

TOWN OF WELLFLEET

DRAFT HARBOR MANAGEMENT PLAN

Submitted By
Natural Resources Advisory Board

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EXECUTIVE SUMMARY

On April 29, 1987, at their Town Meeting, the voters of Wellfleet decided to establish a Natural Resources Advisory Board whose duties were to include the creation of a Harbor Management Plan, the review and updating of such a plan, the identification of the natural resources of significant importance within the Town, and appropriate action as may be possible to preserve and protect these resources. The document which follows has resulted from that mandate.

In formulating a vision for the future of Wellfleet Harbor, the Board (NRAB) has kept in mind that the harbor is an important, integral part of the Town as a whole, physically, aesthetically, economically and environmentally. The plan for the Harbor should be seen as one aspect of a plan for the future of the entire Town and for the well being of its citizens. It should also be seen as an important part of any regional development. The Local Comprehensive Plan contains many elements drawn from this plan.

Our vision for the harbor can be summed up in a few words. We do not see a need for major new large-scale developments in terms of expanded uses - commercial, recreational, or residential. However, some suggested improvements would provide for the inevitable increased uses due to population pressures. In our vision we see a harbor in which the present viable balance of uses is maintained and the physical beauty of the setting is enhanced; which continues to be a major asset of the Town; and which is environmentally protected. Our assurance that these goals are shared by the majority of our citizens is based on the results of workshops, public meetings, and a survey questionnaire.

The Harbor Management Plan (HMP) consists of nine chapters and an introduction. **All of the chapters except the History Chapter (#1) present an inventory, issues, goals, and recommended actions.** The individuals or agencies which should be responsible for enactment are designated. However, specific time schedules have not been set. Some of the goals and actions are summarized as follows.

Water quality is the number one issue of the harbor and is often mentioned as the number one issue facing the Town as a whole. We recommend that special restrictions be placed on land use within the watershed to minimize pollution by nitrogen, bacteria, pathogens, and toxic chemicals. We also recommend that the current program at the Marina to prevent pollution from boaters' uses be augmented and strictly enforced and that the problem of road runoff be pursued more rigorously. A major effort to educate the public about the necessity of protecting water quality and the environment of the harbor must be made if we are to succeed.

Public access to Wellfleet Harbor is deemed to be satisfactory by most residents and visitors. However, some of the town landings

which have been "lost" should be reclaimed. Also, some beaches need to be upgraded for handicap accessibility and restroom facilities should be added. Additional land should be acquired by the Town for access to beaches, viewing and walking. To improve public access and water dependent uses while maintaining its historic character, we recommend establishing a Historic Harbor District along Commercial Street, Duck Creek, and part of Kendrick Avenue. We would also like to see a small research facility and museum on the waterfront to investigate marine life issues and educate the public about them.

Issues that are raised when the subject of dredging is approached are critical and complex. Therefore, we devote an entire chapter to a discussion of the problems - environmental, financial and social - and to suggested alternative solutions. We recommend that the Wellfleet public be thoroughly informed about the choices which need to be made when dredging is being contemplated. We also recommend, in the Economics Chapter, that a task force be established to ascertain whether the Marina Enterprise Fund can be made to function so that the monies required for dredging and maintenance and repair of the Marina will accumulate and be available.

There are special problems associated with the inner Harbor north of the Marina. Because rapid shoaling in the area has hindered navigation and use of Harbor facilities, a study was undertaken to ascertain whether certain structural changes might minimize the siltation. Dr. Graham Giese of the Woods Hole Oceanographic Institute, who conducted the study, concluded that none of the proposed changes would be effective. Therefore, regular periodic dredging of the inner Harbor will be required if that area is to be kept open and accessible at low tide for safe navigation.

The Economics Chapter provides data on known, direct income and expenditures related to the Marina, fishing and shellfishing and lists important indirect economic sources of benefits and costs to the Town. It also lists repairs and improvements which should be undertaken in the near future.

In the chapter on Tidal and Subtidal Land Use we recommend that the Town seek to acquire additional tidelands and that maximum public use be made of those tidelands it already owns for propagation of shellfish and possibly some recreational pursuits.

The Natural Resources Chapter emphasizes the abundance of these resources and the need to protect them. Besides the protection of water quality, as outlined in Chapter 2, we recommend the addition of more conservation areas and the creation of a Harbor Conservancy to protect wildlife, vegetation and archeological sites.

In the final chapter we discuss the need for a Department of Natural Resources and outline the structure of such a proposed

department and the responsibilities of the officer who would be its head.

The final draft of this Plan will be discussed with the Wellfleet Board of Selectmen and all of the boards and committees of the Town whose actions are needed to enact its recommendations.

INTRODUCTION

It is our natural resources that attract people to Wellfleet and it is the people that must regulate their use. People are drawn to our town for its historic character and its pristine beaches, salt marshes, dunes, flora and fauna, and fisheries. Our responsibility is to maintain these resources in their pristine state and make them available for future generations to enjoy. The bitter pill of our generation is the realization that our resources can be used up - that each has its unique carrying capacity and that it is our difficult chore to determine this carrying capacity and insure that we don't exceed these natural limits. The task of managing Wellfleet's Harbor resources is not to carve up the pie into ample slices for all of the users. The task is to tell everyone that there isn't going to be any dessert! This is why Harbor management is so difficult. To manage responsibly, we have to answer a lot of difficult questions. How many houses can this watershed support before nitrogen levels will impact the environment? How much foot traffic can a dune support? How many boats can the mooring area accommodate before the levels of hydrocarbons or bacteria threaten the fisheries?

In 1994 residents and tourists were surveyed for their evaluation of the aesthetic and recreational benefits of the Harbor. (Woods Hole Research Consortium, 1994. "A Socioeconomic Evaluation of the Marina Resource Uses in Wellfleet Harbor"). Residents rated aesthetic beauty, boating, and water quality of highest importance. Tourists also rated aesthetic beauty most important, while fishing, swimming and lack of congestion were considered major aspects of their appreciation of the Harbor. On average, tourists attributed 57 per cent of their total trip enjoyment to the existence of the Harbor.

In 1993 a questionnaire was distributed to Wellfleet residents by the Local Comprehensive Planning Committee to ascertain the general public's opinions on future development in the Town. A large majority of the respondents showed strong support for five proposals concerning the harbor and its environment. They were:

- a) "Implement a comprehensive Harbor Management Plan and allocate its resources equitably among diverse interests"
- b) "Encourage expansion of traditional marine industries, e.g. shellfishing, as an integral part of the Town's economy"
- c) "Establish a small marine research and education center at Wellfleet Harbor"
- d) "Enact more stringent regulations to protect wetlands, floodplains, freshwater resources, beaches, woodlands, etc."
- e) Protect scenic views

A sixth proposal, "Develop more waterfront commercial uses at the Marina", showed an almost equal division between those who supported and those who opposed more development.

A more detailed explanation of the survey questionnaire can be found in the Wellfleet Local Comprehensive Plan.

The primary focus is to develop a comprehensive Harbor Management Plan for Wellfleet that will detail the use and management of harbor resources. Five general goals have been identified that are being used to guide the planning efforts.

- 1) Protect marine water quality, wetlands and wildlife.
- 2) Promote land use practices in the harbor area that protect harbor resources and promote public access and water dependent uses of the land.
- 3) Encourage a wide range of recreational uses of the harbor
- 4) Protect the commercial fishing industry.
- 5) Protect and maintain the character of Wellfleet as a New England fishing village.

The Harbor Management Plan can not possibly answer all of the questions of carrying capacity or solve all of our resource problems. The plan is a call to arms that should at least identify the important questions, demonstrate the collective vision of the townspeople, and set out some actions and agendas for the future.

CHAPTER I

THE HISTORY OF WELLFLEET HARBOR

Wellfleet Harbor, a shallow embayment covering 6,094 acres at high water with a tidal amplitude of ten feet, lies open to southerly winds but is protected on the east and north by the curving arm of the Lower Cape and on the west by a bastion of islands of glacial till linked by tombolos and ending in a long sandy spit, Jeremy Point. For the purposes of this Management Plan, we have defined the Harbor as the area comprising all the waters north of a line running easterly from Jeremy Point to the mouth of Hatches Creek, the Eastham-Wellfleet boundary, including the various adjacent salt marshes, the several estuaries and tributary streams as far as the tide flows, and the surrounding upland shores to the extent that they are significantly related to the environment and economy of the harbor waters. (See maps #1 and #2)

Like all of Cape Cod, Wellfleet Harbor was first formed some 50,000 years ago by the final glacial era of the Wisconsin Stage of the Pleistocene Epoch (Strahler, 1966) and has undergone extensive modifications during the final withdrawal of the ice and from the erosion of both the eastern and western shorelines by wave action, flash flooding, extensive siltation, and the rise of the sea level. The original Cape Cod Bay shoreline slanted southwesterly from High Head (in North Truro) along what is now the western edge of Billingsgate Shoal. Somewhat east of this ancient beach a series of high accumulations of glacial till extended from north to south, comprising what are now called Bound Brook, Griffin, Great, Great Beach Hill, Little Beach Hill and Billingsgate Islands. Still farther to the east another row of glacial deposits ran south from Bound Brook Island to Merrick Island, Chequessett Neck, Indian Neck, and Lieutenant Island. Within the inverted V formed by these two lines of mounded till now lie Wellfleet Harbor and the Herring River, Duck Creek, and Blackfish Creek estuary systems, relics, it is believed, of an ancient glacial lake.

As the sea level rose during the post-glacial period, at a rate of about one meter every 1,000 years, westward sloping valleys (known as pamets) eroded by glacial outwash and other low-lying areas between the hills of glacial till were flooded by the rising waters, creating a multitude of peninsulas and islands. The topography was, however, only temporary, for the incoming tides flowing up these many estuaries and inlets deposited more sediment than was carried out by the ebbing waters. Thus for thousands of years and down to the present there has existed a continuous process by which the various estuaries and embayments around the harbor --- and likewise the northern part of the harbor itself--- have imperceptibly but steadily grown shallower. In addition, as the tidal currents have been slowed, spits of sand and, later, tombolos have formed between the southern islands facing the Bay --

between Griffin and Great Island ("The Gut"), between Great Island and Great Beach Hill ("Middle Meadow"), between Great Beach Hill and Little Beach Hill, and between Little Beach Hill and Billingsgate Island ("Billingsgate Beach", later to become "Jeremy Point"). Likewise, barrier beaches took shape between the South Truro bayshore and Bound Brook Island, blocking the mouth of Bound Brook, and between Bound Brook Island and Griffin Island, diking off Duck Harbor, the old northern outlet of the Herring River. This obstruction of outlets to the Bay increased the rate of siltation and aggradation and over the millennia hastened the evolution of the Herring-River-Pole-Dike-Creek-Bound-Brook estuary system from a complex of subtidal inlets to tidal flats to low marshes to brackish fresh marshes to high marshes, and finally to shrubby wet meadows. A similar process occurred in the Duck Harbor and Blackfish Creek estuary systems.

At the same time, the erosion of the high coastal banks enclosing the Harbor on the west, north and east -- Great Beach Hill, Great Island, Chequessett Neck, and Lieutenant Island--and likewise, the wearing away by waves and currents of the once inhabited Billingsgate Island (last visible at high tide in 1938), of Smalley Bar, and of Egg Island (where, it is said, cows once grazed) caused the flooding and ebbing tides to deposit an undetermined quantity of silt on the harbor bottom, which in the early post-glacial millenia was undoubtedly considerably deeper than at the present. A hydrographic chart surveyed in 1850 shows depths off Chequessett Neck one to three feet greater than at present.

This shoaling of the Harbor caused by waves and tidal currents was increased in the early eighteenth century by the eolian erosion of Griffin and Great Islands, Great and Little Beach Hills, and Billingsgate Beach. These once wooded islands and barrier beaches had been reduced in colonial times to barren migrating dunes by deforestation and overgrazing, and the prevailing westerly winds driving the sand into the Harbor. A series of petitions addressed to the General Court by the inhabitants in 1741 and later years warned that the oyster beds might be buried in sand and the harbor might be made unnavigable by the windblown silt unless further destruction of the islands' vegetation could be prevented.

The aggradation of the estuaries and salt marshes was further increased by artificial structures. Perhaps as early as the eighteenth or even the seventeenth century, the inhabitants began the practice of diking salt marshes to create hay meadows. The largest of these dikes was that across the Herring River, constructed in 1908 and rebuilt in 1974; the remains of other, older dikes are to be seen in many locations, for instance in the upper reaches of Duck Creek near Route 6. In addition, a railroad embankment was constructed across Duck Creek in 1870 and a few years later was extended northward across the Pole Dike Creek, Herring River, and Bound Brook marshes. At about the same time an

embankment was built across the mouth of Mayo Creek to replace a bridge which extended Commercial Street to Commercial Wharf.

The most serious damage was done by the Herring River Dike financed by the town by a \$10,000 bond issue, which turned a productive estuary and salt marsh, abounding in birds and marine life and serving as the most important factor in the harbor's food chain, into a highly acidic and anoxic environment characterized by massive kills of anadromous and catadromous fishes. This 1908, dike, reconstructed in 1974, was, however, only the most detrimental of many dikes and embankments which both diminished the productivity of the harbor and increased the rate of siltation by reducing the rate of tidal exchange. The damage was worsened by the filling in of salt marshes, for instance along Commercial Street.

The natural siltation of Duck Creek was thus accelerated first by the filling of wetlands, the dikes, and the railroad embankment and then was made even worse in 1953 by the construction of the Breakwater and the Marina and the dumping of dredge spoil in Chipman Cove, on the northern point of Indian Neck, and in Mayo Creek marsh.

Riprap and concrete rubble dumped by the Town at the Gut with the intention of retarding erosion of the bank facing the Bay had the unexpected effect of so destabilizing the lateral drift of sand as to threaten a breakthrough of the waters of the Bay into the Herring River. The danger was averted, however, in 1986 by the removal of the rocks and rubble financed by federal funds. With this one exception, the entire bay shore from the Truro line to Jeremy Point and likewise the western Harbor shore from Jeremy Point to the Dike have remained free from seawalls and groins, thanks to the existence of the National Seashore. Consequently, these beaches have maintained their dynamic equilibrium and have suffered minimal destructive erosion. Unfortunately, seawalls and groins built along Chequessett Neck and Mayo Beach from the Herring River to the Town Pier and along the shores of Indian Neck and Lieutenant Island have seriously destabilized these beaches and have caused massive erosion of the unwalled banks and dunes, for instance at the Chequessett Yacht and Country Club and along Mayo Beach Road (Kendrick Avenue). At the northwest corner of Lieutenant Island the average annual erosion has been calculated to be 5.6 feet per year.

Although some depths were greater in earlier centuries, Wellfleet Harbor has been since the first settlements in the 1600's a tidal harbor. Boats and ships, such as the eighteenth-century whalers and the nineteenth-century mackerel schooners, anchored in the deep hole south of Egg Island, where they were tended by boats from the beach, or else, in the nineteenth century, they tied up at one of the five wharves, where they grounded out at low tide. Wellfleeters have sailed on the tides ever since the seventeenth

century, as they still must do from all moorings outside the dredged basins and slips in Duck Creek.

The 1850 hydrographic chart shows all of Duck Creek eastward of Commercial Wharf (the site of the present Town Pier) dry at mean low water, as it probably had been, at least in large part, since the first settlements. It was not until the early 1950s that the Town, under the leadership of Charles E. Frazier, Jr., undertook to create a deep water harbor in these mudflats. The first dredging with state funding was begun in 1952, when a 160 by 275 foot area in front of the newly constructed Town Pier and a 70-foot long channel to deep water were dredged to a depth of six feet at mean low water. In 1955 a channel around Shirttail Point and a basin north of the Point were dredged to six feet at MLW. In 1957 the mooring basin south of the Pier was extended 1,850 feet to the south. The breakwater was constructed in 1958 and the same year the Army Corps of Engineers dredged a ten-foot-deep mooring basin, 800 by 500 feet and a channel of the same depth three-quarters of a mile long to buoy 12. Maintenance dredging was provided by the Army Corps of Engineers in 1972 and 1981 and by the state in 1968 and 1982. The spoil from these later dredgings was barged to a disposal site in Cape Cod Bay, but that from the earlier dredgings was used, as has been noted, to construct the Marina or was dumped in Chipmans Cove, on Indian Neck, or in the Mayo Creek Marsh.

Silver Spring Harbor, south of Lieutenant Island was in the first half of the eighteenth century "the only harbor that the ancient town of Eastham have or can have to harbor their vessels, take in loading, or unload goods either to or from market." (Eastham Town Meeting resolution, May 15, 1738). This haven, which in 1738 was protected by Billingsgate Beach, and the still extensive Billingsgate Point (Island), appears to have fallen into disuse by the nineteenth century, probably both because of shoaling and because of greater exposure to southwest winds. It was supplanted by Blackfish Creek, where the Southern Wharf was constructed in 1856 on what is now called Old Wharf Point.

The Herring River also once afforded a usable tidal harbor. In the early eighteenth century the town's first wharf was built on Griffin Island and was reached by a ford known as the Wading Place. Ships also anchored in Smith's Cove on the North side of Great Island opposite the site of Smith's Great Island tavern. In 1840 the River Wharf Company built the Union Wharf somewhat further upstream under the Chequessett Neck Bluffs. All this area is now largely tidal flats and probably was already shoaling by the middle of the nineteenth century, for the principal piers became Commercial Wharf (1835), Central Wharf (1863) on Mayo Beach near the Mayo Beach Light (1839), and Enterprise Wharf (1870) at the west end of Mayo Beach where the modern road turns inland. The first Billingsgate Light, erected in 1822, was replaced by a new lighthouse in 1858.

Thus the natural processes of nature, abetted by man's "improvements," have created a shallow embayment characterized by a bottom with a very gradual gradient, by a tidal range of ten feet (the largest south of Maine), and consequently extensive tidal flats which total 2,279 acres. The mean depth at mean low water is 3.5 feet and no inshore areas are of navigable depth at low tide (Curley et al, 1972). The six-foot depth contour (at MLW) is 1,000 yards or more distant from Mayo Beach or from any portion of Duck Creek and at least 500 yards distant from Indian Neck. The natural deep-water anchorages in the middle of the harbor are exposed to south and southwest winds and to waves with a fetch of more than eight miles from the Brewster shore. Protected marina slips and inshore moorings navigable at low water can be afforded only by artificial channels and basins, which currently are requiring maintenance dredging about every six to eight years.

The first European to visit Wellfleet Harbor was probably the French explorer Samuel de Champlain, who explored the area in 1606 and appropriately christened it Port aux Huitres (Oyster Harbor). The Pilgrims of Plymouth lost little time in exploiting the region's marine wealth. Indeed they were so impressed by the abundance of both shellfish and finfish that even before the first Lower Cape settlements of 1644 they nicknamed both the harbor and the surrounding shores for London's famous fish market at Billingsgate and had already explored and named the Herring River and knew the "Great Bass Pond" near its mouth.

Native Americans were living around the entire perimeter of Wellfleet harbor from Great Beach Hill to Hatches Creek as early as the Middle Archaic Period (8,000-6,500 B.P. <before present>), and, as the many shell middens attest, they subsisted to a large extent on the abundant shellfish, finfish, and marine mammals of the harbor. By the Woodland Period (3,000 - 450 B.P.) the inhabitants of the Pononakanet, the local village of Nauset Indians, had combined summertime agriculture and wintertime shellfishing to establish a permanent year-round economy, whose stability was evidenced by the large ossuary (a multiple secondary burial) discovered in 1979 on Indian Neck.

The seventeenth-century settlers, who established homesteads widely scattered on the banks of the Herring River estuary and Duck Creek and on Chequessett Neck and near Silver Spring, relied largely on an agricultural economy based on the abundant salt hay meadows, but they also made good use of the oyster beds both for food and for commerce. A 1674 town meeting held in Eastham (of which Billingsgate Hamlet was then a part) voted a bylaw to exclude fishermen from other towns from the Billingsgate flats.

After 1700 the inhabitants turned mainly to the sea for their livelihoods. In the early decades whales were hunted in the waters of the Harbor and of Cape Cod Bay in whaleboats, frequently manned by Indian harpooners, and the whales were brought ashore on Great,

Lieutenant, and Try Islands to be tried in great iron kettles. As the local supply of whales was depleted, the people of Billingsgate began building oceangoing whaling ships which cruised as far as Africa. By 1775, it is reported, 420 men were sailing on town fleets of some twenty or thirty ships, bringing great prosperity to the inhabitants. Elisha Doane, the leading shipowner, was reputed to be the second wealthiest man in Massachusetts. The British blockade during the Revolution, however, brought the town's lucrative enterprise to an abrupt halt. The idle ships rotted at their mooring, the owners went bankrupt, the sailors moved off the Cape, and when peace came there was no money in the town to rebuild the whaling fleet, save on a most modest scale.

The 1770s brought another disaster to Wellfleet, as the town was now called: the loss of the oyster industry. The reasons for the disappearance of the beds have not been positively identified, but it is speculated that the causes were overfishing, the unrestricted use of oyster shells to manufacture lime, and the failure to replace the harvested oysters with cultch (shells) on which new spat could set.

The simultaneous destruction of both the oyster fishery and the whaling had a lasting economic impact, and the population of 1,235 in 1775 declined abruptly. Though after the war Wellfleet slowly recovered, by 1790 the town still contained only 1,113 inhabitants-- over a hundred less than before 1776-- and in 1800 only 1,207 people lived in the town.

After the Embargo of 1807 and the War of 1812, from which New England ports suffered grievously, the fishing fleet was slowly rebuilt and by 1837 Wellfleet was home port to some 39 fishing vessels, mainly mackerel schooners, employing 496 men.

Since the seventeenth century, Cape Cod's rutted sand county roads had made travel and the shipment of freight to and from Wellfleet by ship the fastest and cheapest means. Around 1800 the Mary, a 24-ton sloop, began a packet service between Wellfleet and Boston, which was continued by other vessels, except during the war of 1812, until 1870, when the Old Colony Railroad reach Wellfleet.

From the 1830s the port of Wellfleet developed rapidly, and the town changed from a scattering of widely spaced farmhouses to a village clustered on the north bank of Duck Creek and along Main Street. No doubt the meager overgrazed Wellfleet farmland offered few enticements to keep a man from the sea. A total of five wharves were built, as has been noted, between 1835 and 1870, in addition to the Southern Wharf on Blackfish Creek. Around these wharves arose various supporting enterprises. In 1837, thirty-nine salt works were producing 18,000 bushels of salt annually. Along Commercial Street were grocery stores, ship chandlers, sail lofts, and hardware stores. Henry Rogers' shipyard on Duck Creek below Uncle Tim's Bridge built eight vessels between 1848 and 1853. The

Wellfleet Savings Bank and Wellfleet Marine Insurance Company were established in 1863. Meanwhile, the oyster industry had been revived by the ingenious strategy of bringing oysters from Chesapeake Bay and other southern waters in schooners to Wellfleet and planting them in beds in the harbor until they acquired the true Wellfleet flavor; the oysters were then profitably marketed in Boston. This industry is said to have employed at one time as many as forty schooners. Meanwhile, the relayed oysters spawned and produced a new race of native Wellfleet oysters. Another encouragement to the fishing industry was the Old Colony Railroad, which after 1870 made it possible to ship fish by train to Fall River and thence by steamship to New York and Philadelphia. At the peak of the boom, about 1870, 95 fishing vessels were sailing from Wellfleet.

Yet after 1875 there were signs of decline, though in 1877 the harbor was still homeport to 60 vessels. There were many factors which made it difficult for Wellfleet to compete with Boston, Gloucester, Provincetown, and other fishing ports: the silting of Duck Creek caused by the railroad and Mayo Creek embankments, overfishing of the distant banks, the disadvantages of the shallow-draft centerboard schooners required by the tidal harbor. In the 1870s a petition was sent from Wellfleet to Congress asking that the harbor be dredged, but to no avail. By 1900 not a single deep-sea fisherman was living in Wellfleet.

Captain Lorenzo Dow Baker's purchase in 1885 of the Mercantile Wharf for conversion into the Chequessett Inn marked the beginning of the development of the summer visitor industry planned to replace the defunct mackerel fisheries, though the first summer people had appeared in 1870 with the locomotives. As adjuncts to the Inn, which harbored the Wellfleet Yacht Club, a number of summer cottages were built on Chequessett Bluffs and elsewhere. An associated project was the Herring River Dike intended to "reclaim" the Herring River marshes and thereby, it was hoped, eliminate the mosquitoes, create agricultural land, and open up Great Island, Griffin Island and other areas to real estate development. These and other development projects proved, however, to be premature and except in the case of the Herring River Dike (which put an end to the herring fishery), had little impact on the harbor or its environment. The present Chequessett Yacht and Country Club was not established until 1931.

The project begun in 1952 to convert Duck Creek into a dredged harbor for shellfish draggers and recreational boats, coinciding with the beginning of a period of continuously accelerating real estate development, did, however, have important consequences, some of which have been noted above.

