

## **Chapter 8**

# **Embayment Management in Buttermilk Bay: A Case Study**

## **Background**

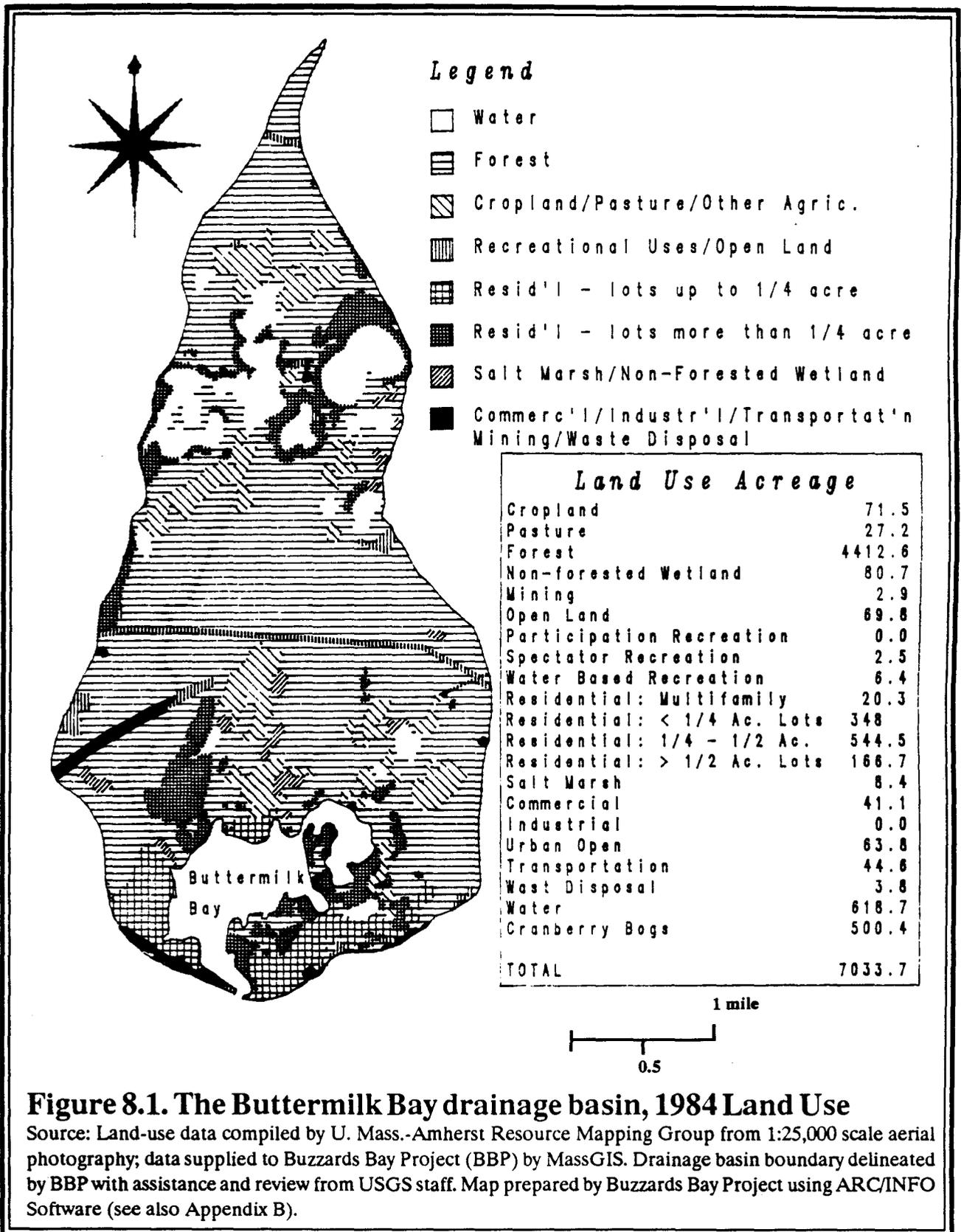
The Buzzards Bay watershed has a number of large pollution sources that are regulated by state and federal agencies. Most of these sources cause local, rather than baywide, water quality declines, and many of them are located in the greater New Bedford area. Throughout most of Buzzards Bay, coastal water quality is typically dominated by many small or diffuse pollution sources. These sources are inadequately regulated by federal or state agencies because they are either beyond an agency's purview, below a threshold level, or simply too low a priority. It has been left to local boards to fill this void and address these small (yet cumulatively significant) sources, such as failing or inadequately designed septic systems, storm drains, boats, and marinas. Consequently, residents and local government have considerable responsibility and authority for controlling contamination within Buzzards Bay.

