlorine to water

Dispersion: the physical process by which a plume of finite extent broadens along its path of travel

Dissolution: the dissolving of a material in a liquid

Dissolved oxygen: the amount of oxygen that is dissolved in a liquid; one of the most important indicators of a water supply for biological, chemical, and sanitary investigations

Ecosystem: the dynamic relationship between biological and physical components of the environment, usually bounded to incorporate functional properties over a defined area

Eutrophication: increased primary productivity (plant growth) in a water body caused by an increase in nutrient supply

Evapotranspiration: the discharge of water from the earth's surface to the atmosphere from surface waters and soil surfaces, and by transpiration from plants

Force main: the discharge pipeline of a pumping station

Headworks: any device or structure at the head or diversion point of a waterway

Heterogeneity: point-to-point variation in hydraulic conductivity of a porous medium

Hydraulic conductivity: the constant of proportionality in Darcy's Law of fluid flow that describes the ease with which the porous medium permits fluid to flow, and the ease with which the fluid flows given its physical properties

Hydraulic detention time: the average amount of time that a fluid element stays within a process or flow regime

Hydraulic gradient: change in head (pressure plus elevation) per unit change in distance

Hydraulic head: the sum of fluid pressure and elevation in a porous medium

Imhoff tank: a sewage-treatment tank in which digestion and settling occur in separate compartments, one below the other

Nitrification: the formation of nitrous and nitric acids or their salts by oxidation of the nitrogen in ammonia; specifically, the oxidation of ammonium salts to nitrites and the oxidation of nitrites to nitrates by certain bacteria

Nitrified mixed liquor: microbial suspension in which the majority of the nitrogen has been converted from ammonia to nitrate

Oxidize: process by which compounds combine with oxygen

Parshall flume: a calibrated device for measuring the flow of liquids in a conduit

pH: a measure of the acidity or basicity of a liquid; a pH of 7 is considered neutral; waters are considered acidic for pH <7 and basic for pH >7

Porosity: the fraction (as a percent) of the open space (voids) within the total volume of a solid

Primary treatment: preliminary treatment processes aimed at removing solids from the influent wastewater; common unit operations include bar racks, medium screening, comminution, flow measuring, pumping, grit removal, preaeration, flocculation, and sedimentation

Recharge: the processes involved in replenishing waters to the saturation zone of an aquifer system

Retardation: the process by which a solute moves through a porous medium more slowly than the ambient solvent

Runoff: surface streams that appear after rainfall; that portion of total precipitation that is not intercepted, held in surface detention, evaporated, used by plants, or percolated below the ground surface

Saturated zone: a subsurface zone in which water fills the soil interstices and is under pressure greater than atmospheric pressure

Saturation: state in which all of the void space in a porous medium is filled with water

Secondary treatment: biological treatment of wastewaters aimed at reducing the organic matter contained in them; accomplished using processes such as activated sludge, trickling filters, or biological towers

Tertiary treatment: advanced wastewater-treatment processes which follow secondary treatment; examples include chemical precipitation, filtration, activated carbon adsorption, and disinfection

Trickling filter: a bed of broken rock or other coarse aggregate onto which sewage is sprayed intermittently and allowed to trickle through, leaving organic matter on the surface of the rocks, where it is oxidized and removed by biological action

Unsaturated zone: a subsurface zone containing water below atmospheric pressure and air or gases at atmospheric pressure

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