The increased residential and commercial building adjacent to the harbor and along Duck Creek, the Marina, and the greatly increased number of boat moorings and slips undoubtedly has had

some relationship with the pollution of the harbor waters by nitrates and bacteria and eutrophication. Duck Creek from Uncle Tim's Bridge to Route 6 was closed to shellfishing in 1974 because of high coliform bacteria count. Next, in 1982 Duck Creek from Uncle Tim's to Shirttail Point was closed seasonally, May 1 to October 1. Then, in 1985 the Herring River above the Dike was closed permanently; in addition, since 1985 the Herring River below the Dike and Hatches Creek in South Wellfleet have been closed intermittently. It is quite possible, however, that undetected pollution existed before 1972, for defective septic systems, boat discharges, and storm-water runoff are not modern inventions.

Perhaps the important environmental event in the modern history of the harbor has been the establishment of the Cape Cod National Seashore in 1961. This act protected the entire western shore of the Harbor from Jeremy Point to the Dike against all development, and afforded similar protection to Griffin, Bound Brook and Merrick Islands and to all the wetlands and shores of the Herring River estuary system as far as Herring Pond. Supplementary protection has been provided by the extensive Massachusetts Audubon Society Wildlife Sanctuary around the shores of Silver Spring Bay and Loagy Bay, and also by the South Wellfleet Marsh Trust in Loagy Bay and the Wellfleet Conservation Trust lands adjacent to Loagy Bay and in Blackfish Creek.

Since the early 1800s oyster seed and mature oysters have been planted on town beds and private beds, known as "grants", which in the early 1900s extended over 2,040 acres of the harbor. The use of power boats for dragging began in 1902. The growing of oysters on grants has enjoyed uneven success in recent years because of the presence not only of oyster drills but also of Codium, a destructive exotic seaweed, and of MSX (multinucleated sphere X), a disease fatal to oysters though harmless to humans. Since 1974, however, local shellfishermen have enjoyed considerable success with the cultivation of littlenecks and cherrystones (quahogs or hard-shelled clams) grown from laboratory-produced seed planted in propagation boxes and transplanted into grow-out beds, where the quahogs are protected from their natural enemies and achieve a high survival rate.

A decision of the Massachusetts Supreme Judicial Court issued on April 20, 1994 has ruled that the planting or growing of shellfish on privately owned tidelands without permission of the owner is not fishing within the meaning of the Ordinances of 1641-1647 and therefore not a public right. Although the "bedding" or planting and growing of shellfish on tidelands has been practiced since antiquity as an uncontested public right under Roman Law and English Common Law and similarly under the Massachusetts Ordinances since the seventeenth century, there is apparently no likelihood of a judicial or legislative reversal of the Supreme Court's revolutionary break with the past. It is important to understand, however, that no natural shellfish bed, such as the one in

Wellfleet, can be continuously harvested without the regular planting of shellfish and cultch and effective control of predators, as we have hitherto practiced in Wellfleet. If the new ruling prevents such effective propagation and culture, the unpolluted quahog and oyster population in the waters of the Commonwealth will suffer the same grave depletion that afflicted Wellfleet in 1770. We are challenged to prevent, somehow, this from happening.

CHAPTER II

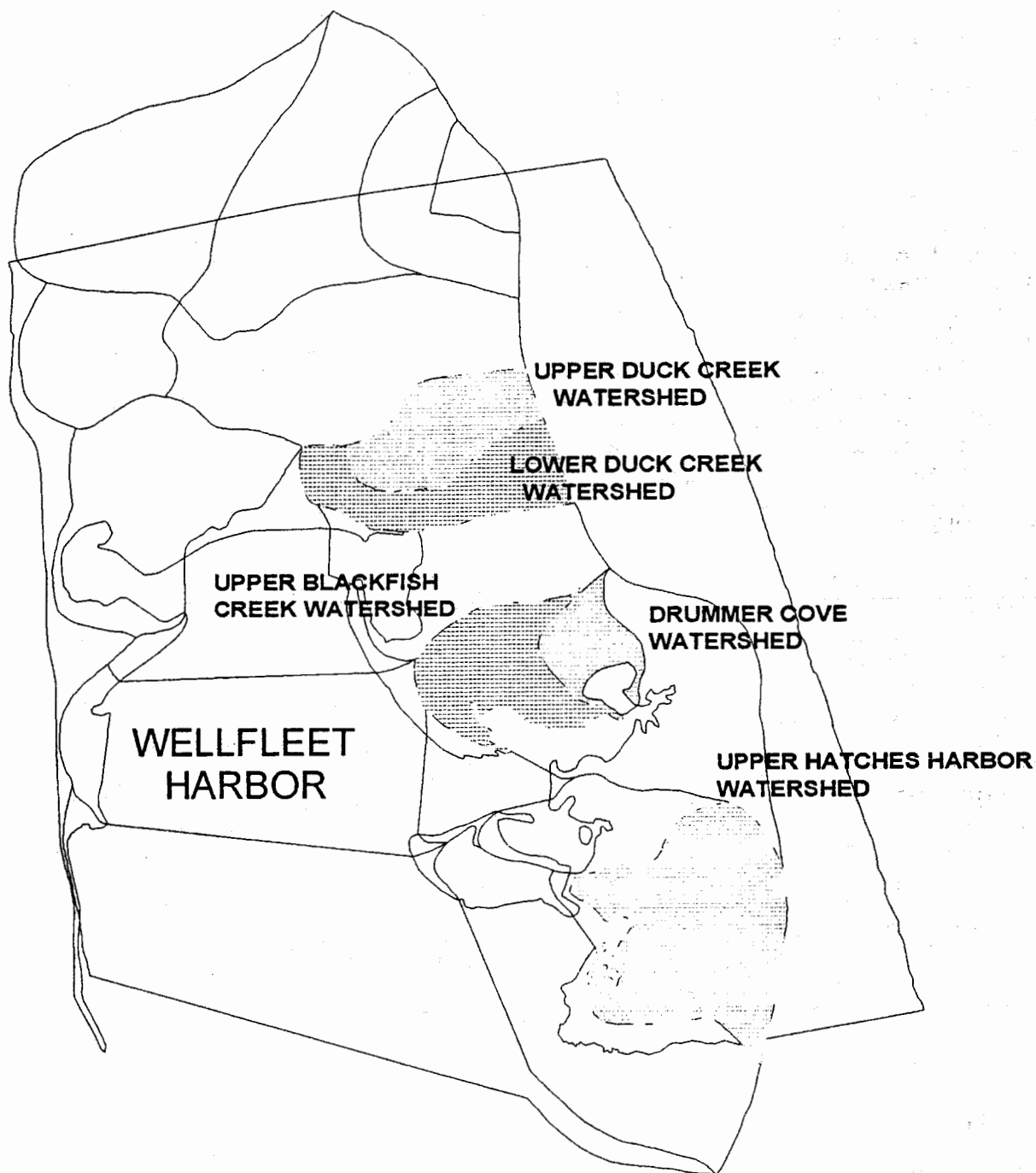
HARBOR AND ESTUARINE WATER QUALITY

Introduction

Wellfleet Harbor is a rich and productive estuarine area that comprises a major and economic resource of the Town of Wellfleet. The shellfishery alone has recently been estimated to have an annual value of over \$3.0 million. In addition, a recent socioeconomic survey conducted by the Woods Hole Research Consortium through the Massachusetts Bays MiniBays Program confirms the link between water quality and the economic livelihood of the town. Within the harbor, a variety of commercial and recreational activities occur including boating, shellfishing, fishing and swimming. There are 200 boat slips and over 250 moorings within the basin. In addition, there are over 100 boat moorings scattered among the harbor's many coves. Of the 164 shellfish grants held in Massachusetts, 54 (roughly one-third of the total) are located in Wellfleet Harbor. As with many of the embayments along our coast, Wellfleet Harbor also serves as a nursery for many finfish species of commercial significance. In recognition of its unique and delicate environmental assets, the harbor was designated an Area of Critical Environmental Concern (ACEC) in 1989. In creating a comprehensive harbor management plan, the ultimate goal is to recommend how Harbor resources can be utilized without detriment to resource quality. In this chapter, long-term measures to maintain or improve marine water quality will be evaluated.

Historically, programs to protect the water quality of marine embayments have focused on activities occurring in the water or in the immediate shoreline area. Recent information, however, suggests that in addition to this information comprehensive water quality protection programs must adopt a **watershed approach**. Simply put, the watershed approach to marine water quality protection examines activities that occur in the entire drainage area of the harbor. This involves both surface drainage, as well as areas that contribute groundwater flow to the harbor (referred to as the watershed). While the surface drainage basin can be determined simply using a topographic map, the delineation of the subsurface watershed can only be done by mapping the groundwater table in the area. Fortunately, the water table map was compiled in 1992-1993 under a grant from the Massachusetts Bays MiniBays Program and serves as the basis for some of the actions proposed herein. In the water table analyses performed by the Cape Cod Commission Water Resources Office, the overall watershed of Wellfleet Harbor was further subdivided as 19 subwatersheds. This approach recognized the fact that although the entire harbor on average has a high flushing rate, some of the smaller poorly-flushed areas may be more dramatically influenced by incoming groundwater.

WELLFLEET HARBOR WATERSHED AND SUBWATERSHED BOUDARIES



SOURCE: Modified from map compiled by the Water Resources Office of the Cape Cod Commission as part of the Massachusetts Bays MiniBays - Wellfleet Harbor Project
Special emphasis on those subdrainage basins determined to be at or near "critical loading" (SEE TEXT)

The map on the following page shows the 19 subwatersheds of Wellfleet Harbor. It was derived from groundwater level observations at 112 sites and 9 surface waters which were measured to the nearest 0.01 inch. Following these observations, groundwater maps were created. A groundwater map looks essentially like a surface contour map. The difference is that the numbers on the groundwater map correspond to height of groundwater as opposed to height of the landform. From these maps the direction of groundwater flow is determined. The boundaries of the watershed are defined by the lines at which water flows are away from one another.

Throughout this text, you will read references to "*critical watersheds*", "*critical areas*", "*critical nitrogen loads*" or "*critical limits*". These terms relate primarily to the effect that nitrogen (particularly the dissolved inorganic forms such as nitrate and ammonia) has on marine environments. While nitrogen is an essential nutrient in marine systems, its overabundance causes excessive algae growth, and periodic depletion of life-supporting oxygen (a situation called anoxia) in the water. The result can kill fish and shellfish, cause noxious odors, and create excessive buildup of organic muds and muck in the bottom sediment. An in-depth discussion of nitrogen and its present and projected effects on Wellfleet Harbor is given below in PART II, NITROGEN CONTAMINATION.

This portion of the management plan focuses on the three most prominent contaminants that can result from activities in and around the harbor and its watershed; human pathogens (bacteria and viruses), nutrients and toxic materials. In each of the following sections, the sources and potential sources of each contaminant are presented along with the associated action plan to reduce or eliminate the water quality threat. A final part of this chapter relates to public education. *The public education and outreach component can not be overemphasized as a necessary component to this management plan.* As you will see, many of the management actions involve regulation of activities in the watershed, expenditure of public funds, and an altering of some traditional ideas on how land within our harbor watershed can be used. In each case, we deem it extremely necessary to carefully lay down the rationale for proposed action and explain the basis of actions to our citizens. The public education and outreach component must constantly be reevaluated to make sure that it is fulfilling this need.

Inventory

This section of the management plan inventories the various sources of each contaminant source in Wellfleet Harbor. It follows the outline below.

PART 1 - Bacteria and Pathogen Contamination

Background and Present Status

Septic Systems

Boat Waste Discharge

Stormwater Runoff

Animal Wastes

Other Nonpoint Sources of Pathogens

Action Plan

Issues (Description of various specific issues)

Goals (Overall goal that we wish to accomplish)

Recommendations (Specific actions to achieve goals)

Responsibility (Department or agency responsible for carrying out recommendations)

PART 2 - Nitrogen Contamination

Background and Present Status

Nonpoint Sources of Nitrogen in the Watershed

Action Plan

Issues (Description of various specific issues)

Goals (Overall goal that we wish to accomplish)

Recommendations (Specific actions to achieve goals)

Responsibility (Department or agency responsible for carrying out recommendations)

PART 3 - Toxic Substance Contamination

Background and Present Status

Nonpoint Sources of Toxics in the Watershed

Action Plan

Issues (Description of various specific issues)

Goals (Overall goal that we wish to accomplish)

Recommendations (Specific actions to achieve goals)

Responsibility (Department or agency responsible for carrying out recommendations)

PART 4 - Education and Outreach

Background and Present Status

Action Plan

Issues (Description of various specific issues)

Goals (Overall goal that we wish to accomplish)

Recommendations (Specific actions to achieve goals)

Responsibility (Department or agency responsible for carrying out recommendations)

PART 5 - Water Quality Monitoring

Background and Present Status

Action Plan

Issues (Description of various specific issues)

Goals (Overall goal that we wish to accomplish)

Recommendations (Specific actions to achieve goals)

Responsibility (Department or agency responsible for carrying out recommendations)

Part 1 - Bacteria and Pathogen Contamination

Background and Present Status

Perhaps the most well known indicators of water quality in marine environments are coliform and/or fecal coliform. The reason for this notoriety is that for a long time there have been public health coliform standards for both bathing and shellfishing. A violation of these standards can prohibit the use of a bathing beach or restrict the harvest of shellfish from a productive area. In addition to signalling a public health threat, both of these events have very high public visibility and can result in long-term damage to a tourist-based or shellfish-based economy. In order to fully understand our treatment of this subject in this Management Plan, a brief review of information regarding this contaminant is necessary.

If disposed of improperly, pathogens in animal and human waste can pose a significant public health threat. Pathogens are organisms (primarily bacteria) or viruses that cause disease in humans. Disease can result from mere contact with the organism, or from ingesting water swallowed incidentally while swimming or ingested when eating contaminated shellfish. The standards for shellfish waters are much more restrictive than bathing beaches in recognition of the fact that shellfish concentrate bacteria in their gut during the process of filter feeding and hence would expose the consumer to higher doses of pathogens should the shellfish feed in contaminated water.

There are hundreds of types of pathogens possible in sanitary wastes. As you might guess, to measure for each of the possible pathogens would be impossible (methods for isolating some pathogens have not even been developed). For this reason, coliform testing was initiated in the 1920's and used as a surrogate measure of pathogens. As an indicator of pollution, fecal coliform had two advantages: it was easy to measure and it was present in all human waste. Since all human waste has the potential to carry pathogens and hence transmit disease, this indicator seemed appropriate to protect the public health. Even from the beginning, however, public health officials understood that fecal coliform was a conservative measure of public health. For instance, although it was clearly recognized that fecal coliform originating from human feces create a concurrent possible threat of disease organisms, the public health threat of fecal coliform originating from other animals (such as birds or domestic animals) is unknown. We do know, however, that many bacterial and some viral pathogens can cross from animals to man. To protect the public health, officials have rightfully maintained a conservative approach to this issue.

At present, the vast majority of Wellfleet Harbor has an "approved" status for shellfish harvesting. Due to more permanent or transitory high fecal coliform levels, some areas summarized

below have been classified as either "prohibited" or "conditional" respectively. In addition, some areas in Wellfleet Harbor are closed for management purposes. These later areas are not listed below.

Shellfish harvesting area closures due to high fecal coliform counts in Wellfleet Harbor

Location	Date	Closure Designation
Herring River		
Upstream of Dike	1985	Permanent
Downstream of Dike	1985	Intermittent/Conditional
Duck Creek		
Upstream of Uncle Tim's Bridge	1974	Permanent
Downstream of Uncle Tim's Bridge to Shirttail Point	1982	Seasonal
Hatches Creek	1988	Intermittent

The bacteriological status of bathing beaches is generally good. Occasional violations of the bathing beach standard of 200 fecal coliform per 100 ml of sample were fairly transient. Occasional violations of the standard would be expected, and are generally associated with either heavy rain (>2.0 inches in a 24-hr period) or abnormally high tides.

Many investigations have been conducted in Wellfleet Harbor over recent years to determine the sources of fecal coliform. Foremost, a comprehensive sanitary survey was completed in 1989-1990 to identify potential sources of fecal coliform. More recently, investigations conducted under the Massachusetts Bays MiniBays Program have confirmed some sources and investigated the overall sources of fecal coliform into the harbor. Regular surveillance for fecal coliform is conducted by both the Massachusetts Division of Marine Fisheries (in shellfish harvesting areas) and the Wellfleet Health Department (in two bathing beach areas). An overview of potential sources of pathogens and fecal coliform in Wellfleet Harbor indicate the following potential sources: septic systems, boat wastes/discharge, road runoff, and wildlife. Additional investigations also confirm that certain areas of the harbor, notably areas in which there is an abundance of organic sediment, act as reservoirs for fecal coliform. These reservoirs release their bound fecal coliform during disruptive hydrographic events such as unusually high/low tides, high wind conditions, or heavy rain.

Septic Systems

The issue of whether septic systems are a significant potential source of pathogen contamination has two aspects that bear mention. Numerous investigations in sandy soils clearly indicate that pathogenic bacteria are likely filtered out within a short distance from a properly sited septic system. Bacteria such as fecal coliform, therefore, can only reach Wellfleet Harbor via either a surface route or by direct pipe discharge. The recent sanitary surveys were an attempt to identify and correct any direct discharges of sewage to surface waters. However, the Board of Health is always ready to respond to reports of any hitherto-not-reported pipe discharges. Likewise, should a septic system fail and discharge sewage to the top of the ground, the Board of Health has a policy of immediate response, particularly in areas where the surface flow could affect shellfish or bathing waters of Wellfleet Harbor.

Complicating the issue of pathogens from on-site septic systems is the issue of viruses. Unlike bacteria, which are filtered effectively in sandy soils, viral pathogens, being much smaller, are not filtered. Studies performed in Long Island beneath functioning septic systems have shown that viruses can travel in excess of 200 ft. from the bottom of a septic leaching field.

Boat Waste Discharge

There is perhaps no greater potential for the direct discharge of untreated sanitary waste into Wellfleet Harbor or any other marine embayment than from marine craft. This is because of the close storage of sanitary waste that can be clandestinely discharged with little or no treatment. Because of this, shellfish harvesting classifications have generally been set based on the potential for discharge rather than actual water quality measurements.

How often boat waste discharge occurs is difficult to determine, but it is prudent to assume that boats that can support overnight stays have high potential to contribute to boat waste discharge. There are up to 150 overnight stays each season in Wellfleet Harbor. At the request of the NRAB and the Harbormaster, the town has designated the waters of Wellfleet Harbor as a no-discharge zone and recently applied to the Environmental Protection Agency for a federal designation for Wellfleet Harbors as a No-Discharge Zone. (See Appendix E, Marina Rules and Regulations)

If one person discharges his/her wastes directly into the harbor, there is a staggering contamination effect on the surrounding water. Using the theoretical fecal coliform contribution per person per day established by the Food and Drug

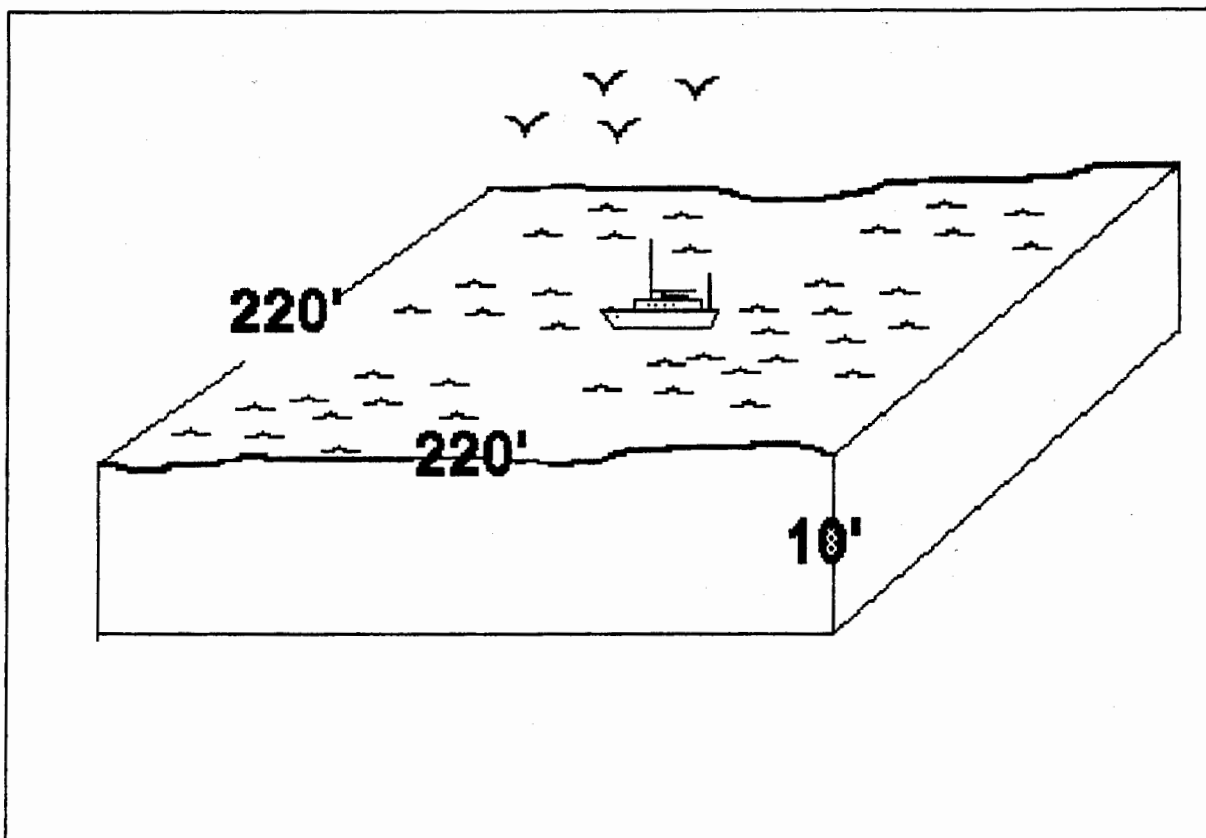


Figure 1. The amount of water contaminated to a level exceeding the shellfish standard when one person's daily waste is discharged.

Administration Interstate Shellfish Sanitation conference, it is possible to calculate the volume of water that is contaminated to a level that exceeds the standards for shellfishing (14 fecal coliform/100 ml. water). In one day, one person's feces discharged directly into seawater will contaminate 3.7 million gallons of water. That is the volume contained in a 220' x 220' area at depth of 10'. This figure ignores the dilution effect of tidal flushing but it indicates the potential effect of dumping sanitary waste into the harbor.

Road Runoff

"Hot Spots" of bacterial and chemical contamination often occur where large quantities of water collect in culverts from roads or poorly drained areas. Water that flows in culverts and small streams is collected from large areas of road or poorly drained ground. Any bacterial contamination encountered is concentrated in this runoff that frequently finds its way into the harbor. The amount of runoff that enters into the harbor is generally a function of the development around the harbor.

The greater the area of roads, parking lots and unvegetated

areas around the harbor the more road runoff there will be. Storm drains, which can channel water into leach pits, can effectively filter bacterial contaminants. Consequently, leaching catch basin installation is extremely important for runoff mitigation. Wellfleet has adopted an aggressive approach to identifying and mitigating road runoff problems. Using the worksheet developed by the Barnstable County Marine Water Quality Task Force, all the individual road runoff areas were ranked in severity. Funds provided by the town for road runoff mitigation are used on the most serious areas.

The predominate importance of road runoff as a source of bacterial pollution has been authoritatively demonstrated by L.E. Koppelman and E. Tanenbaum. The Long Island Segment of the Nationwide Runoff Program. Long Island Regional Planning Board, 1982; Buzzards Bay Comprehensive Conservation and Management Plan. Buzzards Bay Project. U.S. Environmental Protection Agency. Massachusetts Executive Office of Environmental Affairs. 1991. I:65-73; etc. Its importance in Wellfleet has been confirmed by numerous observations by the health agent and workers on the Massachusetts Bays MiniBays Project in Wellfleet Harbor. The April 28, 1986 Wellfleet Annual Town Meeting, Article 71, on the recommendation of the Wellfleet Natural Resources Task Force, voted:

"In order to protect the quality of the waters of the harbor and other wetlands within the town limits, no road or other surface shall be regraded, constructed, or maintained in such a manner as to divert or direct the flow of runoff, defined as including storm water or any other surface waters, excepting natural preexisting water courses, into any wetland, as defined in Massachusetts General Laws Chapter 131, S. 40. Uncontaminated runoff shall be directed in such a way as to recharge the groundwater within the lot where it originates and in such a manner as not to alter natural runoff into any wetland, not to cause erosion, pollution or siltation into or towards any wetland."

In compliance with this ordinance, the State Department of Public Works, 1986-1988, eliminated approximately ten out of twenty-two runoff violations identified on Route 6; three or more violations by private property owners were corrected; two major cases (East Main St.; Holbrook Ave. near Commercial St.) and three lower priority cases (Pilgrim Spring Road, Lieutenant's Island Road, and Wesley Swamp).