To better understand the magnitude of the problem at the local level, to determine the sources and transport mechanisms for coliforms and nutrients in a single embayment, and to establish how nonpoint-source pollution could be quantified, ranked and managed within the local and regional framework, the Buzzards Bay Project has sponsored a number of studies within the Buttermilk Bay embayment. Buttermilk Bay contains high levels of fecal coliform (as documented by state and federal sampling); and shellfish beds in the Bay are closed and swimming beaches are threatened.

The case study of Buttermilk Bay case study described below presents a convenient framework that serves as a model for other embayments throughout the Buzzards Bay estuary, and demonstrates that effective implementation is best achieved at the local and regional levels. The following discussion of knowledge gained in Buttermilk Bay will help communities establish management strategies for other geographic areas within Buzzards Bay.

## **An Embayment Management Approach**

A critical part of the study of Buttermilk Bay pollution was delineation of the drainage area contributing water to the embayment. Although the most obvious areas of concern are the embayment itself and the immediate coastline, it is also important to manage the upland portion of the drainage basin (Figure 8.1). Many pollutants that enter groundwater and streams ultimately enter the Bay. In the case of Buttermilk Bay, nitrogen is the pollutant of most concern. Buttermilk Bay has a large drainage area (19 square miles) whose farthest point is 8 miles from the coast. Much of this area is undeveloped, with most residential development along the coast and along the shoreline of the headwater lakes.



Sources of nitrogen and coliform pollution differ in type, importance, and origin. These pollutants also differ in their impacts and their remedies. Most coliforms enter the coastal zone through direct surface flow (i.e., via streams, stormwater discharge points, and overland flow). Nitrogen contributions, on the other hand, come from the entire drainage basin through either surface or groundwater discharges to the bay.

First, potential sources of nitrogen and coliform pollution were identified. Once identified, water quality testing was used to evaluate these sources of nitrogen and coliform pollution for their relative contributions to Buttermilk Bay. Sanitary surveys conducted by the Division of Marine Fisheries Shellfish Sanitation Program were used for both the inventory and the source evaluation. Nitrogen concentrations were monitored in groundwater, streams, and runoff, and a mass loading budget for nitrogen was developed.

Finally, a strategy was developed to address nitrogen and coliform pollution in Buttermilk Bay. The strategy encompassed voluntary and technical regulatory approaches for controlling the sources of fecal coliform contamination, a comprehensive monitoring program to assess results, and a public participation effort.