On July 1, 1986 the Wellfleet Natural Resources Task Force published a "Status Report on Harbor and Estuarine Pollution." reporting laboratory reports on total coliform (TC), fecal coliform (FC), and fecal streptococcus (FS) in samples collected from Mayo Creek, Herring River, Hatches Creek, Wesley Swamp and Route 6, together with preliminary observations on Wellfleet surface water

pollution, analyses of the problems, and recommended actions. Fecal coliform/100 ml counts ranged from 0 to 30,500.

In January, 1991, the Natural Resources Advisory Board met with the Town DPW Director and the Shellfish Advisory Committee and presented to the Board of Selectmen a survey of pollution currently being caused by stormwater runoff and a prioritized list of projects for correction of the identified problems.

In 1987 the Annual Town Meeting voted a special appropriation of \$5,000 for "Drainage Runoff Corrections," and additional funds have been expended since 1986 from the DPW appropriations. As measured by closures, the FC contamination appears to have remained at about the level measured in 1986. In view of the quantity of "residential" building and the inundations of summer visitors since that date, this tactical standoff may be counted a victory.

Animal Wastes

No discussion of fecal coliform sources can be complete without mention of the miscellaneous direct deposits of fecal material by various animals. Large numbers of ducks, geese and shorebirds flock to Wellfleet Harbor during their fall and spring migrations or to overwinter. There are also large summer and year-round populations of gulls. Fecal matter from these large populations of birds can represent a major source of bacterial contamination.

Despite the nostalgic image of walking one's dog on an open beach, we must bear in mind that dogs too can be significant sources of fecal coliform. Dog feces on the beach or in any area that has surface connection with the harbor must be viewed as an equivalent to human feces. Indeed, a number of diseases caused by *E. coli*, *Pseudomonas*, *Staphylococcus* and others can readily be transmitted to humans from dog feces. No matter what the source of fecal coliform (dogs actually have a higher fecal coliform level per gram of feces than humans), it presents a public health official with a "signal" that he/she must respond to. A regulation that restricts dog walking on Town beaches has recently been enacted. No dogs are allowed from June 1 to October 15. Other times fecal droppings must be picked up.

In each case where the source of fecal coliform is not human, as was mentioned previously, the level of public health threat is unknown. The threat is related, however, to the ability of the animal to shed in their feces diseases transmittable to humans. Every animal mentioned has been shown to have at least one bacterial disease that can infect humans. Certain viral agents have also been shown capable of being transmitted in the case of some birds.

Other Nonpoint Sources of Pathogens

When the source of bacterial pollution can not be traced back to a particular septic system or discharge pipe, it is referred to as *nonpoint pollution*. By definition, nonpoint pollution enters the resource area from diffuse and dispersed sources. In this category of pollution are bird droppings and other natural sources of contamination. Even stormwater runoff derived from various sources, not collected and conveyed by pipes, is included in the classification of nonpoint source pollution. In addition, much recent evidence suggests that fecal coliform, upon entering the marine environment from any source, can have prolonged survival and persistence in certain situations. For instance, organic sediments that are found throughout the slower moving waters and eddies in the harbor, provide a suitable habitat for the prolonged survival of fecal coliform. This phenomena has been confirmed using samples from the Herring River, where high levels of fecal coliform bacteria have been observed in recent years. Since there are not many houses in the vicinity of the dike, county and town officials suspect, and data collected corroborate, that sediments in the river represent a non-point source "reservoir" of bacterial contamination.

Action Plan

To maintain or improve water quality in the future, two general approaches may be taken: 1) prevent future pollution inputs through planning efforts, 2) identify and correct current sources of pollution. Using the first approach, potential problems are identified before they have a significant negative effect, whereas, in the second approach, techniques are used to stop the pollution that is already degrading water quality. The first approach is obviously the best but it involves foresight, public support and a long term planning commitment. In the section that follows, we list recommendations for dealing with the critical water quality problems.

Bacteria and Pathogens - Issue #1: Failing or inadequate on-site septic systems contribute to the pathogen contamination of the harbor.

Goals: To insure that on-site septic regulations in the Town of Wellfleet are stringent enough to protect the harbor from bacterial contamination.

To insure that preexisting on-site septic systems that are contributing to the pathogen contamination of the harbor are identified and repaired.

Recommendations:

A. In light of new evidence about viral contamination the new Title 5 septic regulations the Board of Health should reserve a few of its regularly scheduled meetings to review and consider and more stringent local regulations within 250 feet of a wetland. As a starting point, the regulations adopted in the Towns of Falmouth and Barnstable should be considered. Alternative waste systems, e.g. waterless, low water, "electrical" etc. should be encouraged where appropriate.

B. Houses in the watershed of Wellfleet Harbor should have their septic systems periodically inspected to insure that they comply with local, state and federal regulations.

C. In their effort to revise Title 5 regulations, Massachusetts commissioned a technical evaluation of the regulation by Defeo, Wait & Associates, Inc.. Chapter 14 of this report describes ways to optimize the treatment of wastes in the soil adsorption system and states "Dosing and resting a soil absorption system provides the best treatment efficiency while producing the lowest incidence of soil clogging induced failure." In recognition of the superior treatment of effluent by dosed septic systems, we recommend that, in situations where there is a variance sought from the Town's 100 ft. setback from wetlands, that a pump-dosed system be among the conditions for such a variance.

D. Bacterial data from Shellfish Sanitary Survey and Minibays study should be reviewed and updated, particularly in Duck Creek to determine whether any on-site septic systems are contributing to elevated bacterial contamination.

Responsibility: A,B,C - Board of Health, D - Board of Health, Natural Resources Department - MiniBays Management /Committee

Bacteria and Pathogens - Issue #2: Stormwater runoff represents a significant source of bacterial contamination to the harbor.

Goals: To identify and correct all sources of polluted surface runoff into the harbor. To insure that land use practices around the harbor do not increase chances of pathogen contamination of the harbor.

Recommendations:

A: A checklist of all repairs performed in the past should be kept and all previous repairs to stormdrains should be reviewed annually to make sure that they are functioning properly.

B: A 100 foot buffer zone should be established around Wellfleet Harbor where natural vegetation should be allowed to grow to prevent surface runoff. Private landowners in the buffer zone should be encouraged to have vegetation rather than impermeable surfaces near the shore.

C: A visual survey should be made of all property owners having properties where surface runoff creates a potential problem for the harbor. An informational flyer outlining the problem and giving solutions should be prepared and distributed to these individual property owners.

Responsibility:

A - DPW, possibly the Natural Resources Advisory Board with the help of volunteers.

B - Planning Board

D - Natural Resources Advisory Board with assistance from the MiniBays Project.

Bacteria and Pathogens - Issue #3: Sanitary wastes from boats represent a significant potential source of bacterial contamination to the harbor.

Goals: To insure that all sanitary waste is removed from boats with marine sanitation devices or holding tanks. To insure that no sanitary waste is dumped into Wellfleet Harbor.

Recommendations:

A: In conjunction with the recent application to EPA for a federal No Discharge Zone, the Town should take every opportunity to publicize and encourage use of its marine sanitary waste facilities. Informational flyers should continue to be handed out with all slip and mooring permits. Every attempt should be made to keep the no-fee status for pumping in order to encourage its use. If this is financially not possible, pumping costs should be incorporated into mooring and slip fees.

B: The effectiveness of the pump-out facility should be reviewed after its first year in operation and a bylaw that requires sealed heads for all boats should be considered.

C: The DPW should make every attempt to maintain the attractiveness and accessibility of shoreside facilities. These facilities are important in minimizing the amount of marine sanitary wastes by providing slip owners with a convenient and clean alternative to using their boat facilities.

D: To maintain the economic feasibility of maintaining pumpout and shoreside facilities, the Town should make every

attempt to complete an alternative-type sewage disposal unit for the marina, shellfish shack and ball field. Presently the town pumps out the tight tanks at the marina at a considerable cost. The Massachusetts Bays MiniBays Project has already secured funds for the alternative septic system design.

Responsibility: Harbormaster, DPW, Planning Board

Bacteria and Pathogens - Issue #4: Domestic animal wastes are a significant potential source of bacterial contamination in the harbor.

Goal: To minimize the contribution of animal wastes to pathogen pollution.

Recommendations:

1. The Dog bylaw should be changed to include all beaches; to apply to horses as well; and to prohibit dogs and horses except from November 1 through March 31.
2. The bylaw should be more strictly enforced.
3. A brochure or similar type of literature explaining the law and the reasons for it should be written and distributed to everyone who applies for a beach sticker.
4. A sign stating the regulations and restrictions should be posted at every beach and pond.

Responsibility: Dog Warden, Shellfish Department, proposed Natural Resource Officer

Bacteria and Pathogens - Issue #5: The Herring River is subject to episodic elevations in bacterial levels that are closely correlated to rainfall and it can consequently be managed as a conditionally open shellfishing area.

Goal: To maximize the number of areas open to shellfishing without creating a health risk from bacterial contamination.

Recommendation: The conditional shellfishing status of the Herring River as designated by the State program in cooperation with local and county authorities should be supported in the future.

PART II Nitrogen Contamination

Nitrogen, the nutrient of primary concern in the waters of Wellfleet Harbor, is an element essential to the growth and reproduction of organisms and to the general productivity of this or any harbor. It occurs in various forms, such as ammonia or nitrates, and has always been present in embayments such as Wellfleet Harbor as a result of natural processes. Although nitrogen is beneficial at normal levels, when it is introduced into pristine coastal waters in excessive quantities by human intrusion, it causes an imbalance in the growth of primary producers such as algae, the subsequent effects of which are described below.

Both the natural and anthropogenic (man-made) contributions of nitrogen may vary in any embayment. In Buttermilk Bay, the percent contribution from various sources was as follows: precipitation 3%, sewage treatment facilities 0%, septic systems 74%, and fertilizers 23%. Although there is some temptation to apply these same ratios to Wellfleet Harbor, certain differences in the biological characteristics between these two embayments lead us to believe there are also differences in the importance of nitrogen sources.

In recent years, the observation of degrading water quality in many marine embayments has prompted much research into causes. In many instance, the causes of degraded marine water quality have been linked with anthropogenic (man-made) sources of nitrogen. Excessive nitrogen has various environmental consequences that are particular to each embayment. Some common problems caused by excessive nitrogen are depicted in the figure below and include:

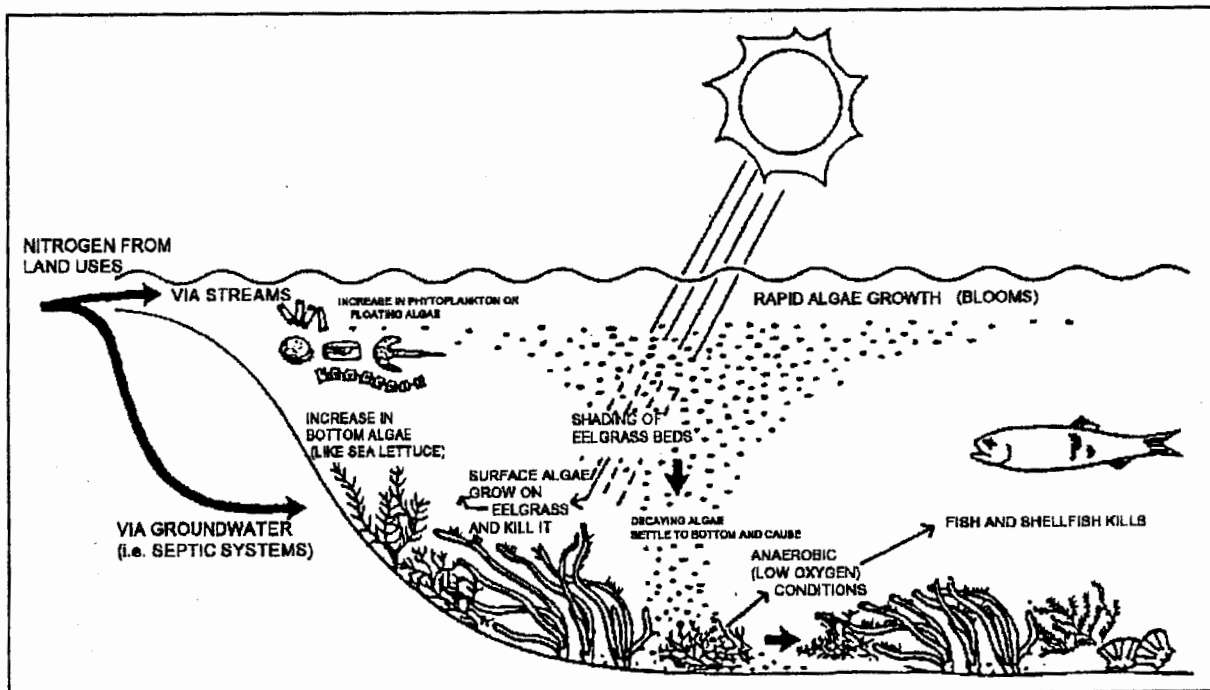
- increased growths of microalgae (eg., phytoplankton or floating algae) and macroalgae (seaweeds);

- increased cloudiness (turbidity) of the water and subsequent shading and death of important submerged vegetation beds;

- anoxic conditions in the sediments following the death and settlement of algae, and;

- subsequent death of fish and shellfish in areas that become anoxic.

Furthermore, eutrophication, turbidity, and decomposition of organic matter contribute to the prolonged survival and the increase in number of coliform bacteria. This effect causes the closing of shellfish beds and bathing beaches as required by public health regulations.



(On eutrophication caused by nitrogen and coastal embayments, see Buzzards Bay Comprehensive Conservation and Management Plan. Vol. I. Buzzards Bay Project U.S. Environmental Protection Agency and Massachusetts Executive Office of Environmental Affairs, 1991. pp. 35 ff.)

Since, as we have previously stated, nitrogen is an essential nutrient to marine systems, a logical question arises - *How much nitrogen is too much?* To address this question and thus to help resource managers and town planning officials make sound decisions regarding land use that effects marine embayments, marine scientists used both laboratory and field observations. By using observations made in a series of experiments in Narragansett Bay (known as the MERL mesocosm studies) and other marine ecosystem study sites, the ("critical") concentrations of nitrogen that cause undesirable effects have been determined. These values are referred to as the "*critical nitrogen limits*". It is the critical nitrogen limit that determines, in concert with the volume and flushing rate of the embayment, what the *critical nitrogen load* (nitrogen load coming from uses in the watershed) will be. The *critical nitrogen load* is that amount of nitrogen entering an embayment beyond which undesirable events, such as fish kills and anoxia, can occur. The goal of a water quality management plan should be to prevent the excessive loading of nitrogen into the receiving marine waters by instituting reasonable measures to prevent excess.

The methodology for determining the critical nitrogen load involves the following steps: Determination of the volume of the

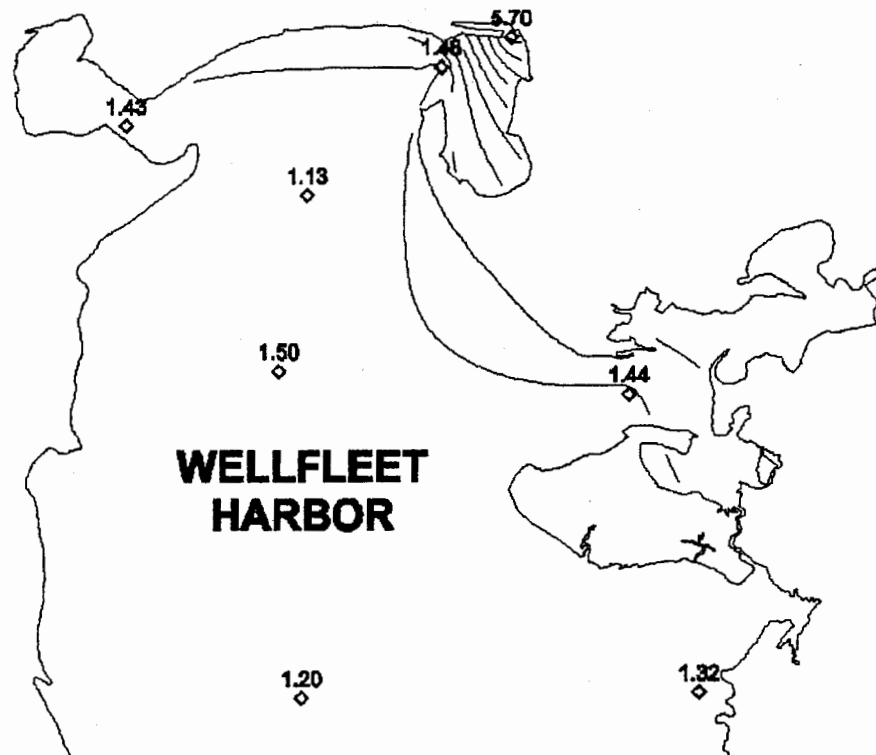
embayment, determination of the flushing rate of the embayment, delineation of the drainage basin (See Introduction), and a parcel-by-parcel examination of the watershed to determine loads from existing development, future potential development, rainfall and runoff from impervious and unvegetated pervious surfaces, lawns, and agricultural land. Much of this groundwork has been conducted by the joint local-county-state-federal effort known as the Wellfleet Harbor Project. The Wellfleet Harbor Project, funded by the Mini-Bays Program of the Massachusetts Bays Program, a cooperative United States Environmental Protection Agency/Massachusetts Executive Office of Environmental Affairs program, was initiated in 1991 and is still in progress. The research conducted to date under this project has tentatively identified four subembayments in Wellfleet Harbor where the calculated loading exceeds the "critical level" and the waters are eutrophic. These critical embayments are: 1) Upper and Lower Duck Creek, from the headwaters of the creek to a line running easterly from the eastern tip of Shirttail Point (the Marina); 2) Upper Blackfish Creek, east and north of a line running from Field Point to Old Wharf Point; 3) Upper Hatches (Silver Spring) Harbor, north and east of a line running from the southeast tip of Lieutenant's Island to the western tip of the mouth of Silver Spring Brook. Drummer Cove, a subembayment on the north side of Upper Blackfish Creek, has waters classified as just below the critical loading level. The waters of other areas of the Harbor contain nitrogen in various degrees of concentration but at present they are still below the critical loading level. The hydrographic boundaries of the several watersheds from which nitrogen is being carried into the critical embayments listed above have been established, as have those of the watersheds contributing to the areas of the Harbor still below the critical nitrate loading level.

For the purpose of planning, areas of the Harbor in which the waters contain nitrogen in quantities still below the critical loading level and the watersheds contributing thereto are designated as *noncritical*. The embayments listed above in which the nitrogen is concentrated in quantities above the critical loading level and the watersheds contributing thereto are designated as *critical*. If the input of nitrogen into the noncritical areas is not permitted to increase beyond the ability of the system to safely assimilate it, it may be assumed that stream and ground water flows and tidal currents will continue to keep these waters at acceptable quality levels. On the other hand, if the input of nitrogen into the critical areas is sufficiently reduced the same natural flows and currents may restore these areas to their original satisfactory quality level.

What do we know about Wellfleet Harbor ?

Studies conducted through the Wellfleet Harbor Project, as well as other sources confirm that Wellfleet Harbor generally has good water quality relative to nutrient levels. Three general

**Average Dissolved Inorganic Nitrogen
(Nitrate + Ammonia) Levels (μM) in
Wellfleet Harbor - June, 1992 to August, 1993**

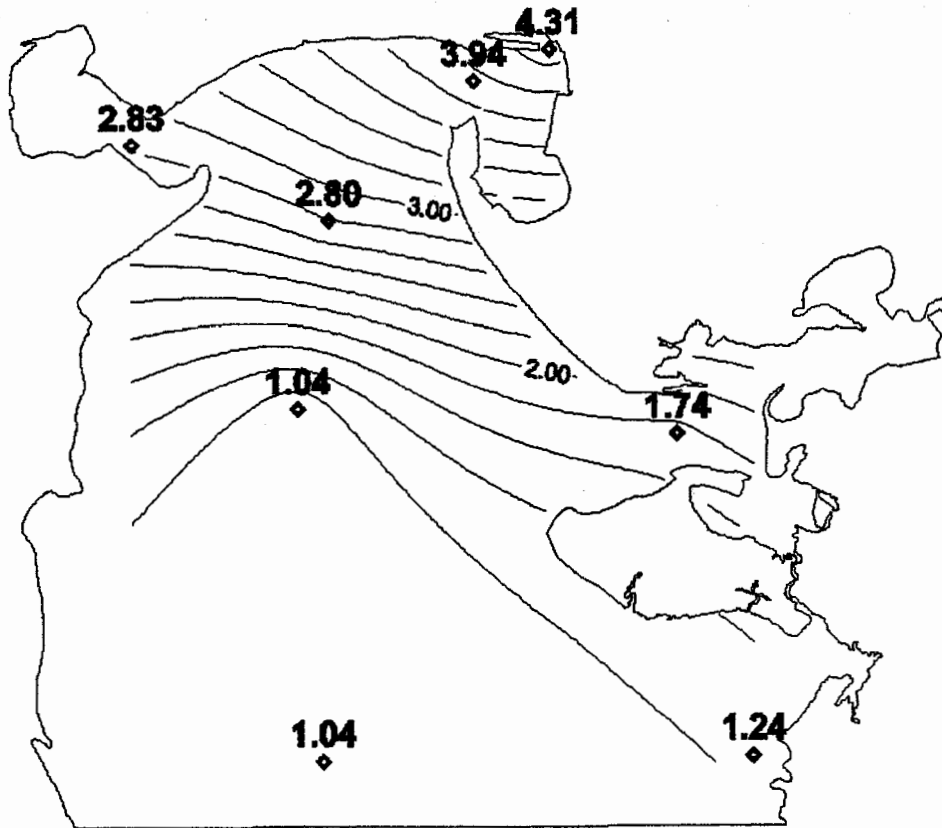


**Samples Taken Monthly June-November
and March-August**

Figure 3. Average Dissolved Inorganic Nitrogen Levels in Wellfleet Harbor over one year of measurement.

areas of the harbor, however, give indication of stress relative to nutrients. Foremost, the area of Duck Creek, by nature of its shallow depth and lower flushing rate shows definite signs of degradation. Thick, mucky organic sediments, depressed levels of dissolved oxygen, and extensive summertime growth of the marine algae *Ulva lactuca* (sea lettuce) and *Enteromorpha sp.* in the Chipman's Cove area give evidence that excessive nutrients are entering and being retained in this area. Average dissolved nitrogen levels, as well as chlorophyll-a levels (Figures 3 & 4), also indicate that the Duck Creek area has above average levels of these compounds compared with open water stations. The level of both these compounds clearly indicate high levels of nitrogen are

Chlorophyll-a Levels (ug/l) in Wellfleet Harbor June, 1992 - August, 1993



Samples Taken Monthly (June - November and March - August)

Figure 4 Average Chlorophyll-a levels in Wellfleet Harbor over one year of measurement.

available and being assimilated by planktonic algae. Although this is not, of itself, a negative aspect, the generally-lower dissolved oxygen in this area suggests that the overenrichment of the area has a negative impact on the health of the system. Of importance in considering these data is the fact that we do not yet know how much of the available nitrogen is from man-made sources and how much is due to sediment regeneration. Sediment regeneration is a process by which the organic matter flowing in from the marsh at Duck Creek settles to the bottom and decomposes, thus releasing available nitrogen to the water column. More pertinent to the management of the harbor is the question as to whether the dominant nitrogen source

is natural or anthropogenic (originating from sewage disposal practices). The answer to this question will play prominently in

a management strategy.

The other two areas that have been tentatively identified as critical are Upper Blackfish Creek and Upper Hatches Harbor. The actual critical nature of these areas is still subject to some question. Although some of the classic indications of eutrophication are present (areas of thick organic sediment, some elevation of nutrients), the area is excessively drained during low tide and has extensive areas of tidal flats. Research in the coming year will focus on determining whether there are factors that compensate for nutrient inputs to the area (see discussion below).

In discussing eutrophication or the process of nutrient enrichment in any area, it should be remembered that, to some extent, eutrophication and nutrient cycling through any system is a natural process. Only in areas where the physical features and characteristics (such as tidal flushing, depth etc.) act in concert with nutrient inputs from various sources to produce the previously-described effects does the term eutrophication take on a negative connotation. Nitrogen from man-made sources, added to the natural sources, actually only accelerates the natural course of events. This is why, in many texts, the term "cultural eutrophication" is used to distinguish the anthropogenic-influenced process from the natural one.

What we still don't know about Wellfleet Harbor

A critical question in applying any of the theoretical models that predict nitrogen levels and harmful effects of those levels on Wellfleet Harbor is "How appropriate is the application of the model to this specific application?". While predictive models are quite useful planning tools, their predictive capability is only as good as their consideration of the variables. Wellfleet Harbor contains a number of features which should introduce caution to the approach of applying nutrient loading models. In brief, some of these are:

- 1) Extensive area of mudflats which may be accomplishing a significant degree of denitrification;
- 2) An extensive marsh system that may be contributing natural sources of nitrogen to the system, and;
- 3) A 9-foot tidal range.

Action Plan

This part of the Management Plan endeavors to prevent excessive inputs of nitrogen from any controllable source into any watersheds that have been tentatively identified as critical in Wellfleet Harbor.

Nitrogen Contamination - Issue #1: The use of chemical fertilizers (particularly lawn fertilizers, which contain typically 29% nitrogen and nitrogen compounds) within any of the watersheds can create an aquatic environment in which tidal flushing is less effective. Ground covers that thrive on low-nitrogen soil and organic fertilizers are available. Details on this and other low-maintenance plantings is available in a publication entitled "Planting and Maintaining Sustainable Landscapes" available through the County Extension.

Goal: To minimize the use of nitrogen fertilizers within all watersheds contributing to the Harbor waters.

Recommendation: The Board of Health should maintain and distribute information on the appropriate use of nitrogen fertilizers. It should further refer all inquiries regarding plants which thrive well on low nitrogen soils as well as inquiries on how to minimize leaching of nitrogen to groundwater to the County Extension.

Responsibility: Board of Health

Nitrogen Contamination - Issue #2: The volumes of nitrogen in the discharges from septic systems in noncritical watersheds must be minimized and the volumes of nitrogen in discharges from septic systems within confirmed critical watersheds (Tentatively identified as Duck Creek, Upper Blackfish Creek including Drummer Cove, and Inner Hatches (Silver Spring Harbor) must be reduced as soon as possible (following their final determination - See Note below). The implementation of the revised state regulation for subsurface sewage (Title 5) is deemed adequate in its nitrogen limitation for noncritical watersheds.

Goal: To prevent inordinate increases in nitrogen in discharges in noncritical watersheds and to decrease nitrogen in septic discharges in confirmed critical watersheds in timely fashion.

Recommendations:

A: Request of the Cape Cod Commission Water Resources Office a clear delineation or the methods for delineation of the critical watersheds. A map should be compiled that will give clear parcel-level information to those parcels in the

critical watersheds.

B. The synthesis of information on nutrient loading to Wellfleet Harbor should be completed to confirm the extent and/or existence of critical watersheds.

*** Note: The synthesis report on nutrients in Wellfleet Harbor is in Progress as of June, 1995, and is to be completed by November, 1995. It is anticipated that a final determination of critical watersheds will be described in this document.

C: All expanded septic systems in confirmed critical areas should be required to provide for approved denitrification if and when available. The level of treatment to be required should be either a net reduction of the system before expansion or such that the property can achieve a 5 ppm level of nitrate at the property boundary, whichever is less. A complete description on how to achieve this level has been described in Technical Bulletin 91-001 NITROGEN LOADING, prepared by the Cape Cod Commission, December, 1991.

D: A policy should be formulated as to what further requirements should be imposed on those individuals in confirmed critical watersheds who are replacing septic systems on properties already exceeding the nitrogen loading requirements of the present Title 5 (440 gallons/acre).

E: The Wellfleet Harbor Project of the Massachusetts Bays Program should conduct its proposed experiments related to alternative septic disposal systems, which, it is expected, will provide for denitrification in addition to improved elimination of pathogens and other pollutants. The Wellfleet Board of Health should vigorously support the education of the public in the benefits to be derived therefrom.

F: Discussions should be initiated to determine what measures would be necessary to reduce nitrogen in confirmed critical areas to non-critical levels. For example, how much nitrogen per parcel would have to be removed and what alternative technology combinations would achieve this reduction.

Responsibility: A- Selectmen or Board of Health request of the Cape Cod Commission. B - Massachusetts MiniBays Project, C,D,E - Board of Health

Part 3 - Toxic Substance Contamination

Background and Present Status

The recent dredging project in Wellfleet Harbor, that allowed uncontaminated dredge spoils to be taken to a site in Cape Cod Bay, underscores the fact that Wellfleet Harbor does not presently have

a toxic material contamination problem. We are fortunate, therefore to be able to act in a preventive mode.

Action Plan:

This part of the Management Plan endeavors to prevent the contamination of the waters of Wellfleet Harbor such that the present uses of the harbor are impaired.

Toxic Substance Contamination - Issue #1: Storage and use of hazardous materials within the watershed are a potential source of contamination to the waters of Wellfleet Harbor.

Goal: To minimize the amount of toxins that enter the harbor system.

Recommendations:

A. Since a large waste oil tank has been installed at the marina, boaters should be educated about the waste oil collection program.

B. The frequency of household hazardous waste collection should be increased. Cooperative efforts between towns should be explored to minimize the cost and enable the Town to collect hazardous waste at least three times a year.

C. The Town of Wellfleet should consider joining the Hazardous Materials Users Grant sponsored by the Barnstable County Health and Environmental Department to register hazardous materials used by businesses and educate users how to handle and dispose of them properly.

D. Boat owners should be required to collect and properly dispose of any residues resulting from scraping and painting their boats.

Responsibility: Harbormaster, NRAB

Part 4 - Public Education

Background and Present Status

It is extremely fortunate that Wellfleet Harbor is the host to a number of institutions that contribute educational opportunities for the general public regarding natural resources and water quality. These include the Cape Cod National Seashore, the Audubon

Society, the Wellfleet Conservation Trust and the Wellfleet Harbor Project. This Harbor Management Plan proceeds on the firm belief that public education and outreach is probably the single most effective avenue for protecting water resources in Wellfleet. It is responsible for consensus building for support for programs, mitigating measures and the expenditure of public funds for water quality protection.

Public Education - Issue # 1 Public education and outreach is the single most effective means for protecting water quality in the Wellfleet Harbor.

Goal: To educate the public about our harbor resources and how to use and protect them.

Recommendations:

A. A short promotional video should be made for the library and local public television about Wellfleet Harbor resources and what the Town is doing to protect them.

B. A video concerning Harbor Management all around Cape Cod should be produced by the Cape Cod Commission and Coastal Zone Management and/or programs concerning water quality and marine ecosystems should be periodically aired locally and on public television.

C. Whenever the Town initiates a new effort to protect harbor resources, like the Minibays cultch program, or the establishment of a pumpout facility, local media from a compiled list of media contacts should be informed.

D. A series of brochures on specific resource quality issues should be compiled and distributed at conspicuous public locations like the marina, post offices, and Town Hall.

E. There should be a display and pamphlet box such as the one at the Marina at each large beach parking area including Indian Neck, Mayo Beach and outside of Town Hall.

F. Specific brochures should be mailed to residents in designated areas, distributed with dump permit, slip or mooring applications or included in the Chamber of Commerce Booklet.

G. County Extension specialists should be encouraged to present their techniques for low-impact gardening each year. These techniques encourage landscaping with indigenous plant species that thrive in local conditions with a minimum of fertilizers and pesticides.

H. The Town should sponsor an annual symposium of all work being performed in Wellfleet Harbor. This would include research, routine monitoring, a report from regulatory boards, and a report from the various committees. Financial support should include a publishing of abstracts and summaries from the symposium.

Responsibility: Proposed Natural Resources Office, NRAB, Board of Selectmen

Water Quality Monitoring

Background and Present Status

There are a number a sampling programs that are presently being conducted in Wellfleet Harbor. The most consistent and historic program is that of the Massachusetts Division of Marine Fisheries, which monitors the harbor at least bi-monthly for the purpose of classifying the shellfish harvesting areas. In addition, the Board of Health, through the support of the Barnstable County Department of Health and the Environment monitor the two bathing beaches for fecal and total coliform during the summer months. More recently, the Massachusetts Bays Program through the minibays component (referred to as the Wellfleet Harbor Project) has been conducting monthly surveys since June of 1992. Thirteen samples are processed for a variety of parameters including nutrients, bacteria and dissolved oxygen. This program is scheduled to end in June, 1996.

Action Plan: It is paramount that the town of Wellfleet continue to monitor Wellfleet Harbor to determine the "health" of the harbor and the effect of any management decisions it makes.

Water Quality Monitoring - Issue # 1: Continuous comprehensive water quality monitoring is the only way that the Town of Wellfleet will be able to track the health of our water resources over time.

Goal: To create a comprehensive, affordable, long term water quality monitoring program for Wellfleet.

Recommendations:

A. An ad hoc committee with representatives from the responsible boards and departments should create a long term water quality monitoring program for Wellfleet.

B. The town should support the continuance of water quality

monitoring presently being performed under the MiniBays Program. This includes the continuance of monitoring for nutrients.

Responsibility: Health Agent, Minibays Grant Coordinators, Conservation Commission, Natural Resources Advisory Board, Shellfish Constable

Glossary of Common Terms* Used in This Chapter

Aerobic. Living, active, or occurring only in the presence of oxygen.

Algae(algal) Bloom. A condition resulting from excessive nutrient levels or other physical and chemical conditions that enable algae to reproduce and grow rapidly.

Anaerobic. The state of being in the absence of free oxygen. Used to describe processes occurring in the absence of free oxygen. Also **Anoxic**.

Chlorophyll-a. A substance in plant cells that is used in the process of photosynthesis. When amounts of chlorophyll-a are measured in the water column, they indicate the measure of primary productivity of algae.

Coliform (Total Coliform). A group of bacteria used as indicators of the sanitary quality of water. This group contains a number of bacteria having their origin in soils and hence coliform bacteria has received less use in recent years as true indicator of sanitary quality. See **Fecal Coliform**.

Critical Nitrogen Load. The amount of nitrogen (or "loading") that, when added to a receiving marine water, produces an undesirable effect. This value assumes a theoretical maximum nitrogen level derived from observations made in various published studies.

Critical Watershed (also Critical Areas). A watershed or area in which it has been determined that nitrogen entering from within its boundaries constitutes a threat to the environmental integrity of the receiving water.

Ecosystem. A community of living organisms interacting with one another and with their physical environment, such as a salt marsh, an embayment or estuary.

Embayment. A small bay or semi-enclosed coastal water body whose opening to a larger body of water is restricted. Also used: **Subembayment:** small embayments opening to a larger embayment.

Eutrophication. The process of nutrient enrichment in aquatic ecosystems. In marine systems, eutrophication results principally from nitrogen inputs from human activities such as sewage disposal and fertilizer use. The addition of nitrogen to coastal waters stimulates algal blooms and growths of bacteria, and can cause broad shifts in ecological communities present and contribute to anoxic events and fish kills.

Fecal Coliform - a group of bacteria used as indicators of the sanitary quality of water. Unlike total coliform, fecal coliform

are considered more specific to fecal origin and are used as indicators of public health threat in shellfish and bathing beach waters.

Flushing Time. The mean length of time for a pollutant entering a water body to be removed by natural forces such as tides and currents.

Leaching Facility. An approved structure used for the dispersion of septic tank effluent into the soil. These include leaching pits, galleries, chambers, trenches and fields.

Nonpoint Source Pollution. Pollution that is generated over a relatively large area and enters a body of water in diffused and dispersed manner, as opposed to being discharged through a pipe. Examples include septic systems, marine craft wastes and certain stormwater runoff.

Nutrients. Essential chemicals needed by plants and animals for growth.

Measurements. Unfortunately, the measurement used among different ecologists may vary according to their needs. The most commonly recognized measurement is

ppm = parts per million
or
mg/l = milligrams per liter, which can essentially be equated to parts per million.

Because nutrient levels become important at extremely low levels, ecologist often express nitrogen, for instance in thousandths of a milligram (or microgram "ug") in a liter.

ug/l = micrograms per liter, 1 ug/l = .001 mg/l

and for certain analyses, a micromolar value is calculated. While it may not be important to know what a molar value is, the example below is meant to give you an idea of what the equivalent molar value is to a value you may be more familiar with - ppm or parts per million.

example: 1.5 uM nitrate (a value you might expect in Wellfleet Harbor)

1.5 uM = .0000015 moles/liter x 14000 mg/mole =

.021 mg/liter or .021 ppm

contrast this level with the 40 ppm nitrate you might find in groundwater beneath your septic system or 2 ppm you might commonly

find in drinking water.

Nitrogen - an element essential to the biological productivity of ecosystems. Nitrogen is measured, in various forms, to assess the "health" and productivity potential of marine systems. These measurements include the inorganic forms of nitrogen such as ammonia(ium), nitrate, and nitrate, as well as nitrogen bound in various organic compounds.

Pathogen (Human Pathogen) - An organism or virus capable of producing a disease in humans.

Watershed - The land area that contributes groundwater or surface runoff to a surface water.

* Some definitions from Buzzards Bay Comprehensive Conservation and Management Plan. Vol. I. Buzzards Bay Project U.S. Environmental Protection Agency and Massachusetts Executive Office of Environmental Affairs, 1991.

CHAPTER III

NATURAL RESOURCES

Introduction

This portion of the Harbor management plan concerns the natural resources of Wellfleet Harbor. Probably the primary attraction of Wellfleet Harbor to the people who live here and visit is the unique assemblage of resources - the marshes, tidelands, wildlife, finfish and shellfish of our town. These natural resources are the wealth continuously produced by the forces of nature. We can increase this wealth by being good husbandmen, by nurturing our lands and waters, and harvesting no more than nature can allow. Or we can destroy our bounty by carelessness, ignorance, and indifference. It is hoped that we can learn from our mistakes of the past.

The goals of the natural resources chapter are to:

1. Maintain or improve the quality of harbor natural resources
2. Assure the sustainable use of resources.

PART I. INVENTORY

Wellfleet Harbor is 4.8 miles long north to south and varies in width east to west to a maximum of 3.3 miles at MHW (mean high water). The maximum depth at MHW is 43 feet but the mean depth is only 6.2 feet. Since tidal amplitude is 10 feet, much of the Harbor is dry at low tide; the area decreases from 6,094 acres at MHW to 3,815 acres at MLW (mean low water), a difference of 37.4%; the bordering marshes total 1,117 acres (Curley et al., 1972). The principal creeks and estuaries are the Herring River, Duck Creek (two branches), Blackfish Creek, Fresh Brook, Silver Spring Brook, and Hatches Creek. Much of the surrounding shores have been preserved from modern clearing and development by the Cape Cod National Seashore and the Massachusetts Audubon Society's Wellfleet Bay Wildlife Sanctuary.

Water Quality

A more detailed analysis of water quality with recommendations is found in the Water Quality Chapter 2, Harbor and Estuarine Water Quality.

The large tidal amplitude produces a MHW volume of 17.1×10^8 cu. ft., a MLW volume of 6.3×10^8 cu. ft., and a tidal exchange of approximately 63%. The recorded water temperature range is from 81° to 31°F; floe ice frequently fills the harbor from December through February. Recorded salinity ranges from 15 o/oo at the Herring River mouth to 34 o/oo near Jeremy Point. Narrower ranges of 28-33 o/oo, 28-32 o/oo and 29-34 o/oo have been observed at the

Town Pier, Loagy Bay and Jeremy Point respectively. Dissolved oxygen samples taken in 1968-69 had a mean value of 8 ppm, with only one sample below 5 ppm. (Concentrations of 5-8 ppm are considered satisfactory for marine fishes.) All samples for relative acidity taken in 1968-69 showed pH values of 7-9, which is considered compatible with marine life (Curley et al., 1972). In recent years, however, conditions of extreme acidification and anoxia have been observed in the Herring River (Roman et al, 1987). In 1969 samples of water, oyster tissue and mud were taken for traces of chlorinated hydrocarbon pesticides at locations in the Herring River, Duck Creek, and Blackfish Creek, with the following highest findings: water: DDT 0.83 ppb, from the Herring River; oysters: dieldrin, 30 ppb, from the Herring River; mud: DDT, 220 ppb, from Duck Creek (Curley et al., 1972). No further tests for pesticides have been made.

Nitrogen: see Chapter 2, Harbor and Estuarine Water Quality

Coliform Bacteria: Water samples for bacteria have been taken regularly for many years by DEP (previously DEQE) and DMF. The following table shows the areas in the Harbor that have been closed to shellfishing because of high fecal coliform bacteria counts.

The principal causes of bacterial pollution are: septic systems; storm-water runoff; boats (sanitary wastes); and animals (waterfowl, dogs etc.).

The Herring River Estuary presents special problems. The construction of the Herring River Dike in 1908, reconstructed in 1974, has restricted the tidal flow, causing major hydrological and vegetational changes, stream acidification anoxia, environmental effects, and degradation of the estuary as a habitat for anadromous, catadromous and estuarine fishes, shellfish, birds, marsh vegetation, and other forms of life. The National Park Service has funded extensive research and has nominated the area to the Massachusetts Bays Program for the Habitat Restoration Program (Roman, 1987); however, this project has yet to receive funding.

Productivity

The various estuaries, tributary streams, and adjacent marshes, especially the Herring River, contribute an unmeasured but considerable flow of fresh water, which produces the low salinity levels and gives Wellfleet Bay its unique estuarine characteristics. In addition, they provide a constant supply of organic nutrients which form the base of the complex estuarine food web renowned for being one of the most productive ecosystems on earth. These special conditions have given Wellfleet Bay its legendary productivity and moved its discoverer, Samuel de Champlain, to name it in 1606, Port aux Huitres and the first Pilgrim settlers to nickname it Billingsgate after the famous

London fishmarket. This productivity has once again been attested to by the unusual high growth rate of quahogs achieved by modern grant holders.

Landscapes

The Major portion of the shores of the Harbor consists of sites designated by the Massachusetts Landscape Inventory, Department of Environmental Management, 1981, as either distinctive (D) or noteworthy (N). (Wellfleet Conservation Trust, 1988, Fig. 5)

Hamblin Park (D): A town park of 4.6 acres on Cannon Hill in Duck Creek, off Commercial St. with a view of the harbor.

Town Pier and Marina (D): At Commercial St. and Mayo Beach Rd., with views of Duck Creek and the Harbor.

Mayo Beach (D): Four town beaches on the harbor.

H. Burton Baker Beach (D): Town beach on Indian Neck, off Cove Road.

Sunset Hill (N) Town park on Griffin Island, on Chequesset Neck Rd., with view of Cape Cod Bay.

Griffin Island and Duck Harbor Beach (N): Town beach, coastal dunes, and coastal banks, with views of Cape Cod Bay, off Griffin Island Rd.

Bound Brook Island (N): Beach, coastal banks, kettle holes, with views of Cape Cod Bay, off Bound Brook Island Road.

Herring River Estuary (N): Tidal estuary, fresh and salt marshes, bird watching, off Duck Harbor Rd.

The Gut (D): Tombolo, coastal dunes and barrier beach, between Griffin and Great Islands, by footpath from Sunset Hill.

South Wellfleet Marshes (N): Extending from Hatches Creek (Eastham boundary) north around the shores of Silver Spring Harbor to the western end of Lieutenant's Island; Loagy Bay and adjacent marshes; Blackfish Creek and adjacent marshes; Indian Neck marshes. Access by Wellfleet Bay Wildlife Sanctuary entrance; Lieutenant's Island Rd.; Old Wharf Rd.; Paine Hollow Rd.; Cove Rd. and King Philip Rd.

Fishes

The Harbor affords an important nursery area for juvenile fish of many sport and commercially harvested species (see species list below). In the 1960's it ranked third in total number of species (35) captured among eleven estuaries sampled in Massachusetts and fifth (24) in number of estuarine associated species. By far the most plentiful species in Wellfleet Harbor is the Atlantic menhaden, present in tens of thousands in the summer months. Juvenile winter flounder are encountered in large numbers in all seasons. Locally abundant forage species are the Atlantic Silverside, Fourspine stickleback, Mummichog (Common killifish), Striped killifish, Tidewater silverside, Alewife, Blueback herring and White perch. These form the forage base for large numbers of predatory fishes including Bluefish, Atlantic mackerel and Striped bass. Other common fish species include Winter flounder, Tautog,

Northern kingfish, Cunner, White perch, and Cod.

Migratory Fish Runs: Five anadromous species, Hickory shad, Alewife, Blueback herring, Striped bass, and White perch and one catadromous species, the American eel, are found in the Herring River. The eel, alewife, and blueback herring constituted important local food sources and a commercial fishery from the seventeenth century and probably from thousands of years earlier, but their numbers have greatly declined because of the obstruction of the Herring River Dike, ditching, and the resulting acidification and anoxia (Curley et al., 1972; Wellfleet Conservation Trust, 1988, Roman et al., 1987).

Bivalve Molluscs

Oysters (*Crassostrea virginica*), Quahogs (*Mercenaria mercenaria*), Soft-shell clams (*Mya arenaria*), Bay scallops (*Argopecten irradians*), Razor clams (*Ensis directus*), Blue mussels (*Mytilus edulis*), and Surf clams (*Spisula solidissima*) constitute the most common bivalve species. Since prehistoric times Wellfleet Harbor has been the site of extensive and highly productive shellfish beds. The two most plentiful and economically important species have been the oyster and quahog. Soft-shell clams have been harvested in smaller numbers; bay scallop populations fluctuate in numbers from year to year but in general have been declining. Surf clams taken by draggers in waters outside of Wellfleet Harbor have in recent years been landed in large numbers at the Town Pier.

Oysters: Wellfleet is near the northern limit of the range of the species. Salinities in the harbor approximate the upper part of the 5 to 30 o/oo range considered favorable to oyster survival and growth. Oyster growth occurs at temperatures above 45°F; recorded temperatures remain above this figure from April through October, providing a seven-month growing season. Spawning takes place when the water temperature rises above 70°F, which normally occurs from early July through August.

Various factors, however, may limit oyster propagation and survival. One is the lack of clean, hard bottom or substrate suitable for the setting of oyster larvae. This deficiency is currently being remedied by the laying down of cultch (empty oyster clam and scallop shells used as a substrate for larval settlement) especially in areas such as Chipman's Cove and the mouth of the Herring River where abundant larval settling occurs. The infectious protozoan MSX (multinucleated spheroid X), fatal to oysters though harmless to humans, first observed in Wellfleet in 1967 and probably introduced by transplanted oysters, has caused serious mortalities. *Codium fragile*, an exotic seaweed which spread to local waters in the early 1980's and which attaches itself to oysters and floats them off the bottom as the plant matures, has caused serious losses, in addition to impeding shellfish cultivation operations. The oyster drill (*Urosalpinx cinerea*) is a predatory snail that drills through the shells of

oysters and digests the contents. Lastly, oysters on intertidal flats suffer heavy mortalities from ice floes in winter and are subject to freezing temperatures. (Curley et al., 1972; Wellfleet Natural Resources and Shellfish Management Plan, 1986).

The first settlers in the 1640's discovered extensive beds, which were heavily harvested in the seventeenth and eighteenth centuries; oystering in the colonial times was a local industry second only to whaling. In the early 1770's, however, the beds were found to be depleted, probably because of overfishing and the failure to lay down cultch to replace the shells either shipped to markets or ground to make lime for building. In the 1790's the practice was begun, to be continued through the nineteenth century, of transporting in schooners oyster seed and marketable oysters from Buzzards Bay, Long Island Sound, and Chesapeake Bay to be laid down in private grants in Wellfleet Harbor and later reharvested for shipment to Boston and other markets. One result was that by the first decade of the twentieth century a population of native Wellfleet oysters had been reestablished. In 1910 oyster grants covered 1,473 acres; in 1916 a harvest of 16,000 barrels was reported (Curley et al., 1972). In 1989 a total harvest of 4,601 bushels was recorded (Wellfleet Shellfish Department Report, 1989).

Until the present, oysters have been grown from seed gathered locally and planted on private licensed grants or else have been harvested by draggers or by handpicking from the flats at low tide, especially from Chipman's Cove and the mouth of the Herring River.

Quahogs: Wellfleet Harbor, which is close to the northern boundary of the natural range of the species, provides nevertheless an environment extremely favorable to the survival and growth of quahogs. The salinity range of 20-34 o/oo coincides with that found suitable for quahog development. Growth occurs in water temperatures exceeding 49°F, which are normally recorded from April through October. Spawning occurs in temperatures in the low 70's, which occur in July and August (Curley et al., 1972 pp. 23-25). The various tributary estuaries, streams, and marshes and the ten-foot tidal amplitude provide an ample supply of nutrients for the quahogs to thrive. It is generally accepted that the growth rate of quahogs in Wellfleet Harbor is close to the highest in the state if not the highest.

The principal predators feeding on quahogs are Green crabs (*Carcinides maenas*) and Moon snails (*Polinices lactens*), both of which have been controlled by specially designed traps. Quahogs are also the prey of gulls, certain species of ducks, other waterfowl, starfish and some fish.

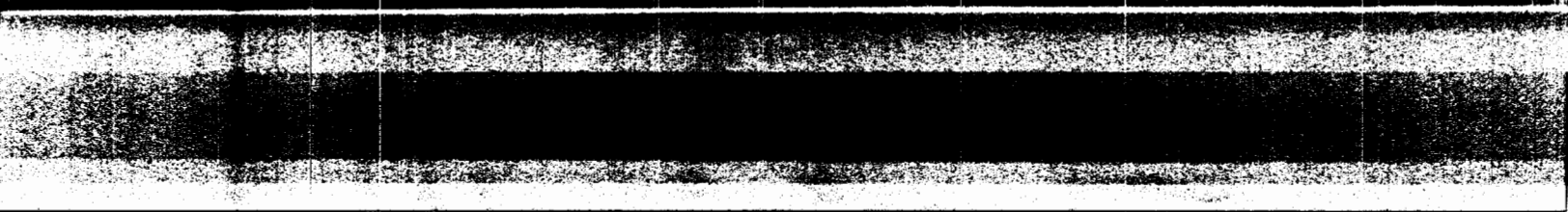
Quahog beds have undoubtedly existed in the Harbor since prehistoric times in virtually all the tidal flats and subtidal areas, but their density and distribution today varies considerably because of intensive harvesting. The commercial quahog fishery

appears to have commenced locally in the nineteenth century. Between 1863 and 1869 2,500 bushels were taken annually. With the introduction of gasoline-powered draggers in the twentieth century annual harvests temporarily increased; 33,000 bushels were taken in 1906. By 1957, however, the annual crop had declined to 6,000 though it later increased to 10,000 bushels in 1960 (Curley et al., 1972 pp. 22-23).