## **Bacteriological Loading and Management**

### **Sources of Coliform Contamination**

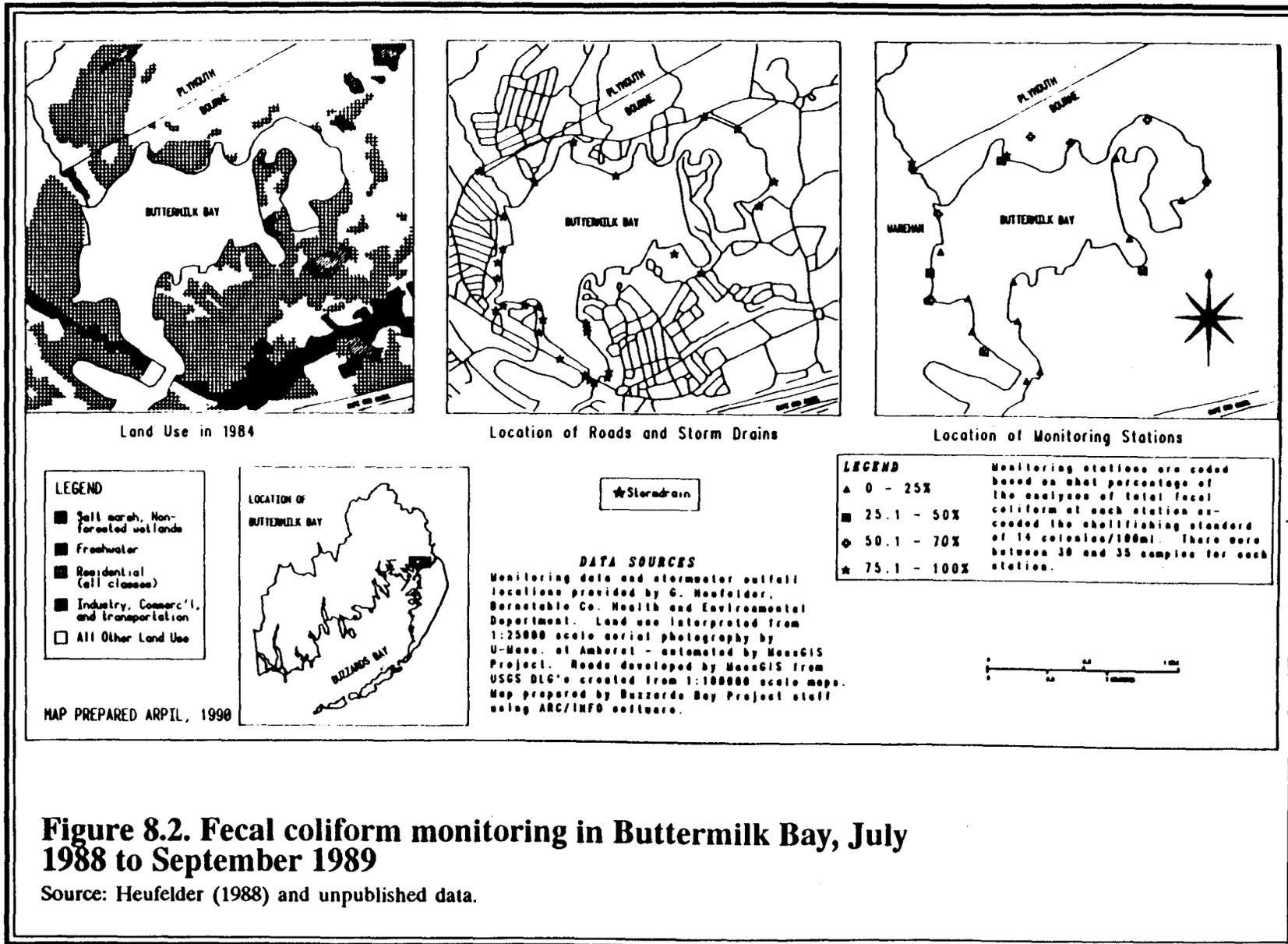
An essential part of the study of Buttermilk Bay, and critical for any embayment project, was an inventory of possible sources of coliform contamination (Figure 8.2). This was accomplished through sanitary surveys that identified the sources of fecal coliform that were causing, or had the potential to cause, shellfish closures in Buttermilk Bay. The inventory included storm drains, septic systems, wildlife, marinas, freshwater inputs (streams, marsh areas) and point discharges, and it provided an excellent snapshot of potential sources of coliform. The Buzzards Bay Project funded the sanitary surveys that were later incorporated in the state program.

#### **Sanitary Survey Has Four Major Components:**

1. An evaluation of the pollution sources that may impact the area
2. An evaluation of the meteorological factors
3. A review of hydrogeographical factors that may affect the distribution of pollutants
4. An assessment of water quality (water testing for the presence of bacteria) under adverse pollution conditions.