In the late 1970's a revolution in the local quahog fishery was initiated by the first successful attempts to realize a proposal made by Dr. David Belding, The Quahaug Fishery of Massachusetts, 1912, and anticipated by a special act of the state legislature in 1904 and a general law of 1909, later amended (MGL, Ch. 130, Sec. 57), and finally rendered feasible by the development of a technique for the commercial production of quahog seed. The procedure consists in the planting of seed in shallow net-protected boxes or trays slightly elevated above the intertidal flat, from which in the fall the half-grown seed are replanted in grow-out beds protected from predators by netting laid out in the adjacent flats. Such operations are carried out on surveyed areas on public or private tidelands protected from poaching and other interference by licenses issued by the Board of Selectmen in accordance with the provisions of MGL Ch. 130, Sec. 57 and the principles established by the Colonial Ordinances of 1641-1648, which vest in the inhabitants the public right to fish on private tidelands, subject to licenses and regulations issued by the Board of Selectmen. This new technique has been extremely successful in spite of occasional losses due to storms and ice. The first significant quahog harvests from grants were taken in 1983.

At the present moment the recent decision by the State Supreme Judicial Court (Pazolt v. Director of the Division of Marina Fisheries et al., April 20, 1994) ruling that the reserved public right to "fish" on all tidelands of the Commonwealth does not include the right to "plant, grown, and cultivate shellfish" on another's property without permission may have grave but still uncertain effects. If a substantial number of documented owners of tidal flats suitable for the planting, growing, and cultivating of either quahogs or oysters under licenses issued in accordance with the General Laws Chapter 130, Sec. 57 refuse permission to licensees to plant, propagate, or grow shellfish, it appears likely that the Massachusetts production of oysters and quahogs will decline, that the market price will rise, that the harvesting of the wild fisheries will become more intense, and that consequently the species will come under intense pressure and will greatly decline and become locally depleted. On the other hand, if the Town is able by acquisitions or gifts to assure an acreage of suitable flats sufficient to compensate for the losses cause by shoreline owners, then the Wellfleet fisheries will continue to prosper as they have in recent years. See table below.

The town has also maintained in recent years a propagation area at the mouth of the Herring River for the raising of two-inch littlenecks to be planted in the non-commercial shellfish area near



The ten-foot tidal amplitude exposes large areas of flats at low tide on which bay scallops may become stranded. Water temperatures over 45°F such as occur from April through October are suitable for bay scallop growth but summer temperatures in the low 70 s are not optimal. A salinity range from 10 to 27 o/oo is considered conducive to good growth, but the salinity samples taken in the Harbor tend to be mainly above this range. A considerable amount of mechanical damage is known to be caused by extensive quahog dragging. Eelgrass, which provides a favorable protective habitat for juvenile bay scallops, has been scarce or absent since 1972 or earlier (Curley et al., 1972, pp. 28, 31).

Harvests of Bay Scallops in Bushels, 1977-1989

1977	1,687	1983	279	1989	888
1978	743	1984	5,954	1990	NA
1979	6,407	1985	1,111	1991	1,720
1980	214	1986	2,265	1992	76
1981	70	1987	1,732	1993	1,950
1982	265	1988	715		

(Wellfleet Shellfish Department Reports, 1980-1993; Wellfleet Natural Resources and Shellfish Management Plan, 1986)

Soft Shell Clams: From the contents of the Indian shell middens on the shores of the Harbor it is evident that beds of soft-shell clams have thrived in the tidal flats since early times. The species did not, however, become a significant commercial crop until the twentieth century. The most productive areas have been along both shores of Blackfish Creek south of Drummer Cove, the southeast shore of Lieutenant's Island, in Chipman's Cove at the mouth of Duck Creek, and on the beaches of Chequesset Neck. (Curley et al., 1972, p. 28)

Estimated Recent Harvests of Soft-Shell Clams in Bushels

	Commercial	Non-Commercial		Commercial	Non-Commercial
1969	360	360	1987	26	26
1980	210	63	1988	100	40
1981	110	--	1989	88	50
1982	46	20	1990	NA	NA

1983	84	59	1991	218	NA
1984	67	73	1992	190	NA
1985	98	29	1993	180	NA
1986	26	17			

(Wellfleet Shellfish Department Reports; Curley et al., 1972, p. 28)

E. Wildlife

Habitats

See Maps #7, 8, 9 and 10, "ACEC, RARE WETLANDS WILDLIFE"

Birds (237 species logged)

Red-throated Loon	Common Loon
Pied-billed Grebe	Horned Grebe
Red-necked Grebe	Cory's Shearwater
Greater Shearwater	Sooty Shearwater
Wilson's Storm-Petrel	Leach's Storm-Petrel
Northern Gannet	Great Cormorant
Double-Crested Cormorant	American Bittern
Great Blue Heron	Great Egret
Snowy Egret	Little Blue Heron
Green-backed Heron	Black-crowned Night-Heron
Yellow-crowned Night-Heron	Glossy Ibis
Brant	Canada Goose
Wood Duck	Green-winged Teal
American Black Duck	Mallard
Northern Pintail	Blue-winged Teal
American Wigeon	Common eider
Oldsquaw	Black Scoter
Surf Scoter	White-winged Scoter
Common Goldeneye	Bufflehead
Hooded Merganser	Red-breasted Merganser
Turkey Vulture	Osprey
Bald Eagle	Northern Harrier
Sharp-shinned Hawk	Cooper's Hawk
Northern Goshawk	Broad-winged Hawk
Red-tailed Hawk	Rough-legged Hawk
American Kestrel	Merlin
Peregrine Falcon	Ring-necked Pheasant
Ruffed Grouse	Northern Bobwhite
Clapper Rail	Virginia Rail
Sora	Black-bellied Plover
Lesser golden Plover	Semipalmated Plover
Piping Plover	Killdeer
American Oystercatcher	Greater Yellowlegs

Lesser Yellowlegs
Willet
Whimbrel
Ruddy Turnstone
Sanderling
Western Sandpiper
White-rumped Sandpiper
Dunlin
Short-billed Dowitcher
Common Snipe
Wilson's Phalarope
Laughing Gull
Ring-billed Gull
Great Black-backed Gull
Roseate Tern
Arctic Tern
Least Tern
Black Skimmer
Mourning Dove
Yellow-billed Cuckoo
Great Horned Owl
Long-eared Owl
Northern Saw-whet Owl
Whip-poor-will
Ruby-throated Hummingbird
Yellow-bellied Sapsucker
Hairy Woodpecker
Olive-sided Flycatcher
Yellow-bellied Flycatcher
Eastern Phoebe
Eastern Kingbird
Tree Swallow
Bank Swallow
Barn Swallow
American Crow
Tufted Titmouse
Whitebreasted Nuthatch
Carolina Wren
Winter Wren
Golden-crowned Kinglet
Blue-gray Gnatcatcher
Veery
Swainson's Thrush
Wood Thrush
Gray Catbird
Brown Thrasher
Cedar Waxwing
European Starling
Solitary Vireo
Warbling Vireo
Red-eyed Vireo
Golden-winged Warbler

Solitary Sandpiper
Spotted Sandpiper
Hudsonian Godwit
Red Knot
Semipalmated Sandpiper
Least Sandpiper
Pectoral Sandpiper
Stilt Sandpiper
Long-billed Dowitcher
American Woodcock
Parasitic Jaeger
Bonaparte's Gull
Herring Gull
Black-legged Kittiwake
Common Tern
Forster's Tern
Black Tern
Rock Dove
Black-billed Cuckoo
Eastern Screech-Owl
Snowy Owl
Short-eared Owl
Common Nighthawk
Chimney Swift
Belted Kingfisher
Downy Woodpecker
Northern Flicker
Eastern Wood-Pewee
Willow Flycatcher
Great-crested Flycatcher
Horned Lark
N. Rough-winged Swallow
Cliff Swallow
Blue Jay
Black-capped Chickadee
Red-breasted Nuthatch
Brown Creeper
House Wren
Marsh Wren
Ruby-crowned Kinglet
Eastern Bluebird
Gray-cheeked Thrush
Hermit Thrush
American Robin
Northern Mockingbird
American Pipit
Northern Shrike
White-eyed Vireo
Yellow-throated Vireo
Philadelphia Vireo
Blue-winged Warbler
Tennessee Warbler

Orange-crowned Warbler
 Northern Parula
 Chestnut-sided Warbler
 Cape May Warbler
 Yellow-rumped Warbler
 Blackburnian Warbler
 Prairie Warbler
 Bay-breasted Warbler
 Black-and-White Warbler
 Ovenbird
 Connecticut Warbler
 Common Yellowthroat
 Canada Warbler
 Scarlet Tanager
 Rose-breasted Grosbeak
 Dickcissel
 American Tree Sparrow
 Field Sparrow
 Savannah Sparrow
 Sharp-tailed Sparrow
 Fox Sparrow
 Lincoln's Sparrow
 White-throated Sparrow
 Dark-eyed Junco
 Snow Bunting
 Red-winged Blackbird
 Rusty Blackbird
 Brown-headed Cowbird
 Northern Oriole
 Purple Finch
 Red Crossbill
 Common Redpoll
 American Goldfinch
 House Sparrow

Nashville Warbler
 Yellow Warbler
 Magnolia Warbler
 Black-throated Blue Warbler
 Black-throated Green Warbler
 Pine Warbler
 Palm Warbler
 Blackpoll Warbler
 American Redstart
 Northern Waterthrush
 Mourning Warbler
 Wilson's Warbler
 Yellow-breasted Chat
 Northern Cardinal
 Indigo Bunting
 Rufous-sided Towhee
 Chipping Sparrow
 Vesper Sparrow
 Grasshopper Sparrow
 Seaside Sparrow
 Song Sparrow
 Swamp Sparrow
 White-crowned Sparrow
 Lapland Longspur
 Bobolink
 Eastern Meadowlark
 Common Grackle
 Orchard Oriole
 Pine Grosbeak
 House Finch
 White-winged Crossbill
 Pine Siskin
 Evening Grosbeak

Finfish

In surveys conducted in 1968-69 and 1984 the following thirty-six species were identified:

Alewife (*Alosa pseudoharengus*)
 American eel (*Anguilla rostrata*)
 American cod (*Gadus morhua*)
 Atlantic herring (*Clupea h. harengus*)
 Atlantic mackerel (*Scomber scombrus*)
 Atlantic menhaden (*Brevoortia tyrannus*)
 Atlantic silverside (*Menidia menidia*)
 Atlantic tomcod (*Microgadus tomcod*)
 Blueback herring (*Alosa aestivalis*)
 Bluefish (*Pomatomus saltatrix*)
 Cunner (*Tautoglabrus adspersus*)
 Fourspine stickleback (*Apeltes quadracus*)

Goosefish (*Lophius americanus*)
 Grubby (*Myoxocephalus aeneus*)
 Hickory shad (*Alosa mediocris*)
 Little skate (*Raja erinacea*)
 Lump fish (*Cyclopterus lumpus*)
 Mackerel scad (*Decapterus macarellus*)
 Mummichog (Common killifish) (*Fundulus heteroclitus*)
 Northern kingfish (*Menticirrhus saxatilis*)
 Northern pipefish (*Syngnathus fuscus*)
 Northern puffer (*Sphoeroides maculatus*)
 Northern searobin (*Prionotus carolinus*)
 Ocean sunfish (*Mola mola*)
 Scup (*Stenotomus chrysops*)
 Smooth dogfish (*Mustelus canis*)
 Striped bass (*Morone saxatilis*)
 Striped killifish (*Fundulus majalis*)
 Striped searobin (*Prionotus evolans*)
 Tautog (*Tautoga onitis*)
 Threespine Stickleback (*Gasterosteus aculeatus*)
 Tidewater silversides (*Menidia beryllina*)
 White perch (*Morone americana*)
 Windowpane (*Scophthalmus aquosus*)
 Winter flounder (*Pseudopleuronectes americanus*)
 Winter skate (*Raja ocellata*)

Reptiles and Amphibians

FE Federally listed as endangered species
 FT Federally listed as threatened species
 * State-listed as species of special concern
 ** State-listed as threatened species

Northern Black Racer (*Coluber constrictor*) Common
 Ring-necked Snake (*Diadophis punctatus edwardsi*) Rare
 Hognose Snake (*Heterodon platyrhinos*) Rare
 Ribbon Snake (*Natrix saurita*) Common
 Garter Snake (*Natrix sirtalis*) Common

Box Turtle (*Terapene carolina*) Rare *
 Painted Turtle (*Chrysemys picta*) Common
 Spotted Turtle (*Clemmys guttata*) Rare *
 Snapping Turtle (*Chelydra serpentina*) Common

Diamondback Terrapin (*Malaclemmys terrapin*) Rare ** The
 northernmost nesting terrapin
 Green Turtle (*Chelonia mydas*) Rare FT
 Loggerhead (*Caretta caretta*) Rare FT
 Kemp's Ridley (*Lepidochelys kempi*) Rare FE
 Leatherback (*Dermochelys coriacea*) Rare FE

Woodland Salamander (*Plethodon cinereus*) Common
 Spotted Salamander (*Ambystoma maculatum*) Rare

Four-toed Salamander (*Hemidactylium scutatum*) Very rare *

Spring Peeper (*Hyla crucifer*) Common

Green Frog (*Rana clamitans*) Common

Bull Frog (*Rana alustris*) Rare

Pickerel Frog (*Rana palustris*) Rare

Wood Frog (*Rana sylvatica*) Rare

Fowler's Toad (*Bufo fowleri*) Common

Spadefoot Toad (*Scaphiopus holbrooki*) Rare *

Species of Particular Interest

Box Turtle* - A species being adversely impacted by development

Diamondback Terrapin** - Reaches its northern limit in the Harbor and surrounding uplands adjacent to marshes near Great Island, Indian Neck, Lieutenant's Island, and Wellfleet Bay Wildlife Sanctuary. Very sensitive to coastal development. Nests in town-owned sanctuary managed by Massachusetts Audubon Society on Lieutenant's Island.

Eastern Spadefoot Toad* - Located in two sites and may be present elsewhere in Harbor area.

Four-toed Salamander* - In Herring River floodplain.

Leatherback Turtle - FE - Feeds on jellyfish in Harbor during summer.

Ridley Sea Turtle - FE - Feeds on crabs in Harbor during summer. (Wellfleet Conservation Trust, 1988, pp. 25-26, 36)

Marine Mammals

FE Federally listed as endangered species

* State listed as species of special concern

Gray Seal (*Halichoerus grypus*) Rare, migrant *

Harbor Seal (*Phoca vitulina*) Common

Harp Seal (*Pagophilus groenlandicus*) Very rare

Hooded Seal (*Cystophora cristata*) Very rare

Harbor Porpoise (*Phocoena phocoena*) Common

Saddle-back Dolphin (*Delphinus delphis*) Winter visitor

Striped Dolphin (*Stenella coeruleoalba*) Winter visitor

White-sided Dolphin (*Lagenorhynchus acutus*) Common

Blackfish (Pilot Whale) (*Globicephalus melaena*) Common

Finback Whale (*Balaenoptera physalus*) FE Common

Humpback Whale (*Eubalaena glacialis*) FE Rare spring visitor

Minke Whale (*Balaenoptera acutorostrata*) Common

Orca (*Orcinus orca*) Rare

Right Whale (*Eubalaena glacialis*) FE Rare spring visitor

Species of Particular Interest

Blackfish (Pilot Whale) - This species historically has entered the

Harbor in very large numbers, and sizeable groups continue to do so, frequently stranding at low tide and dying. Other species which occasionally strand are the Harbor porpoise, the White-sided dolphin, and the Minke whale. Jeremy Point is the location of the largest seal haul-out site in Cape Cod Bay. It may also be an important pupping area for harbor seals. (Wellfleet Conservation Trust, 1988, pp. 25, 36-37)

Terrestrial Mammals

Big Brown Bat (*Eptesicus fuscus*) Common, hibernator
Chipmunk (*Tamias striatus*) Common
Common Mole (*Scalopus aquaticus*) - In wetlands and salt marshes.
Coyote (*Canis latrans*)
Eastern Cottontail (*Sylvilagus floridanus*) Rare
Gray Squirrel (*Sciurus carolinensis*) Common
Keen Brown Bat (*Myotis keenli*) Common
Little Brown Bat (*Myotis keenii*) Common
Long-tailed Weasel (*Mustela frenata*) Rare
Meadow Jumping Mouse (*Zapus hudsonius*) - On barrier beaches and marsh islands
Meadow Vole (*Microtus pennsylvanicus*) Ubiquitous
Muskrat (*Ondatra zibethicus*) Common
New England Cottontail (*Sylvilagus transitionalis*) Common
Opossum (*Didelphis virginiana*) - Upland sites, near populated areas
Raccoon (*Procyon lotor*) Ubiquitous
Red Bat (*Lasiurus borealis*) Common
Red Fox (*Vulpes vulpes*) Common
Red Squirrel (*Tamiasciurus hudsonicus*) Common
Red-backed Vole (*Clethrionomys gapperi*) - In freshwater wetlands and maple swamps
Short-tailed Shrew (*Blarina brevicauda*) Ubiquitous
Silver-haired Bat (*Lasionycteris noctivagans*) Rare, migrant
White-footed Mouse (*Peromyscus leucopus*) Common
White-tailed deer (*Odocoileus virginianus*)
(Wellfleet Conservation Trust, 1988, p. 37)

F. Vegetation

The shores and wetlands surrounding the Harbor and its many estuaries have been the scenes for centuries of varied and intensive human activities, commencing with the Archaic Indians, and the long usage explains in part the wide variety of plant communities. Among the more common and interesting species to be noted are:

Trees

Black cherry (*Prunus serotina*)
Black locust (*Robinia Pseudo-Acacia*) Not native
Black oak (*Quercus velutina*)
Pitch pine (*Pinus rigida*) The dominant species

Red cedar (*Juniperus virginiana*)
White oak (*Quercus alba*)

Shrubs

Bayberry (*Myrica pensylvanica*)
Beach plum (*Prunus maritima*)
Bearberry (*Arctostaphylos uva-ursi*)
Black huckleberry (*Gaylussacia baccata*)
Blueberry (*Vaccinium angustifolium*; *V. corymbosum*; *V. vacillans*)
Broom crowberry (*Corema Conradii*) - Species of special concern
Golden heather (*Hudsonia ericoides*)
Scrub oak (*Quercus ilicifolia*)

Grasses

Beach grass (*Ammophila breviligulata*) - On coastal dunes and beaches
Cattails (*Typha angustifolia*)
Hairgrass (*Deschampsia fluxuosa*)
Little blue stem (*Andropogon scoparius*)
Pennsylvania sedge (*Carex pensylvanica*)
Red fescue (*Festuca rubra*)
Saltwater cord grass (*Spartina alterniflora*)
Saltwater meadow grass (*Spartina patens*)

Some Forbs (flowering plants):

Butterfly weed (*Asclepias tuberosa*) Rare
Dusty miller (*Artemisia ca data*)
Sea lavender (*Limonium Nashii*)
Seaside goldenrod (*Solidago sempervirens*)
Wild lupine (*Lupinus perennis*) Rare

And do not overlook:
Poison ivy (*Rhus radicans*)

Some infrequent harborside species (e.g., on Try Island in the Wellfleet Bay Wildlife Sanctuary):

Mockernut hickory (*Carya tomentosa*)
Sassafras (*Sassafras albidum*)
Shadbush (*Amelanchier canadensis*) - but plentiful along the Herring River

G. Archeological Sites

The most significant archeological site in the Harbor area is that of the ossuary (a multiple secondary burial) on Indian Neck discovered in September 1979 and excavated under the supervision of the National Park Service. It contained skeletons of at least fifty-six individuals interred in the late tenth or eleventh

centuries.

From the late Archaic Period natives of this area were leading sedentary lives in year-round residence at sites around the shores of the Harbor and the Herring River and Duck Creek estuaries in a relatively stable cultural adaptation to an environment rich in resources. Their subsistence economy included agriculture (maize and other crops), hunting and gathering, and shellfishing (mainly during the winter months). When the first settlers arrived in the 1640's the local settlement of Nauset Indians was known as Punonakanit, whose inhabitants had at one time or another occupied the whole Harbor area. Shell middens and the sites of temporary camps and of permanent settlements have been located on Indian Neck, the shores of Chipman's Cove, on both banks of Duck Creek, Taylor Hill, Chequesset Neck, Griffin Island, Bound Brook Island, Great Island, Great Beach Hill, the shores of Silver Spring Harbor, and on Lieutenant's Island. Pottery and lithic artifacts from these sites have been preserved in various collections. Virtually all known sites have been dug to some extent by professional or amateur archaeologists or pot hunters, but very probably intact sites still await discovery and professional investigation. The archeological survey sponsored by the National Park Service and conducted in 1979-1986 under the direction of Francis P. McManamon generally omitted the Harbor area except the ossuary.

Numerous cellar holes, sites of seventeenth- and eighteenth-century dwellings, barns, and other structures are found on Great Beach Hill, Great Island, Griffin Island, Bound Brook Island, Coles Neck, and Chequesset Neck as well as in the areas along Herring Brook and Fresh Brook and adjacent to the various ponds and elsewhere. The only historic site excavated by professional archaeologists is that of the so-called Wellfleet Tavern on Great Island investigated in 1969 and 1970 by the National Park Service under the direction of Professor James Deetz of Brown University and Plimouth Plantations. There has been some digging in other historic sites by pot hunters.

H. Existing Conservation Areas

See Maps #4 and #5

1. Cape Cod National Seashore.

The islands and tombolos forming the entire western shore of the Harbor, including the adjacent waters of the Harbor and of Cape Cod Bay on the west; the Herring River Estuary from its mouth to its source; and all the lands northward of the Gut from the waters of Cape Cod Bay to the Seashore boundaries on the east and south, including Griffin, Bound Brook, and Merrick Islands and the adjacent marshes.

2. Massachusetts Audubon Society Wellfleet Bay Wildlife Sanctuary.

The area extending inland from the waters of Silver Spring Harbor to Route 6 and from south of the Eastham-Wellfleet boundary to the southwest corner of Lieutenant's Island, including various adjacent salt marshes and tidal flats; Loagy Bay, including the barrier beach and about half the salt marshes and tidal flats; salt marshes and uplands east of Loagy Bay.

3. Wellfleet Conservation Trust

Wetlands on Lieutenant's Island; salt marshes and uplands east of Loagy Bay; salt marsh on Blackfish Creek; various small parcels near Drummer Cove; on Indian Neck a barrier beach, Sewell's Gutter, and extensive salt marshes in the Indian Neck Conservation Area; various parcels on Old Wharf Point, Chipman's Cove, in the Pole Dike Creek marshes, on Chequesset Neck, and near Duck Creek.

4. Town of Wellfleet

Barrier beaches at The Gut, Indian Neck, Lieutenant's Island, Bound Brook Island, Mayo Beach, and Duck Harbor. F. Burton Baker Beach on Indian Neck; the Diamondback Terrapin Sanctuary on Lieutenant's Island and the Town Bird Sanctuary the north bank of Hatches Creek (both managed by the Massachusetts Audubon Society).

5. Commonwealth of Massachusetts, Division of Fisheries and Wildlife

Field Point; Fox Island and adjacent marshes in the Indian Neck Conservation Area.

6. South Wellfleet Marsh Trust

Marshes in Loagy Bay and north of Silver Spring Harbor.

Action Plan

Issue #1

A. Water Quality

See also Chapter II

Issue #1: The last testing of the waters of the Harbor for pH and dissolved oxygen was in 1993. The last testing for pesticides was in 1969 (Curley, et al 1972). It is necessary that pH, dissolved oxygen, and pesticides be tested frequently enough to detect without harmful delay changes in conditions.

Testing for fecal coliform bacteria is conducted regularly by the Division of Marine Fisheries.

On nitrogen loading, see Chapter II

Issue #2: The Herring River estuary is seriously degraded in respect to pH, dissolved oxygen, nitrogen loading, eutrophication and fecal coliform bacteria.

Goal: To improve water quality in the Harbor.

Recommendations:

a. The sampling and testing of the waters of the Harbor should be done at intervals of not less than five years for pH, dissolved oxygen, and pesticides and PCBS.

b. The Town should give full support and cooperation to the National Park Service in the proposed Restoration Project for the Herring River estuary and the Massachusetts Bays Habitat Restoration Program for the Herring River Estuary.

Responsibility: Proposed Natural Resources Department, NRAB, Board of Selectmen, Board of Health

B. Landscapes

Issues:

1. The Chequesset Neck, Mayo Beach, Duck Creek, Indian Neck, Old Wharf Point, and Lieutenant's Island areas are especially degraded.

2. Lack of adequate town zoning bylaws for areas within the National Seashore has resulted in serious scenic degradation on Griffin Island.

3. Areas in need of and susceptible to preservation: Northern barrier beach extension of Indian Neck (privately owned portion), Indian Neck marshes on east side (privately owned portions); marshes east and north of Loagy Bay (privately owned portion); marshes east of Power's Landing on Chequesset Neck (privately owned).

Goal:

To improve and protect shoreline land subject to degradation.

Recommendation:

a. Enact a Town Zoning Bylaw regulating the enlargement and construction of private dwellings within the boundaries of the National Seashore.

b. Establish conservation areas to be owned by the Town or by private conservatoin organizations at:

The Barrier beach forming the northern extremity of Indian Neck
Additional marshes and other wetlands adjacent to the Indian Neck
Conservation Area.

Unprotected marshes east and north of Loagy Bay

Wetlands adjacent to Powers Landing

Unprotected marshes adjacent to Silver Spring Harbor

Responsibility: Conservation Commission, Planning Board

C. Finfish and Shellfish

Issues:

The Purposes of the Wellfleet Natural Resources and Shellfish Management Plan, 1986, as amended, are in part;

1. General

"A. To support and conform to the Massachusetts Coastal Zone Management Program Policy #14, viz: Encourage and assist commercial fisheries research and development, restoration and management of fishery resources, development of extensive and intensive aquaculture, and enhancement of anadromous fisheries...

"B. To contribute to the protection of the following interests defined by the Wetlands Protection Act (MGL C. 131, Sec. 40):

"a) prevention of pollution;

"b) protection of land containing shellfish;

"c) protection of fisheries. (320 CMR 10.01 (2))

2. Goals

"A. To maintain the biological diversity of Wellfleet Harbor.

"B. To restore economically important marine animals by improved habitat management.

"C. To protect and increase by propagation and other means the wild population of oysters, quahogs, soft-shell clams, and bay scallops in the waters of Wellfleet Harbor.

"D. To protect and assure the natural increase of the populations of alewives, bluebacked herring, eels, mussels, razor clams, sea worms, and protected species.

"E. To maintain the commercial harvest of shellfish at the maximum annual level consistent with sound management practice.

"F. To maintain the maximum possible level of employment in the shellfish industry in Wellfleet.

"G. To promote and encourage shellfishing for family use and recreation by providing an adequate year-round stock of oysters, quahogs, and clams for holders of non-commercial licenses.

"H. To prevent or mitigate the pollution of the waters of the harbor.

"I. To resolve conflicting interests between the shellfish industry and recreational boating.

"J. To promote scientific research supportive of the above purposes.

An additional purpose is to restore the Herring River estuary in accordance with the National Park Service's Restoration Project and the Habitat Restoration Program of the Massachusetts Bays Program.

Recommendation:

Implementation and enforcement of the Wellfleet Natural Resources and Shellfish Management Plan, 1986, as amended; of the Wellfleet Shellfish Regulations and Temporary Regulations, as amended; of Wellfleet General Gylaws, Art. VII, Sec. 24; and of applicable State regulations.

Responsibility: Shellfish Constable

D. Wildlife, Vegetation, and Archeological Sites

Issues:

A. A continuing problem is the destruction of vegetation in the Harbor area by the illegal gathering of plants, especially sea lavender, and by illegal traffic of ORV'S in violation of Town Bylaws Article VII, Sections 24 and 24 A, MGL Ch. 266 Sec. 121A, and the Code of Federal Regulations, CH. 1, Secs. 4.10 and 7.66

B. Illegal hunting and killing of rare and protected species may occur.

C. Illegal hunting in the vicinity of public roads and residences occurs.

D. It is desirable that beds of eelgrass be restored if possible.

Archeological sites are being continuously destroyed by development and pot hunting.

Goals:

- 1) The protection and preservation of indigenous mammals, birds, reptiles, amphibians, and other marine species.
- 2) The protection and conservation of trees, plants, and other vegetation on public lands and private conservation lands.
- 3) The exclusion of all unauthorized motorized vehicles from protected areas.

- 4) The prevention of unauthorized digging, destruction, or alteration of archeological sites on public lands and, to the extent permitted by law, on private lands.
- 5) Cooperative projects for the restoration and protection of the environment, e.g., the restoration of eel grass beds.
- 6) Cooperative establishment and maintenance of foot trails and other facilities for the public enjoyment of areas within the Conservancy.
- 7) Establishment of conservation areas identified above 3.B.b.

Recommendation:

It is recommended that the Wellfleet Natural Resources Department take the initiative in establishing a body to be known as the Wellfleet Harbor Conservancy, of which the concern shall be the area lying within the defined boundaries of the Wellfleet Harbor ACEC; and that the participating members shall be the Town of Wellfleet, the National Park Service, the Massachusetts Division of Fisheries and Wildlife, the Massachusetts Audubon Society, the Wellfleet Conservation Trust, and such other governmental or non-profit bodies as the founding members shall invite by unanimous vote. It shall be the purpose of the Wellfleet Harbor Conservancy, acting by unanimous consent, to further certain common interests, including but not limited to the implementation of the above goals.

E. Recreation

Issue:

There is a danger to hikers in the National Seashore and in other conservation lands and to occupants of vehicles and dwellings within the ACEC and elsewhere from the discharge of firearms.

Recommendation:

It is desirable that appropriate walking trails be laid out by the National Park Service in cooperation with the Natural Resources Department of the Town of Wellfleet on Griffin, Merrick, and Bound Brook Islands, in Paradise Valley, and along the Herring River and in adjacent meadows.

CHAPTER IV

TIDAL AND SUBTIDAL AREAS USE

Introduction

Wellfleet's tidal and subtidal areas encompass many sensitive marine habitats and support a wide range of commercial and recreational uses. The focus of this chapter is to plan for the prudent uses of harbor resources while protecting and preserving the delicate ecosystem. The various uses include finfishing, shellfishing, boating, windsurfing, water skiing, diving, swimming, etc. Many of these uses overlap temporally and physically and in some cases create conflicts.

The goal of the chapter is to establish equitable use of the harbor resources by all of the various interests while maintaining a viable ecosystem.

Inventory and Regulations

The tidal area of the Harbor is 2,279 acres and the subtidal 3,815 acres. (See Map #11 "TIDEMARSHES and DEPTH CONTOURS") All the land below the extreme-low-water line (ELW) or a line 1600 feet from the mean-high-water (MHW) line, whichever is less, is the property of the Commonwealth. The tidal lands between MHW and ELW (or 100 rods) constitute the tidelands, which may be privately owned. By the Colonial Ordinance of 1641-1647 these lands were conveyed to the person to whom the adjacent upland was granted. In many cases over the years titles to the uplands and the adjoining tidelands have been separated by distinct and separate conveyances, but the title to the tideland has been presumed by the courts to be in the owner of the adjoining upland unless there is clear evidence of separate and different conveyances of the two parcels. In many cases in Wellfleet titles to tidelands are obscure. Some tidelands in Wellfleet have been surveyed and appear on the Assessors' Atlas and are taxed. Many tidelands, however, are not taxed and there is no public record of their ownership.

By the Ordinance of 1641-47 the private tidelands are subject to the reserved public rights to fish, fowl, and navigate. The precise definition of these public rights has been the subject of litigation and court decisions from 1647 to 1994.

Titles to private tidelands in Wellfleet Harbor are held not only by individuals but also by conveyance by:

The United States: An undefined strip about 1,000 feet wide extending into both the Harbor and Cape Cod Bay from the MHW of the land owned by the Cape Cod National Seashore.

The Town of Wellfleet: Unsurveyed and undefined tidal flats

extending to mid channel, ELW, or 100 rods from the MHW of the following parcels: Map 20, Lots 9, 12, 16, 114; Map 22, Lot 23; Map 28, M. Burton Baker Beach, extending seaward from MHW of a portion of Indian Neck; Map 35, Pleasant Point Flats, an unsurveyed area between Pleasant Point Landing and Lot 139, extending from MHW to 100 rods or ELW; Map 30, Cannon Hill Beach, an unsurveyed area on Blackfish Creek; Map 35, Old Wharf Road Landing and "wading place" extending across Blackfish Creek.

Commonwealth of Massachusetts: Indian Neck Conservation Area and Field Point.

Massachusetts Audubon Society: Various.

South Wellfleet Marsh Trust: Various.

Wellfleet Conservation Trust: Various.

Various real estate trusts and corporations.

A. SHELLFISHING (See Map #6, "SHELLFISH LEASES")

The Board of Selectmen under the authority of M.G.L. Ch. 130, Section 57 may grant shellfish aquaculture (propagation) licenses in any of the tidal or subtidal lands of the Harbor. As of August 1994 they have designated the following areas for such licenses:

Area 1: On tidal lands off Mayo Beach and Chequessett Neck from the eastern boundary of the Town property at Powers Landing to the Town Pier and at least three hundred feet northward of a line from the seaward end of the Breakwater to the easternmost tip of Great Island, except in the area above mean low water on Egg Island, so-called.

Area 2: On tidal lands lying north and easterly of the Breakwater and of the northerly tip of Indian Neck.

Area 3: On tidal lands off Indian Neck from Omaha Road south to the eastern tip of Field Point.

Area 4: On tidal lands off the westerly side of Old Wharf Point and at the entrance to Loagy Bay.

Area 5: On tidal lands on the west side of the Harbor from the easternmost tip of Great Island south of the southern end of Great Beach Hill Island.

As of August 1994 the Board of Selectmen had granted a total of 66 licenses to 36 licensees for areas totalling 120 acres. (See Map #6)

The entire tidal and subtidal lands are divided into areas

open to holders of commercial and non-commercial shellfish permits as follows:

Area 1: Commercial only - area north of a line from the seaward end of the Breakwater to the easternmost tip of Great Island.

Area 2: Non-Commercial only - area off Indian Neck south from the Breakwater to the second groin.

Area 3: Commercial and Non-Commercial - all the rest of the Harbor except licensed area ("grants").

From the subtidal lands lobsters are taken by traps (pots) and by diving; various species of fish are caught in fish traps. These activities are regulated by the Division of Marine Fisheries of the Commonwealth and present no management problems.

The principal bottom harvests of the Harbor are quahogs and oysters taken by draggers from the subtidal areas; oysters and quahogs taken by handpicking and raking from the tidal flats; and quahogs (littlenecks) and oysters propagated and harvested on licensed tidal areas or Town beds.

Proposed revisions to the Shellfish Management Plan are in Appendix D. Continuous review and updating of the plan is required by the charges voted on at the 1987 Annual Town Meeting.

The dense populations of sexually mature but less-than-legal-size shellfish on licensed propagation areas and the Town propagation area throw out during the summer months literally billions of eggs and sperm which unite to create free swimming spat, which are widely dispersed by currents in the water column and eventually come to rest on or in the substrate and develop into mature shellfish. Thus, the licensed propagation areas and Town propagation area not only produce the mature shellfish harvested by the licensees or transplanted by the Shellfish Department but also serve to maintain the essential "wild" populations outside the licensed propagation areas, which either are harvested by fishermen holding commercial or non-commercial permits or which remain to serve in turn as spawning stock.

B. FINFISHING

The many species of fish found in the harbor are discussed in the Natural Resources chapter. A large boat for recreational fishing by individuals is available. Party boats for charter are also available. Probably the largest group are recreational fishermen using private boats. All of these boaters face the worsening problem of shoaling in the inner harbor and the reduced accessibility around low tide.

C. WINDSURFING

The wind exposure in Wellfleet Harbor makes it very attractive to the board-sailing public. Many people enjoy sitting near the beach and watching the sails fly back and forth across the harbor. The speeds these sailors can achieve is quite significant.

Windsurfing regulations include:

1. No windsurfing within the designated swimming area of Mayo Beach, within 50 feet of a swimmer or within the mooring basin.
2. Launching windsurfers at Mayo Beach must be west of the designated swimming area.
3. Because of possible damage to aquaculture structures, windsurfers must stay clear of all shellfish grants marked with buoys and are prohibited from 3 hours before until 3 hours after low tide at the Mayo Beach vicinity.
4. At Indian Neck and Burton Baker Beaches, windsurfers must stay at least 50 feet from all swimmers.

D. BOATING

The vast expanse of Wellfleet Harbor offers exceptional opportunities for recreation and boating. The many tributaries, small bays and salt marshes are an invitation for exploring and "gunkholing" with sail, power or paddle. A deep water channel is clearly marked from the mooring basin to a point south of Billingsgate Island. Many boaters enjoy picnicking on the beaches of the southwest shores.

A private yacht club conducts sailboat races in the Harbor during the summer. All boats should stay clear of racing yachts.

Excellent mooring, launching and other services are provided at the Marina and are discussed in Chapter V. Small mooring areas throughout the harbor are in use.

To protect persons and property there are various Harbormaster Regulations, Coast Guard Regulations and Inland Rules of the Road (Federal).

The universal rule that power boats must yield to boats under sail is always in effect except when a fishing boat is "under tow" or dragging.

E. WATER SKIING

Water skiing is prohibited within 500 feet of all Town-owned

beaches and in the mooring basin.

F. JET SKIING

Jet skis are not allowed in Town parking lots or beaches. They must stay at least 500 feet from all Town-owned beaches.

G. DIVING

All divers must display a diving flag and stay within 100 feet of it. Divers must stay 100 feet clear of any shellfish grants except the grant holder. There shall be no diving for shellfish from October 1 to April 1 south of a line from the breakwater to the eastern tip of Great Island. Diving in the channel is prohibited.

H. SWIMMING

There are four town beaches for swimming in the harbor. They are presented fully in the Shoreline Land Use Chapter.

I. MOTOR VEHICLE TRAFFIC ON BEACHES AND TIDELANDS AND OFF ROAD ON WATERFRONT LAND

Motor vehicle traffic on beaches and tidelands below mean high water is regulated by the Wellfleet General Bylaw, Article VII Section 24. No person shall operate a motorized vehicle on any tidal beach or flat or other land below mean high water except:

- 1) in an emergency for the purpose of protecting endangered persons, animals or property;
- 2) a town, county, state or federal official or employee on official business;
- 3) for the purpose of launching or retrieving a boat not exceeding twenty (20) feet in overall length at a launching point designated by the Selectmen;
- 4) for the purpose of work duly authorized and conditioned by the Conservation Commission and other appropriate authorities;
- 5) for the purpose of setting or retrieving a mooring, entering and leaving the beach at a point designated by the Selectmen;
- 6) a person legally engaged in or working in commercial shellfishing or holding a grant.

Whoever violates this section shall be fined in an amount of two hundred dollars (\$200) for each offense. The Town of Wellfleet Police Department (including special officers), the Harbormaster, the Assistant Harbormaster, the Shellfish Constable, the Assistant Shellfish Constable, the Health and Conservation Officer, and any other official whom the Board of Selectmen may from time to time designate shall have authority to enforce this section and by the Wellfleet Shellfish Regulations:

5.1.9. No person engaged in commercial shellfishing or

aquaculture shall operate on any tidal beach or flat or other land below the mean high water line a motorized vehicle at a speed in excess of fifteen (15) miles per hour or a motorized vehicle which is dual-wheeled or which has greater than 9,200 lbs. GVW.

5.1.10 Persons engaged in commercial shellfishing or aquaculture operating motor vehicles on any tidal beach or flat or other land below the mean high water line shall drive only on the foreshore of the tidal area below the high tide line but above the tidal flat, closely rounding any groin or other obstruction extending below the high water line, to a point opposite a grant and thence to the grant. Traffic not directed to a grant shall be confined to the area below the high tide line above the tidal flat, closely rounding any groin or other obstruction extending below the high water line.

Action Plan

Issue:

It has been established in Wellfleet and elsewhere that sustained yields of oysters, quahogs, and soft-shell clams are possible only under a well conceived and disciplined propagation program consisting of appropriate closures as necessary, the planting of cultch to catch oyster spat, the planting of seed in protected areas, the transplanting of seed and mature shellfish, and protection against predators, codium and ice. In the April, 1994 Town Meeting Wellfleet appropriated \$19,730 for the propagation and conservation of shellfish in the fiscal year 1994-95, supplementing the propagation to be effected in licensed areas by Wellfleet fishermen.

Propagation in 1993 produced a harvest totaling 5,650 bushels of oysters, 316 bushels of soft-shell clams, and 65,033 bushels of quahogs, (See Chapter #3, Natural Resources) with a combined wholesale market value of \$2,130,951. These figures may be taken to represent the minimum sustainable Wellfleet harvest assuming continuation of the methods of propagation practiced in 1993. It may be assumed also that they indicate the permanent existence of a continuous shellfish population at least three times as great as the last harvest. Such a population, if properly managed, not only can form the base from which equal future harvests may be produced but also can provide a vital contribution to the local marine and avian food chains and, in addition, significantly reduce the nitrogen in the Harbor, prevent eutrophication, and thereby reduce the concentration of fecal coliform bacteria. (see Chapter 3, Water Quality)

It has been understood in Wellfleet since at least 1772 that the propagation of shellfish anywhere on the Town's tideland is an activity included in the reserved public right of the inhabitants

to fish, long established under English Common Law and reaffirmed by the Colonial Ordinance of 1641-1647. The decision of the Massachusetts Supreme Judicial Court of April 20, 1994 ruling that the propagation (planting, growing, and cultivating) of shellfish on private tidelands is not (and presumably never has been) a public right but rather is a violation of the property owner's private rights if practiced without his permission could gravely curtail all future shellfish propagation both by licensees under M.G.L. Ch. 130 and by the Town Shellfish Department on tideland other than those owned by the Town, by the United States, and by owners willing to grant permission for propagation.

Furthermore, the courts have hitherto repeatedly ruled that the right to travel across a private tideland for the purpose of fishing elsewhere was a "natural derivative" of the right to fish. Now, however, the courts will presumably rule that this right of free passage cannot be allowed to persons intending to propagate (plant, grow, and cultivate) shellfish but only to persons intending to "dig and take" shellfish. Thus a fisherman having permission from a tideland owner to propagate (plant, grow, and cultivate) may find himself barred from access by an intervening tideland owner opposed to shellfish propagation.

There have been a variety of reasons for opposition to shellfish propagation. The nursery trays in which quahog seed are first planted may extend no more than 18" above the natural ground level and in accordance with Coast Guard regulations must be marked by the prescribed warning buoys. Nevertheless occasional windsurfers at low tides have grounded on the seed beds. Since the eighteenth century Cape Cod shellfishermen have worked the flats using wagons drawn by oxen or horses, and in recent years they have substituted light trucks operated in accordance with the Wellfleet General Bylaw, the Wellfleet Shellfish Regulations, and the Orders of Condition issued by the Wellfleet Conservation Commission. Lastly, it has proved not to be economically or physically feasible to transport heavy tools and materials to licensed areas by barges because of the lack of available deep water loading docks and because of the ten foot tide. For this reason, no shellfishermen has applied for a license to be located on the west side of the Harbor, where there are no roads permitting vehicular access.

Goal:

To achieve the maximum beneficial public use of publicly owned beaches and tidelands for recreation and for shellfish propagation on Town Shellfish Department beds and in licensed areas.

Recommendation:

The Town should resume and expand the program proposed in the 1950s to acquire beaches and tidelands and make them accessible by open town landings for the purposes of recreation, boat launchings and

landings, and shellfish propagation. It is to be noted that the Town may lease tidelands on which licensed areas are to be located and receive rentals to compensate the Town taxpayers for the cost of the tidelands. Annual Town Meeting, February 9, 1953, Article 20: Voted ... to keep all properties abutting on salt or fresh water beaches to which the Town acquires title under Tax Title proceedings, or by deed of gift or otherwise, and to retain them for the use of the Town Annual Town Meeting, February 13, 1956, Article 36: Voted otherwise, including acceptance of a deed from the beneficiaries of the Captain L.D. Baker Estate, the title holders thereof, of their title, interest, riparian rights and ownership of the foreshore and flats of waters on the north and northwesterly part of Wellfleet Harbor from Herring River Dyke to other town-owned land along Mayo Beach Road, and raise and appropriate the sum of \$100 therefor, and to ask the Selectmen to extend the appreciation of the Town of Wellfleet to the donors. The Town acquired more than twice as many fresh and saltwater beaches and landings in the 1950s as it did in any decade in its history.

(See also recommended actions under "Promote Public Access" in Chapter 7)

Responsibility:

Board of Selectmen, Planning Board, Shellfish Warden, Open Space Committee, proposed Natural Resources Officer

Recommendation:

The Natural Resources Advisory Board should cooperate with the Marina Advisory Board and the Shellfish Advisory Board to facilitate resolution of problems concerning uses of tidelands.

Issue:

Occasionally, conflicts arise among the various users of the harbor's resources. Often, this is because the regulations, and especially the reasons for having them, are not known to visitors. The fishermen are concerned about clean water; their livelihood depends on it. Many other users do not share their concern and do on occasion foul the water in various ways, such as spilling hydrocarbons, discharging human waste, scraping boat bottom paint, and walking dogs on the beach. Many Harbor regulations stem from these problems.

Shellfishermen have their problems with shoreline landowners. Driving small trucks on the tidal flats and gaining access to shellfish beds without trespassing are the main issues.

In the recent past there were problems associated with windsurfing. A school was established next to the pier and May Beach. Beginning

board sailors had very little control over their courses. They were a hazard to swimmers and many damaged the structures on shellfish grants. The present regulations seem to have solved the problems.

Conflicts between swimmers and windsurfers do occur on Indian Neck and Burton Baker Beaches. Burton Baker has been designated a launching site for windsurfers but many people have not been made aware of this.

Goal:

To improve cooperation among various users.

Recommendation:

Interaction of all the user interests should be continually monitored and all conflicts should be addressed with proposed equitable solutions and regulations.

Responsibility:

Harbormaster, proposed Natural Resources Officer, Board of Selectmen

Recommendation:

Visitors who apply for parking stickers, shellfishing permits, boat launching and boat mooring should be given a pamphlet describing important regulations concerning uses of the harbor and the reasons for them where applicable (e.g. dog regulation). In addition, a large bulletin board or sign outside the Harbormaster's offices should display basic regulations.

Responsibility:

Board of Selectmen, Harbormaster, proposed Natural Resources Officer

CHAPTER V

WELLFLEET MARINA

Introduction

In this section we will summarize the facilities and services at the Wellfleet Marina, identify the key issues that concern this area of our harbor and make recommendations for the future. The marina is a focal point of Wellfleet Harbor because it is the primary location where recreational and commercial boaters access the harbor. As the primary access point the marina is subject to a number of critical environmental, economic, public safety and congestion problems. Our objectives when considering management alternatives in the marina are:

1. Maintain or improve the quality of the environment (water quality, habitat, wildlife etc.)
2. Maintain or improve public access to harbor resources.
3. Balance the above two objectives without an undue burden on the taxpayers.
4. Maintain a safe and navigable harbor

Dredging is one of the primary issues to be considered when discussing management of the marina and because of its importance will be considered in a separate chapter.

Inventory (See Map #12 "WELLFLEET MARINA")

The Wellfleet marina consists of an L-shaped pier for commercial vessels, 217 slips and a mooring area. There are two boat launching ramps and a parking lot on Shirttail point to accommodate the people who use the marina facilities. Restrooms with six toilets and 2 showers are provided for public use. Newly upgraded restrooms consist of a tight tank septic system, low flow flush toilets and restricted shower heads. The tight tanks effectively eliminate the nitrate leaching into the harbor that was demonstrated in the IEP (198) report. Fueling facilities (gas 5000 gallons, diesel: 3000 gallons) are provided on the outer pier. Facilities for disposal of sanitary waste include a touring pump-out boat, a 25 gallon mobile unit and a stationery unit. There is a 175 gallon waste oil container. Oil pollution containment equipment consists of a 180 foot containment boom and a 100 foot absorbent boom. The harbor master and assistant harbor master are trained in the use of the pollution control gear.

Marina Facilities

Type	Number
Slips	217
Moorings	279 (present cap of 350)
Boat Launching Ramps	2 (2 more are proposed)
Storage	
Dinghy	50
Trailer	50
Fishing vessels, (winter only)	6

While the majority of users of the marina and mooring basin are recreational boaters, Wellfleet has a commercial fishing fleet with a variety of different kinds of vessels.

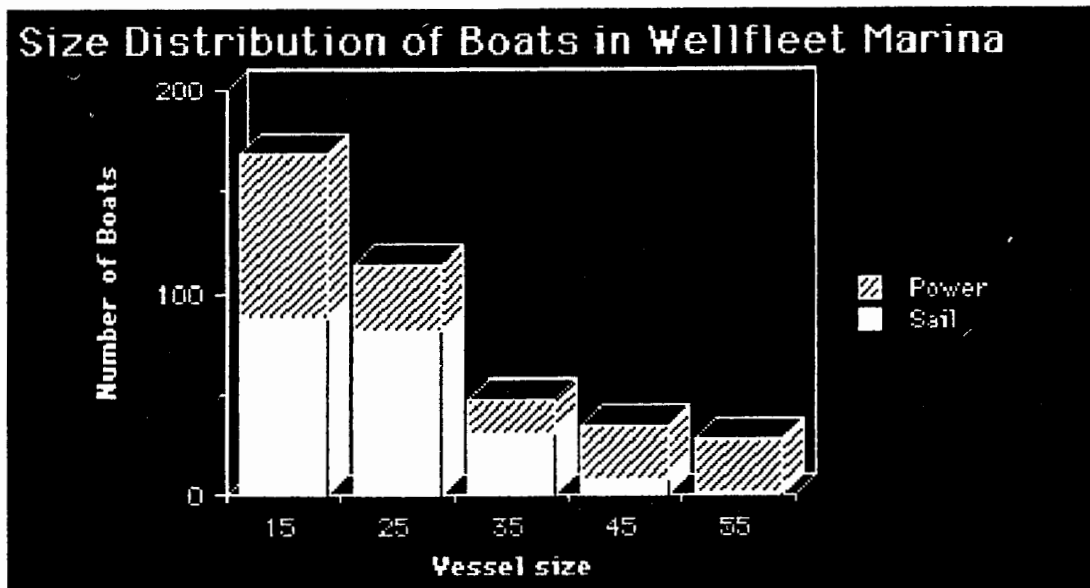
Commercial Fishing Fleet

Type	Number
Draggers	10
Mini Draggers	20
Sea Clammers	5
Lobster Boats	5
Sport Fishing Boats	5
Head Boat	1

The following graph depicts the distribution of sizes of power and sail boats that berth in the Wellfleet marina. In 1990 there were 207 sailboats and 183 power boats berthed. The majority of vessels are between 15 and 25 feet. There are few boats in excess of 60 feet. At present the docks are not adequately designed nor is the mooring area deep enough to safely accommodate vessels in excess of 60 feet in length.

Parking facilities at the marina include 280 spaces for cars. The marina has storage facilities for up to 50 dinghies, 50 trailers and winter storage on the pier for fishing vessels only. In addition, several trailer trucks used for transporting shellfish are allowed to park on the pier.

There is a great deal of demand for slips and moorings in the Wellfleet Marina. There is a waiting list of 210 for slips and 40 for moorings with an average turnover rate per year of 10 and 25 respectively. The ratio of residents to nonresident slip holders is 50:50 and mooring holders is 40:60. Services at the marina are provided by three private companies (Bay Sails Marine, Inc., Wellfleet Marine Corp. and Small Boat Service). Among the services are sail and power boat rental.



Action Plan

Slips and Moorings

Issue:

Should the number of slips and moorings be changed?

Goal:

Maintain natural resources in the harbor area.

Recommendation:

The Natural Resources Board believes that the current number of berths provides an ample opportunity for commercial and recreational boaters to use the resources of Wellfleet Harbor while maintaining water quality, protecting bordering wetlands and insuring a productive shellfish resource. The current mooring area borders the productive natural oyster bed in Chipman's Cove and shellfish grants inside the breakwater. Any expansion of the berthing area would displace these important resources. The area also lies within an Area of Critical Environmental Concern (ACEC). Therefore, we recommend that there should be no expansion of the berthing accommodations at this time.

Responsibility: Harbormaster, NRAB, Marina Advisory Board, Natural Resources Officer

Private Docks

Issue:

Should new docks and piers be permitted in Wellfleet Harbor?

Goal:

To protect wetlands, wetland resources, and shellfish habitat

Recommendation: The existing docks should be brought into compliance with Chapter 91 regulations. Private docks may be built only with a special permit. They should not impact shellfish areas, wetland habitat, or swimming beaches.

Responsibility: Harbormaster, NRAB, Conservation Commission.

Marina Fees

Issue:

Should the fee schedule for users of the marina be changed?

Goal:

To see that all users of the marina pay an equitable share of the expenses to maintain marina facilities and resources.

Recommendation: The NRAB recommends that the fee schedule differential for residents and nonresidents be maintained at the present level (50% more for nonresidents).

Responsibility: Harbormaster

Boat Launching

Issue:

How should access to the harbor by the boating public be maintained or improved?

Goal:

To protect shoreline, facilitate easy, quick and safe harbor access for boaters

Recommendations:

All boat launching via trailer must be done at the marina facilities or at designated launching points. It is also

recommended that two more launching ramps be added at the marina.

Responsibility: Harbormaster

Facilities For Commercial Boaters

Issue:

There is concern that recreational, seasonal interests at the marina will displace the year around commercial fisherman.

Goal:

To insure that adequate berthing space be provided for commercial fishermen.

Recommendation:

The fisherman must have the appropriate local and state licenses and he/she must be actively engaged in fishing (shellfish/finfish) during the applicable fishing season and it must be his/her prime occupation. The berth of a given vessel can not be transferred to the lessee of that vessel.

Responsibility: Harbormaster

Recommendation:

Commercial fishermen should be given higher priorities on the waiting lists.

Pump-out Facilities

Issue:

Sanitary wastes from boats when discharged can be a major source of bacterial and chemical contamination of marine waters.

Goal: To insure that all sanitary waste is removed from boats with marine sanitation devices or holding tanks.

Recommendations:

We recommend that the Town fully support the pump out facility program that the Harbormaster has established. We recommend that a sealed head program and an alternate program for transients be established.

Responsibility: Harbormaster, Board of Selectmen, NRAB

Oil Containment Gear

Issue:

There is always a possibility of polluting the harbor by accidental oil spills.

Purpose:

To insure that supplies and personnel are available to handle any kind of oil spill that may occur at the marina.

Recommendation:

The town should make resources available (for training, personnel and gear) to expand the current oil containment program that the Harbormaster has established.

Responsibility: Harbormaster, Town Administrator

Road Runoff/Marina Resurfacing

Issue:

Shirttail point (the marina parking lot) is a huge paved structure that is surrounded by one of Wellfleet's premier shellfish resources. Road runoff from paved surfaces represents a significant source of bacterial contamination to inshore marine waters.

Purpose:

To minimize the impact of road runoff from the marina parking lot.

Recommendation:

We recommend that the Town install catch basins (8), regrade the surface so that water is directed into the catch basins and regrade and resurface the entire parking lot. There is an approved State grant for \$110,000 subject to availability of funds for this project. The Town should aggressively pursue obtaining these funds.

Responsibility: DPW

Public Education

Issue:

How should the public be educated about key marine resources and

the regulations that govern their protection?

Goal:

To see that the public is educated about the complexity and delicacy of the harbor's natural resources and to make them aware of their responsibilities to protect Wellfleet's resources. To make educational material easily accessible to the public.

Recommendation:

We recommend that the Chamber of Commerce booklet contain several pages detailing harbor ecology and marina/harbor/shellfish regulations and facilities.

We recommend an outside bulletin board at the Harbormaster's facilities for posting marina/harbor regulations and public information.

We recommend that the Harbormaster also distribute educational materials.

We recommend that the town institute a lecture series where town staff, board members or other people with expertise in harbor related issues discuss harbor resources and planning.

Responsibility:

Board of Selectmen, Harbormaster, Natural Resources Officer, Board of Education

Issue:

Tight tanks now hold sewerage from marina restrooms and showers. The high cost of pumping tanks needs to be reduced.

Goal:

To reduce the cost of pumping sewerage.

Recommended Action:

"Recycle" sewerage by designing and installing a peat leaching or other experimental system that has vegetation that will absorb nutrients. This system needs to be coordinated with the issue of parking lot runoff (above).

Responsibility: Board of Health

CHAPTER VI

DREDGING

Introduction

In this chapter we will review the history of dredging in Wellfleet, discuss the circulation and sedimentation characteristics that create the need for dredging and summarize the options available to the town in creating a dredging plan for the future. Before 1950 the site of the marina was accessible only around high water. Boats moored in the Cove or in Duck Creek were aground at low tide. In the last 30 years different portions of Wellfleet Harbor have been dredged making it one of the most desirable ports on Cape Cod for commercial and recreational boating. Any consideration of a future dredging plan must consider all of the resulting costs and benefits: environmental, social and economic. The following are our objectives:

1. Maintain the quality of Wellfleet Harbor for recreational and commercial boating
2. Maintain the Harbor without an undue burden on the taxpayers.
3. Maintain or improve the quality of the environment (water quality, habitat, wildlife etc.)

It has been said "No reasonable person initiates a dredging project without good cause." If the water is too shallow, it should be dredged. Simple enough, but unfortunately it is far more complex than that, with a host of very difficult questions and decisions.

- The cost of dredging is extremely high. Can it be justified economically by public safety concerns or loss of commercial or recreational opportunities?
- The environmental impact can be severe. Dredging is an invasion of a biological system in equilibrium containing organisms with commercial importance as well as the food for such resources. Dredged material must be disposed of in a manner which is not detrimental to the environment.
- There are many local, state and federal agencies which must be involved for permits, licenses, and consultation.

Table 1 summarizes the economic, environmental and social costs and benefits that should be considered when making management decisions about dredging projects.

Dredging Costs and Benefits

Issue	Cost	Benefits
Economic	Cost of Dredging	Revenue from boaters launching, mooring, fishing party boats Dredged Harbor as attraction for tourism
Environmental	Removing dredge spoils Habitat destruction	Removal of contaminants Fewer satellite moorings
Social		Facilitated boating Decreased Ramp Congestion Enhanced Public Access

Complicating the management process is that the currencies for measuring costs and benefits are different for economic, environmental and social issues. While slip fees can be measured in dollars and cents, habitat destruction is measured in species abundance and diversity. How do you balance costs and benefits measured in different currencies? It may be that the economic benefits of a dredging project outweigh the economic costs but excessive costs in environmental or social currencies might make it a poor management choice. Care must be taken in assigning and comparing values of costs and benefits.

Inventory

Dredging History

Until 1952 Wellfleet operated a tidal harbor with as many as six piers. Whaling ships and fishing schooners moored in the deep water south of Egg Island and came into the piers at high tide to load and unload. The Duck Creek estuary east and north of the northern tip of Indian Neck was a tidal flat dry at low tide but navigable at high tide at least as far as Uncle Tim's Bridge. Piers formerly were also operated on the Herring River both above and below the present site of the Dike.

From the 1950's through 1982 the State (with a 25% contribution from the Town) and the Army Corps of Engineers, at no cost to the Town, maintained a dredged 10-foot channel from deep water (Buoy #12), an 800 x 500 - foot mooring basin in Chipman's Cove, a dredged area around and behind the Pier, a 6-foot channel around Shirttail Point, and a 6-foot inner basin north of the Point. The channel and mooring basin have been dredged by the Army Corps of Engineers in 1958, 1972, and 1981. The inner harbor from the mooring basin around Shirttail Point has been dredged by the

State Department of Environmental Management in 1952, 1955, 1957, 1958, 1969, and 1982. It is expected that the Army Corps of Engineers will again dredge the channel from deep water and the mooring basin in Chipman's Cove in 1994. There is a proposal to dredge around Shirttail Point and the inner basin north of the Point in 1996.

Dredging History of Wellfleet Harbor

<u>Date</u>	<u>Contract</u>	<u>Location</u>
9/52	1271	Dredged to 6 ft. at MLW an area in front of the Town pier and a 70 ft. channel
3/55	1478	Dredge basin to 6 ft. at MLW on North side of Shirt Tail Point and 120 ft. channel around point
7/57	1769	Dredge mooring basin south of Shirt Tail Point, 1850 ft. south.
1958, 1972, 1981	Army Corps of Engineers	Dredge to 10 ft. a 500 X 800 ft. mooring basin and 125 ft. channel from mooring basin to deep water.
3/58	1879	Dredge to 10 ft. from L-shaped pier to anchorage.
10/68	2644	Dredge to 8 ft., channel around Shirt Tail Point and around L-shaped pier.
1969	77-111	Mooring basin only
1981-1982		Channel around Shirt Tail Point to gas dock, outer channel and mooring basin
1992, 1993		Dredge around L-shaped pier and use sediment for beach renourishment on Kellers Corners

*This table was excerpted from the *Nomination proposal for the Wellfleet Harbor Area of Critical Environmental Concern*.

Experience has shown that the dredged area inside the Breakwater fills in rapidly with a black, viscous and

semi-fluid muck known as "black mayonnaise." The dredging of this peculiar sediment is generally believed to present serious problems because (1) the viscous sediment is difficult to contain; and (2) it flows by gravity from undredged to dredged areas.

Planning for dredging of Wellfleet Harbor is limited to the areas that have been dredged in the past. The harbor has been designated by the state as an Area of Critical Environmental Concern (ACEC) which prohibits dredging except in those areas previously dredged and excluded from the ACEC.

The channel and mooring basin are getting very shallow and the Corps of Engineers is planning to dredge in the near future. A disposal site for the dredged material is located in Cape Cod Bay. This project will be funded by the federal government.

Disposal of Dredge Spoils

The question of disposal of dredged material becomes more restrictive as time goes by. In the past dredge spoils have been used for beach replenishment and to fill wetlands such as the south shore of Chipman's Cove and Baker's Field. However, this was before the enactment of much legislation to protect wetlands and coastal resources. The town has been able to conduct limited beach renourishment taking sand dredged from the L-shaped pier to renourish the beach at Kellers Corners (the sediments are of comparable grain size).

State officials have recently informed the town that upland disposal on Indian Neck would jeopardize the barrier beach and is in conflict with the Wetlands Protection Act and the ACEC designation in this area. Since all areas immediately landward of the dredge sites are included in the ACEC program and are for the most part wetlands, upland disposal cannot be considered for dredge spoils within the ACEC. This leaves only two possibilities: 1) to use an offshore dump site in the middle of Cape Cod Bay west of Great Island or 2) dewater the spoils on the pier in quantities of a manageable size and then remove by trucking to an inland dump site. This disposal area has been approved but can be used only under restrictive conditions and at narrowly proscribed times in order to protect the marine environment.

Harbor Circulation and Sedimentation Study (See Appendix A)

G.S. Giese and T.R. McSherry of Woods Hole Oceanographic Institution conducted a study to characterize sedimentation and circulation in the inner harbor and to assess management alternatives. After gathering data of tidal height and bathymetry (bottom contours) a computer model was created to simulate tidal conditions in the system. The purpose of the study was to characterize the flushing rate and circulation in the study area

and to determine what, if any, changes could be made to the system to alleviate siltation and pollution. Modifications to the harbor could be tested for their effect on current velocities and flushing rates for Duck Creek and Chipman's Cove. Four modifications were simulated:

1. Widen the channel in the RR dike from 70 to 210 feet
2. Open Mayo Creek tide gate
3. Open a 200 ft. canal through the pier parking lot
4. Widen the channel at the end of the pier (remove 140 ft. of the pier)

The Giese study concluded that Wellfleet Harbor is a flood dominated system where flood tide velocities are greater than ebb tide velocities, which results in import of sediments. Changes in the system like those suggested would have little, if any, effect on the overall sedimentation rate. Short of massive changes in the basin profile there is nothing that we can do to reduce the sedimentation rate. Furthermore, water moving from shallow areas across the mooring basin (a flow expansion) will tend to drop sediments into the mooring basin. The study concludes that the inner harbor, because of its characteristics, acts as a sediment trap. The harbor is filling in and it will continue to do so. If we decide to dredge our harbor it will have to be done frequently to counter the natural tendency to fill in.

Modifying a tidal system like this has no small amount of risk involved with it. Because of the Commercial Street dike and clapper valve, Mayo Creek has become a non-productive brackish eutrophic swamp. In 1955, Shirttail Point was extended eastward to create the parking lot and the boat slips on the north side. The basin north of Shirt Tail Point because of restricted circulation is prone to severe sedimentation. It will always need to be dredged to remain open for navigation.

In planning harbor modification it is, therefore, essential that all aspects of the change be thoroughly investigated.

Action Plan

Management Alternatives

Since dredging is such a complex issue it is useful to explicitly state the alternative management options to be considered. While these are not all of the possible management options they represent a range of possibilities that are consistent with the facts that we have about the harbor. For example, expanding the dredged area of the harbor is not being considered because it is not feasible economically and environmentally and it is not consistent with the plan's overall goal of maintaining Wellfleet's character as a small fishing village. The following are three management options:

1. Dredged harbor management: all areas that have been previously dredged in the harbor should be dredged on a regular basis.
2. Tidal harbor management: the harbor should be allowed to revert to natural conditions (no dredging) and provisions made for facilitating boaters' access.
3. Combination approach: the different subsections of the dredged areas should be designated and prioritized and dredging should occur in selected areas based on a cost-benefit evaluation while other areas will be left undredged.

Option No. 1

This option suggests that all areas previously dredged (Areas A, B, C, D, Map 13/14), be dredged on a regular schedule. This is extremely costly involving the dependency on State funding and the accumulation of money for dredging designated within the Enterprise Fund. (see Chapter VII for cost factors). The option of dredging all of the areas previously dredged, while attractive to recreational and commercial boaters, poses several serious problems. (see Graham Giese Report Appendix "A")

Option No. 2

This option suggests the continued periodic dredging of the outer channel and mooring basin by the Army Corp of Engineers. (refer to areas A, B, Map 13/14) There is no cost to the Town for this dredging and it provides access to the "L" shaped pier and mooring basin at low tide. The County dredge does not have the capacity to dredge Area D all at one time. It is suggested that over several years the time allowed for Wellfleet to use the dredge, a substantial and gradual improvement could be made. Cost factors are presently not available for the use of the County dredge.

Included in this option are the environmental concerns mentioned in Option No. 1.

Option No. 3

No dredging.

A combination approach would probably mean that some areas would be dredged while others would not. Table 2 is a sample prioritization scheme for the dredged areas. (See Maps #13 & #14 "DREDGED AREAS") Priorities are based on probable financial and environmental costs.

Area	Prior-ity	#Vessels Affected	Volume cu yds	Dredge Inter-val (yrs)	Disposal Area	Respon-sibility	Relative Cost* cu yds/boat/yr
A channel	1	All (557 + ramp traffic)	65,000	8	Cape Cod Bay	Army Corps	<11
B Mooring Basin	2	320	70,000	8	Cape Cod Bay	Army Corps	27
C L-Shaped Pier	3	20	5,000	2	Beach Renour-ishment	Army Corps, Town	250
D Channel around Shirtail and Inner Basin	4	217	110,000	4	Cape Cod Bay	State, County, Town	98

* The relative cost is a figure of the amount of dredged material that must be removed for each boat each year in a given area (volume/# Vessels affected/dredge interval). This does not necessarily reflect the cost relative to the usage. For example only a small number of boats are kept on the L-shaped pier but many boats use the fuel facilities and would benefit from dredging this area. Also these commercial fishing boats bring income to the Town.

Issue:

The environmental consequences of dredging any or all of the aforementioned areas are not known. It is possible that irreversible damage to the biological system can result.

Goal:

To learn more about biological effects of dredging in order to make more informed decisions.

Recommendation:

A study should be conducted to determine effects of dredging on the biological systems of the Harbor. Data should be collected before and after dredging takes place.

Responsibility: Mini-bays Project, Conservation Commission, proposed Natural Resources Officer

Issue:

A solution to the problem of disposal of the highly organic, fine silt in Area D has not yet been found, although the Harbormaster and others have devoted considerable effort to that end. The effort is ongoing as of April 1995.

Goal:

To make the Town's residents aware of the problems associated with

disposing of dredging spoils and to seek their opinions.

Recommendation:

When and if a plan for disposal of dredge spoils from Area D is proposed by the Harbormaster and the State, details of the plans should be explained to Wellfleet residents at an open forum where any concerns about environmental consequences and other costs can be addressed.

Responsibility: Board of Selectmen, Harbormaster, NRAB

Issue:

The Town has been dependent in the past on the State for 75% of the cost of dredging Area D. In recent years no funds have been available from the State. There will always be some uncertainty as to when and if the State will advance the funds. Furthermore, the Enterprise Fund has not been accruing sufficient funds to pay the Town's share (see Economics Chapter). There are three alternatives for financing dredging of Area D all or any of which should be considered:

1. Float a bond issue
2. Increase fees and rents to sufficient level to pay costs
3. Decrease the indirect charges against the Enterprise fund

Goal:

To educate the public about the above alternatives.

Recommendation:

Full disclosure of the above alternatives including a cost/benefit evaluation as well as the alternative of not dredging Area D should be made to the Town's residents at least one month prior to the Town Meeting at which any of the above actions may be taken.

Responsibility: Board of Selectmen, Harbormaster

CHAPTER VII

SHORELINE LAND USE

Introduction

Waterfront land is a precious resource. It is unparalleled in beauty, ecologically sensitive, highly sought after, valuable, and under tremendous pressure on one side by the forces of wind and water, and on the other by people in their desire for access to the sea.

The shoreline land use chapter focuses on the use and protection of Wellfleet's waterfront lands. The specific goals of the land use planning efforts are to:

- 1) protect traditional maritime (water dependent) activities
- 2) promote public access to the waterfront
- 3) preserve open space around the shoreline
- 4) maintain and improve natural resources (water quality, habitat protection etc.)

This chapter will examine the waterfront resources in Wellfleet, identify key shoreline land use issues and outline an action plan to address the issues.

Inventory

Wellfleet Waterfront Land (See Maps #15 and #16)

This section of the Harbor Management Plan focuses on all of the shoreline of the town from the mean high water mark to 250 feet landward, and all of that part of the Central District Zone which borders the harbor including Duck Creek. Much of the land bordering Duck Creek on the west side and all of the land along Kendrick Avenue westerly to the trailer park is currently considered part of the Central District zone. The remaining land bordering the inner and outer harbor is zoned residential or is part of the Cape Cod National Seashore.

Historic Seaport

The land bordering Duck Creek along East Main Street and Commercial Street was developed beginning in the early 18th century. At that time, what has become the Duck Creek Marsh was a port for large fishing and whaling vessels. Although whaling died with the Revolutionary War, fishing and shellfishing continued and by the mid 1800's wharves circled Duck Creek. Banks, groceries, hardware stores and lumber yards opened on Main and Commercial Streets.

The deforestation of the landscape in the late 18th century caused the sands to shift and slowly the inner Duck Creek harbor, along with the outer harbor, inside the present breakwater and the outer harbor that reaches to the shores of Great Island became shallow tidal flats and salt marsh. The railroad bridge and dike built across Duck Creek in 1869 contributed further to the siltation and formation of marshes. Eventually boats could enter or leave the inner harbor only at high tide. Shorefront development in the Central District has remained almost static since the late 1930's since it had been developed extensively during the previous half century. The major change came with the building of the present marina. In the mid 1950's, a breakwater was constructed at the end of Indian Neck to provide a sheltered anchorage. A marina with "L" shaped pier was created and dredging was initiated to create deep water anchorage in the harbor and around the marina. A more detailed discussion of the waterfront is found in the History chapter.

The Waterfront Today

Map #15 and #16 show that much of the shorefront property is zoned residentially. The remaining land is either owned by the Town, the Conservation Trust or by the Cape Cod National Seashore Park. Town-owned land includes the Marina with an "L" shaped pier, several public beaches, Hamblin Park (6 acres) and many shoreline public access points (Appendix B).

Wellfleet Land Use

Type	Overall (1990)*	
	Acreage	%
Agriculture	15	0.12
Open Land	1727	13.26
Wetland	1889	14.51
Forest Land	6441	49.47
Disposal	38	0.29
Recreation	301	2.31
Urban Land	2610	20.04

* Source: Town of Wellfleet Open Space and Recreation Plan Update 1992.

Open Space/Protected Land

Cape Cod National Seashore Park

The Cape Cod National Seashore Park was established in 1961 and preserves large tracts of unique seashore land in Wellfleet (61% of the Town's area) including a large section of the harbor

shoreline (Map 15). The entire Herring River estuary, Great Island and the barrier beach that extends southward to Jeremy Point are within the Park's boundaries. The National Park Service is active in resource management and public education.

Wellfleet Bay Audubon Sanctuary

The Wellfleet Bay Audubon Sanctuary covers 777 acres on the shoreline of the harbor in South Wellfleet. Massachusetts Audubon Society land extends from south of Lieutenant Island to the Eastham Town line. Sanctuary lands are open to the public. Staff conduct a wide range of guided walks and educational seminars and are actively involved in resource preservation.

Conservation Trust

The Wellfleet Conservation Trust owns approximately 110 acres and holds conservation easements on close to 10 acres, most of which is wetlands. These holdings will be preserved in conservation in perpetuity. In addition, the state is buying the Indian Neck Marsh north of Field Point (92 acres) including the 4 1/2 acre Fox Island. This will be managed by the Trust for conservation and probably passive public access.

Public Access

Beaches

Most of the harbor is surrounded by beautiful sandy beach which provides excellent swimming conditions with relatively calm water except during stormy weather. Most of the beach is privately owned but the Town owns four public beaches with varying levels of facilities for the users.

Power's Landing

Facing south and located west of the Marina, this beach has 122 feet of shoreline and a parking lot large enough for 20 cars. No drinking water, changing or toilet facilities are provided.

Mayo Beach

This is the most centrally located beach lying immediately west of the Marina with a shoreline of 1700 feet. Parking for 95 cars and a boardwalk for handicapped access are provided. Toilet facilities are available.

Indian Neck Beach

Located immediately south of the breakwater, this beach faces west and extends 575 feet along the shore, 325 owned by the Town and 250 owned by the Wellfleet Conservation Trust. The only

facility is a parking lot for 60 cars.

Burton Baker Beach

Also on Indian Neck, this beach lies one half mile south of the breakwater, has 2,150 feet of shoreline and very limited parking along the side of the road and the entrance to the beach. Designated as a windsurfer beach, it has an area set aside for rigging.

BEACH FACILITIES

	<u>Powers Landing</u>	<u>Mayo Beach</u>	<u>Indian Neck</u>	<u>Burton Baker</u>
Shoreline Length, Ft.	122	1,700	575	2,150
Cars Parked	47	95	80	10
Handicapped access	N	Y	N	N
Lifeguard	N	N	N	N
Parking Sticker	Y	N	Y	Y
Swim Area Marked	N	Y	N	N
Drinking Water	N	N	N	N
Change Rooms	N	N	N	N
Toilet Facility	N	Y	N	N
Windsurfer Restriction	N	Y	Y	N
Windsurfer Rig Area	N	N	N	Y

Shoreline Access Points

Wellfleet has 30 town owned ways to water on the harbor (Appendix B). Slade Associates Surveyors in their survey of the town have identified 18 town landings.

Private Landings

The Chequessett Neck Yacht Club has a launching area restricted to members only. There are two private docks near Paine Hollow Landing, one in Duck Creek by the Cove Gallery, and two in Loagy Bay.

Public Parks and Recreational Areas

Hamblin Park (6 acres), also known as Cannon Hill, located across a picturesque foot bridge on the east bank of the Duck Creek has several foot paths and a panoramic view of the harbor. It was donated to the town by Arthur T. Hopkins in 1931. It is the only Wellfleet park that is within the Central District and has a summit with a view of Wellfleet Marina and harbor.

Baker's Field located in the central district north of Mayo beach has a large playing field, a playground, four tennis courts and a basketball court across the street. Parking is available in a small lot at Baker Field or at the Mayo Beach parking lot.

Central District

Many of the 18th and 19th century structures in town remain today and have become art galleries, restaurants, rooming houses, apartments and private homes. Many of the buildings have been preserved and restored giving Wellfleet its unique character as a traditional fishing village. Besides marine services, commercial seasonal enterprises near the new marina include two restaurants, a snack bar, fish store and a theatrical company.

The Marina and Mooring Basin

The Wellfleet marina consists of a L-shaped pier for commercial vessels, a series of slips and a mooring area. There are two boat launching ramps and a parking lot on Shirttail Point to accommodate the people who use the marina facilities. Restrooms with six toilets and 2 showers are provided for public use. Newly upgraded restrooms consist of a tight tank septic system, low flow flush toilets and restricted shower heads.

Conservation and Habitats

Conservation and habitat protection will be considered in detail in the natural resources chapter of the Harbor Management Plan.

Motor Vehicle Traffic on Uplands

Motor vehicle traffic off road on all uplands, including but not limited to coastal beaches, dunes, and banks, is regulated on town-owned property by the Wellfleet General Bylaw Article VII:

"Section 24A. No person shall operate or park a motorized vehicle on: 1. Any bicycle, pedestrian, or bridle path or trail owned or maintained by the Town of Wellfleet, Barnstable County, the Commonwealth of Massachusetts, or the United States and prohibited to motorized vehicles by competent authority; 2. Any real property of the Town of Wellfleet above the mean high water line not encompassed within the boundaries of any public or private road, way, public landing, or parking area designated for the parking and operation of motorized vehicles EXCEPT 1. In an emergency for the purpose of protecting endangered persons, animals, or property; 2. A town, county, state, or federal official, employee, or

authorized agent on official business. In addition to notice required by General Laws, Chapter 40, Section 32, the Town of Wellfleet shall post signs reasonably calculated to apprise operators of motorized vehicles of the requirements of this bylaw. The Town of Wellfleet Police Department (including special officers) shall have authority to enforce this section, which enforcement shall include without limitation the non-criminal disposition procedure provided for in the General Laws, Chapter 40, Section 21D."

"On the Cape Cod National Seashore land by the Code of Federal Regulations, 36 CFR, Ch. 1, Sec. 4.10; and on private lands without the owner's permission by the General Laws, Chapter 266, Section 121A." (For Motor Vehicle Traffic on Beaches and Tidelands, see Chapter #4, "Tidal and Subtidal Areas Use")

Action Plan

Protecting Water Dependent Uses

Issue:

Much of the present inner harbor shoreline is within the Central District Zone. Town zoning by-laws allow for certain kinds of development in this district that block public access to and views of the shore, and do not act to conserve this historic section of town. The town needs to encourage abutting businesses to allow for and invite the public's view and use of the harbor.

Goals:

The goals are to protect the historic character of the central district and ensure that the public has access to the shoreline.

Recommendation:

A separate Historic Harbor District (HHD) should be established. The HHD would have specific zoning to address the need for preserving the character of the town and to allow for and encourage public access to the shoreline. The Historic Harbor District would include that land etc.

Responsibility: Planning Board, Zoning Board of Appeals, NRAB

Recommendation:

It is recommended that an Architectural Review Advisory Board be established for the purpose of making people aware of the contribution their new building, addition or alteration could make to retain the character of the historic district.

Responsibility: Architectural Review Advisory Board, Board of Selectmen, NRAB

Recommendation:

It is recommended that the town explore the feasibility of developing a joint public and private marine research facility with a small marine demonstration museum both to be located near or on the waterfront in the Historic Harbor District. The purpose of this facility would be to conduct critical research on the marine resources that are the foundation of our community and to educate our towns people and visitors about our harbor.

Responsibility: Natural Resources Advisory Board, Board of Selectmen, Marina Advisory Board

Promote Public Access**Issue:**

As Wellfleet has become more developed, places for the public to access and enjoy the harbor have been reduced or eliminated.

Goal:

The goal is to promote public access to the harbor for a variety of activities.

Recommendation:

The public access points that are identified in Appendix B should be reviewed and a procedure should be developed for reestablishing their use as public ways to the water. For each access point the specific type of public access should be identified and maintained. At least one new public way to the water should be established south of Old Wharf Point at the end of West Meadow Road.

Responsibility: Planning Board

Recommendation:

The old fire station on Commercial Street is on a small parcel of land that borders Duck Creek. The bank to the Creek is steep and vegetated. In its present state the bank is being broken down by those who use this landing. It is recommended that a float and foot ramp from the float be created to allow easier public water access.

Responsibility: Harbormaster

Recommendation:

The landing on Old Pier Road at the edge of Chipman's Cove is used as a parking area by people who use the beach in the cove (bathers and shellfishermen). Since the landing is so narrow, surrounding

dunes are damaged when vehicles turn around at the landing. The survey (Map #16) shows the road to be 40 feet wide. It is recommended that the last 75 feet of Old Pier Road be widened for a parking and turn around area. The surface should be covered with shell aggregate.

Responsibility: Department of Public Works, Conservation Commission, NRAB

Recommendation:

We recommend that Hamblin Park be renovated to provide the public with a place to walk and enjoy the scenic salt marsh while minimizing erosion and habitat destruction. The area should have clearly marked paths and benches and surroundings should be revegetated with native trees and plants. The former railroad bed from Cahoon Hollow Road (the Herbert T. and Annie Pierce property purchased from the railroad, Map 21 lot 55, Town Assessors Map) is recommended for a public path that would connect with Hamblin Park shoreline path.

Responsibility: Department of Public Works, NRAB, Conservation Commission, Board of Selectmen

Recommendation:

It is recommended that the Indian Neck Beach facilities be upgraded by adding bathroom facilities, handicapped parking spaces, and a boardwalk from the lot to the beach for wheel chair access.

Responsibility: Department of Public Works, Conservation Commission

Preserve waterfront open space, protect marine resources

Issue:

Because of its economic value, waterfront land is usually developed and rarely left as open space. There are a number of advantages to preserving public open space along the shoreline. Naturally vegetated areas act as filters of bacterial contamination that may enter waterways from road runoff. Preserving waterfront land saves habitat for delicate marsh and dune ecosystems. Finally, waterfront open space promotes public access for such activities as swimming, boating, shellfishing, walking or simply viewing the harbor.

Goal:

Preserve waterfront open space.

Recommendation:

It is recommended that the town acquire all of the Whitman property that is in the flood plain zone on Indian Neck. The northeastern area comprised of four acres now serves as an unpaved launching beach for dinghies used to take people to their boats in the mooring basin. This area is a delicate barrier beach and should be protected from development and be maintained as a point of public access to the harbor. An aggregate surface road and turnaround should be clearly defined in that area and the remaining land revegetated.

Responsibility: Town Administrator, Conservation Commission, NRAB

Recommendation:

It is recommended that the Town seek to acquire any property available in the proposed Historic Harbor District to support water dependent uses or create open space.

Responsibility: Planning Board, Open Space Committee, NRAB

Recommendation:

It is recommended that the town create a naturally vegetated buffer zone, wherever possible, from mean high water landward 100 feet on all public shorefront land. Waterfront landowners should be encouraged to do the same through public education and zoning requirements.

Responsibility: Planning Board, Conservation Commission, Town Health Agent

Motor Vehicle Traffic on Beaches and Waterfront**Issue:**

Property owners to whom the Conservation Commission or D.E.P. has issued Orders of Conditions for the building or repair of seawalls or other structures on coastal flats, banks, dunes, beaches, land subject to tidal action, land subject to coastal storm flowage, or land subject to flooding may employ contractors who engage in activities incidental to the approved project which cause grave environmental damage to adjacent areas subject to protection under the act, including removing, filling, dredging, and altering by the passage of extremely heavy vehicles and the temporary dumping and storage of boulders, rocks, gravel, and sand incompatible with the soil on the site, destroying shellfish and other fauna and vegetation and causing erosion.

Goal:

To prevent incidental environmental damage caused by the construction of coastal structures.

Recommendation:

It is recommended that the Conservation Commission consult with D.E.P. and issue orders of condition protecting areas subject to protection under the act outside the project boundaries from incidental prohibited activities both within the boundaries of the project and outside such boundaries.

Responsibility: Conservation Commission

CHAPTER VIII

THE ECONOMY OF THE HARBOR

Wellfleet Harbor is the site of numerous economic activities. Lobstering, shellfish draggers, shellfishing, and aquaculture are all sources of income. Recreational boating docking fees and services are a major source of revenue for the marina. Additionally, tourists are attracted to the harbor where there are restaurants, a theater, and a park, as well as public beaches in the inner and outer harbor. All of these activities incur expenses for the town as well as provide income.

This chapter will focus on the economic uses of the harbor. The specific goals of the economic planning efforts are:

1. To promote economic benefits of the harbor while maintaining and improving a sustainable environment.
2. To plan for funding for dredging, major maintenance and annual maintenance of the Marina.

Inventory

Beaches and Parks Located in the Inner and Outer Harbor

There are four town swimming beaches, and a four mile continuous National Seashore beach extending along the western shore of the outer harbor. The remaining shore line is privately owned or owned by private conservation organizations. Each private home on the inner and outer shores of the harbor is assessed higher than non-shore property. This provides a positive economic benefit to the town.

There is a recreational park adjacent to Mayo Beach with four tennis courts, a playground and ball field. Hamblin Park, reached by a scenic footbridge, has a summit overlooking the harbor. All of these attractive amenities offer incalculable indirect benefits affecting rentals, restaurant patronage, etc., and provide direct non-economic benefits to the townspeople.

Commercial and Non-Commercial Shellfishing: Commercial Finfishing, Lobstering

Shellfishing is one of the three major sources of income in the town. Tourism provides the most income, followed by the building industry and shellfishing. Aquaculture has provided increased production and income for shellfishermen.

Number of Shellfish Licenses and Permits

Shellfish Licenses: Total 36 (total acres: 120 and # of grants: 66)
Annual Town license fee per acre: \$25
Total Income: \$3,000

Commercial Shellfish Permits: 125
Seniors 101
Juniors 2

Total: 228

Permit Cost:	Commercial \$100 -	Total:	\$12,500
	Senior: 15 -	Total:	1,515
	Junior: 50 -	Total:	100

			\$14,115

Non-Commercial Permits: Resident 303
Senior 111
Non-Resident 243

Total: 657

Permit Cost:	Resident \$15 -	Total:	\$ 4,545
	Senior Res. 5 -	Total:	555
	Non-resident 30 -	Total:	7,290

			\$12,390

TOTAL LICENSES AND FEES: \$26,505

The recent decision of the LaForte case may significantly decrease the production of shellfish in Wellfleet. The court found in favor of the landowner whose property includes tidal flats. The essence of the finding is that no aquaculture, the planting and growing of shellfish, is permitted on the tidal land without the consent of the owner. If agreements cannot be reached between the fisherman and the landowner, the highly productive and lucrative method of producing shellfish will have to be abandoned.

SHELLFISH REPORT 1993

WHOLESALE PRICES

COMMERCIAL

Quahogs	Necks	\$1.00 lb.	\$.18 ea
	Cherries	.25 lb.		
	Chowder	.15 lb.		
Oysters				.40 ea
Quahogs	Flats			
	2100 bu.	126,000 lb.	\$	56,700.00
	Deep Water	326,000 lb.	\$	146,700.00
Bay Scallops	1950 bu.		\$	879,000.00
Sea Scallops		27,843 lb.	\$	194,901.00

NON-COMMERCIAL

Quahogs	600 bu.	\$	16,200.00
Oysters	400 bu.	\$	40,000.00

SHELLFISH GRANTS

Oysters	1,455.5 bu.	\$	145,550.00
Quahogs (Necks)			
	3,450,000 bu.	\$	651,000.00
Soft Shell Clams			
	91 bu.	\$	900.00

		\$	2,130,951.00

Shellfish Department Budget, 1992-93:

Salaries and Wages	\$ 54,086.99
Overtime	2,509.00
Holiday	412.78
Longevity	250.00
Operating Expenses	5,144.49
Capital Outlay	300.00
Total	\$ 62,703.26

Shellfish Conservation and Propagation Budget

Operation Expenses	\$ 10,075.00
Capital Outlay	1,535.00
Total	\$ 11,610.00
GRAND TOTAL	\$ 74,313.26

Number of Registered Draggers 1993

Registered in Wellfleet (18' to 62') 17

Number of Private Fishing Party Boats

Registered in Wellfleet 5

Boats Engaged in Finfishing, Including Traps and Lobstering

Registered in Wellfleet 20

Income benefit to the towns from these private boats is not calculable other than the fees they pay.

Beach Sticker Income 1993 \$283,000

Beach stickers are required at Burton Baker Beach, Indian Neck Beach, the ponds, Atlantic and Massachusetts Bay beaches. An insignificant expenditure of beach sticker income is used for harbor beaches. (This is not part of the Marina Enterprise Fund)

Municipal Waterway Income 1993

The Town received a fifty percent reimbursement from the State for the Boat Excise Taxes collected.

Total received from the State \$7,248.07 (This is not part of the Marina Enterprise Fund)

Town Marina, Moorings

The Marina is a center of economic activity for recreational and commercial boats. There are a harbormaster building, restrooms, showers, two launching ramps, fuel dock, public landing dock, and an "L" shaped pier, slips and a mooring basin.

MARINA ENTERPRISE FUND

Sources of Income for the Marina Enterprise Fund

The Marina has a total of 255 slips. The mooring basin has 225. In addition, there are 110 private moorings on tidal flats or "waterways" in the inner, outer harbor and other areas like Duck Creek and Blackfish Creek.

Slip Fees

Concrete Floats

Slip fee, resident	\$ 850.00
non-resident	1,170.00

Wood Float Slips

resident	\$ 600.00
non-resident	820.00

Mooring Fees (Corp of Engineers Basin)

resident	\$ 70.00
non-resident	95.00
"Waterways"	
resident	30.00
non-resident	35.00

Parking Space Rental

Boat trailers overnight	\$ 5.00
Tractor Trailers (annual)	200.00

Rents Received from Marina Buildings

(Building on west property line rented to the Town for the sale of beach and dump stickers)

Rental Income 1993	\$ 400.00
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In 1989 the Town established a Marina Enterprise Fund. The purpose was to use all income from the Marina to provide funds to maintain the Marina and for periodic dredging.

MARINA ENTERPRISE FUND INCOME STATEMENT

	FY'91	FY'92	FY'93
<u>Revenues</u>			
Charges for Services	201,591.00	206,900.35	206,651.50
Earnings on Investments	9,227.00	9,890.87	8,199.16
Other Financing Sources:			
Transfers In	0	0	10,000.00
Total Revenues & Sources	210,818.00	216,792.12	224,850.66
<u>Expenditures</u>			
Personal Services	68,578.00	72,371.72	74,221.70
Purchase of Services	2,887.00	3,037.79	9,134.76
Supplies	5,742.00	1,634.04	2,632.03
Other Charges & Expenditures	581.00	4,877.97	4,203.90
Depreciation	10,000.00	43,244.48	0
Other Capital Outlay	2,807.00	4,287.09	9,749.60
Total Expenditures	90,595.00	129,453.09	99,941.99
Total Transfer to Gen Fund	75,922.00	83,784.00	87,631.00
Other Financing Uses:			
Transfers Out	0	0	14,500.00
Total Expenditures & Transfers	166,517.00	213,237.09	202,072.99
Net Income	44,301.00	3,554.13	22,777.67

The Woods Hole Consortium, with support from Barnstable County and the Town of Wellfleet, conducted socioeconomic evaluation of marine resource uses in the Harbor in 1994. They found that Wellfleet residents spent, on average, for equipment and permits for the following recreational activities per year:

Fishing	39.75
Shellfishing	60.40
Swimming	7.56
Boating	236.36

A typical cost:

Fishing	17.00
Shellfishing	9.12
Swimming	3.80
Boating	60.62

The authors of the study calculated that the average and aggregate willingness to pay for harbor resource preservation among Wellfleet residents and tourists was:

<u>Wellfleet Residents</u>	<u>Wellfleet Tourists</u>
\$64 per household	84-108 per tourist party
\$86,319 per year	393,792 - 506,304 per year

This information gives an indication of the high value of the Harbor to its users when measured in economic terms.

Action Plan

Issue:

1. In 1988 the Marina Enterprise Fund was established by Town Meeting vote. The intended purpose was to have the Marina become self supporting and to be able to set aside funds for periodic dredging and major maintenance.

Note: At this time (10/94) the Municipal Contributed Capital Account has \$153,000. Of this amount, \$140,000 was transferred from the Wharf Fund when the Marina Enterprise Fund was established. Over the past five years insufficient funds have been reserved for dredging. The original goal of the Marina Enterprise Fund has not been achieved.

One of the most important economic consideration in this Harbor Management Plan is the cost of dredging. The following is a cost analysis based upon the most recent figures provided by the Harbor Master.

The cost of dredging the estimated 110,000 cubic yards in area "D" (Map #13 & #14) has been calculated to be ~\$1,000,000. In the past the State has funded 75% of this cost and the Town 25%.

At the end of the fiscal year June 1994 there is \$120,600 in the Marina Enterprise Fund. This money is available for dredging and major maintenance of the Marina, such as repairing the rip-rap, repairing the bulkhead, etc. If the full amount is used for dredging there would be no funds to do the other needed major repairs.

Area "D" has 217 slips (Map #13 & #14). Sixty-six percent of the Marina Enterprise Fund annual income is derived from these slips.

The cost per slip for this dredging would be \$1,152 per slip. (\$250,000 divided by 217). This does not imply the slip charge would be increased to this amount to pay for the dredging.

Additional dredging information is in Chapter 5 "Dredging". See also Appendix C, "Harbormaster's Projected Needs for the Marina".

Goals:

To have funds available to do regular maintenance, major long term capital improvement projects and periodic dredging.

Recommendation:

To form a committee within the NRAS to periodically report on the Enterprise Fund status.

CHAPTER IX

THE NATURAL RESOURCES DEPARTMENT

Wellfleet is at a turning point. It is time to dedicate ourselves to protecting the environment. As one step in that direction, we recommend that we profit from the experiences of other Cape towns and establish a Natural Resources Department (NRD) under the authority of the Town. This step was recommended in 1986 in the Natural Resources and Shellfish Management Plan.

The natural resources of the Town are the wealth supplied to us by natural forces, as distinct from wealth produced by our own manufacture. These natural resources include our indigenous flora and fauna, both those with immediate market value and those providing aesthetic pleasure and long-term market value in terms of enhancing tourism in Wellfleet. These resources include the air we breathe, the land in all its various configurations; the waters lying under the land; and the marshes, streams, pond, and embayments that water and surround the land.

A large measure of protection has been given to the natural resources of this Town by the Act of Congress creating the Cape Cod National Seashore. Various acts of the Commonwealth such as the Wetlands Protection Act and the fish and game laws provide additional protection to certain specific resources. Nevertheless, the greatest portion of our natural resources are the responsibility of our local government.

From the incorporation of the District of Wellfleet in 1763, this community has attempted to fulfill its responsibility by creating numerous special agencies such as the committees "to take care of the Indian lands" and "to take care of the Herring Brook," and, in recent times, various committees, commissions, departments, and boards, including the Shellfish Department, the Shellfish Advisory Committee, the Conservation Commission, the Open Space Committee, the Natural Resources Advisory Board, and others.

Yet no one department has the overall responsibility for protecting the environment. The result is that "things fall through the cracks" and the Town has experienced, from time to time, clear cutting, overgrazing, the pollution of the water table, the pollution and eutrophication of ponds, coastal erosion, and other forms of environmental decline.

Thus, there is a clear need for a department that has the overall responsibility for protecting our environment. A Natural Resources Department would satisfy this need, as it would have the overall responsibility to:

- take note of all threatened or actual damage to our

resources

- take action to prevent or repair such damage
- recommend regulations and policies to preserve or restore these resources.

The NRD should be headed by a Natural Resource Officer. The functions of this officer would be to oversee and enforce relevant regulations and sections of the Town General Bylaws as well as relevant state and federal laws and regulations.

The NRD should, within legal limits, cooperate with the Department of the Interior, the Commonwealth, and nonprofit organizations such as the Massachusetts Audubon Society, the Wellfleet Conservation Trust, and the Nature Conservancy to protect and preserve natural resources within the Town and to foster appropriate public use and enjoyment of these resources.

The management plans, policies, and operation of the NRD should be guided by the recommendations of the Natural Resources Advisory Board (NRAB), which should transmit its recommendations directly to the Board of Selectmen. The Natural Resources Advisory Board should continue, in accordance with the vote of Town Meeting, to review and recommend revisions of the Natural Resources and Shellfish Management Plan and the Harbor Management Plan.

The responsibilities of the NRD should include but not be limited to the following:

1. In conjunction with the Park Commissioners, the planning, development, and operation of all town parks.
2. In conjunction with the Beach Study Committee, the planning development and general supervision of the Town pond and harbor beaches.
3. Management and protection of all fauna and flora on Town property.
4. Restoration of the Herring River Estuary, including particularly the anadromous and catadromous fishes, in cooperation with the National Seashore, the Division of Marine Fisheries, the Habitat Restoration Program of the Massachusetts Bays Program, and authorized private organizations.
5. The monitoring of all areas subject to protection under the Wetlands Protection Act and the filling of requests for determination or the taking of whatever other action may promote adherence to the letter and spirit of the Act.
6. Enforcement of all state and local regulations and laws

protecting wildlife.

7. Education of the public about the Town's natural resources and the need for their protection.

8. Working with the Town Administration to write grant applications related to the Town's natural resources.

9. In conjunction with the Conservation Commission and the Harbormaster, assessment of the environmental impact of all proposed work affecting the Town's natural resources, including dredging and coastal constructions.

10. In conjunction with the Harbormaster, coordination of the response to oil spills.

11. In conjunction with the Wellfleet Health Department and the Division of Marine Fisheries, water quality testing (pathogens, nutrients, dissolved oxygen, hydrocarbons, salinity, acidity, and pesticides) and management in embayments, ponds, and streams.

The NRD should not be responsible for the duties presently assigned to:

1. The Harbormaster (Management and maintenance of the pier, marina, moorings, dredging, etc.)

2. The Health Department as prescribed by the General Laws.

3. The Shellfish Warden, except when necessary to consult regarding environmental issues and when necessary to coordinate activities to protect the environment.

4. The Conservation Commission as prescribed by the General Laws.

5. The Department of Public Works as specified in the Wellfleet Home Rule Charter, except that the design and maintenance policies for Town parks, beaches, and undeveloped open space shall be developed in consultation with the NRD.

6. The Recreation Department in respect to the design, maintenance, and use of recreational equipment and playgrounds and playing fields. The Natural Resources Advisory Board and the Open Space Committee should make recommendations to the Park Commission regarding proposed conversion of Town-owned undeveloped open space to special recreational purposes.

The job description of the Natural Resources Officer and the evaluation of the Officer will be conducted by the appropriate Town boards.

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