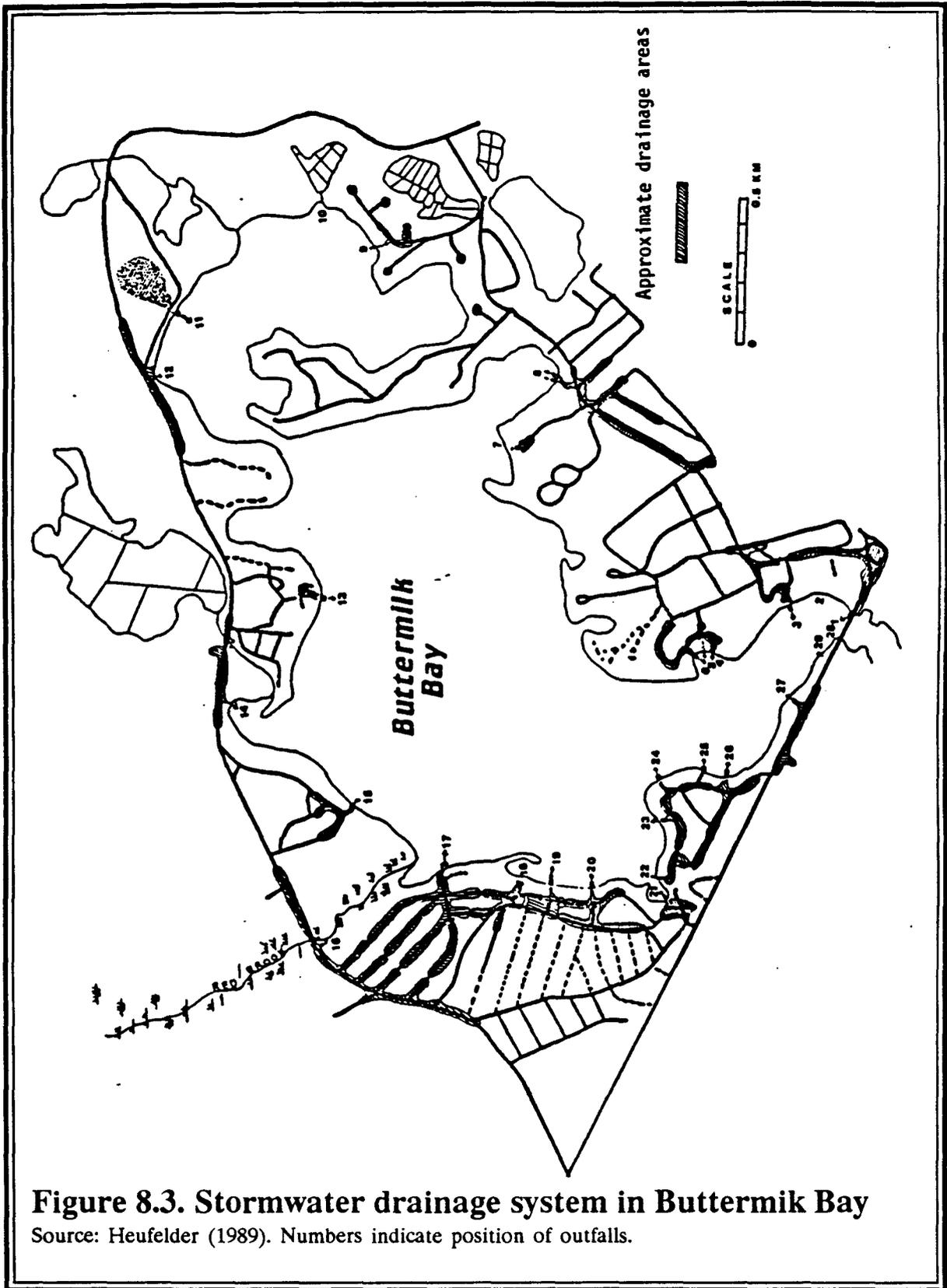
### **Storm Drains**

Stormwater discharges around Buttermilk Bay (Figure 8.3) appear to be the most important factor causing the periodic closure of shellfish harvesting areas (Heufelder,



**Figure 8.2. Fecal coliform monitoring in Buttermilk Bay, July 1988 to September 1989**

Source: Heufelder (1988) and unpublished data.



### Indicator Test for Fecal Coliform Bacteria

Managers and health agents need to assess the risk of disease associated with pollution sources. Because it is too costly and time consuming to test for all known pathogenic (disease-causing) organisms, regulators have settled for the fecal coliform indicator test as an overall assessment of health risks. Fecal coliforms in themselves do not cause disease, but are indicators that human pathogens are present. This test was chosen because most pathogens are associated with human wastes, and human wastes have high concentrations of fecal coliforms.

As with any simplified method, this test poses a number of problems. First, fecal coliforms are not restricted to humans; that is, all warm-blooded animals (including waterfowl, dogs, etc.) excrete coliforms. It is agreed that bird wastes present less of a threat to human health than human wastes; therefore high fecal coliforms from nonhuman sources may misrepresent true health risks. Another problem is that organisms that may confound the test are found in the environment. The fecal coliform test is specific to two groups of organisms: *Escherichia coli*, which is found in the intestines of warm blooded animals, and *Klebsiella*, a bacteria found on decaying plant matter. The presence of *Klebsiella*, together with wildlife, may in part account for high fecal coliform levels found in relatively pristine marshes. A third problem is that coliforms are effectively filtered out during passage of groundwater through the sandy soils of the region. However human pathogens, such as viruses, may travel 300 ft or more without attenuation. For this reason the indicator test *underestimates the presence of human pathogens from septic systems*. Finally, there is evidence that the indicator may persist and possibly reproduce in sediments and beach wrack in nitrogen-enriched areas. These phenomena complicate the use of coliform as a management tool and indicator of public health risk.

1988)). The level of fecal coliform contamination from stormwater discharges is probably related to three factors:

1. The extent and density of residential development nearshore
2. The frequency of rain events and the collection and direct discharge of stormwater to the Bay (frequent rain lessens the ability of fecal matter to accumulate), and
3. Seasonality (with drastically increased bacterial counts in warmer months).

A survey of storm drains during dry periods failed to disclose any cross connections of sanitary pipes. This suggests that the source of fecal coliform during discharge events is not human sanitary waste, but wastes from dogs and birds and materials flushed from the drainage system. In addition to direct discharges, storm events cause a significant release of fecal indicators from sediments and beach wrack.

### Septic Systems

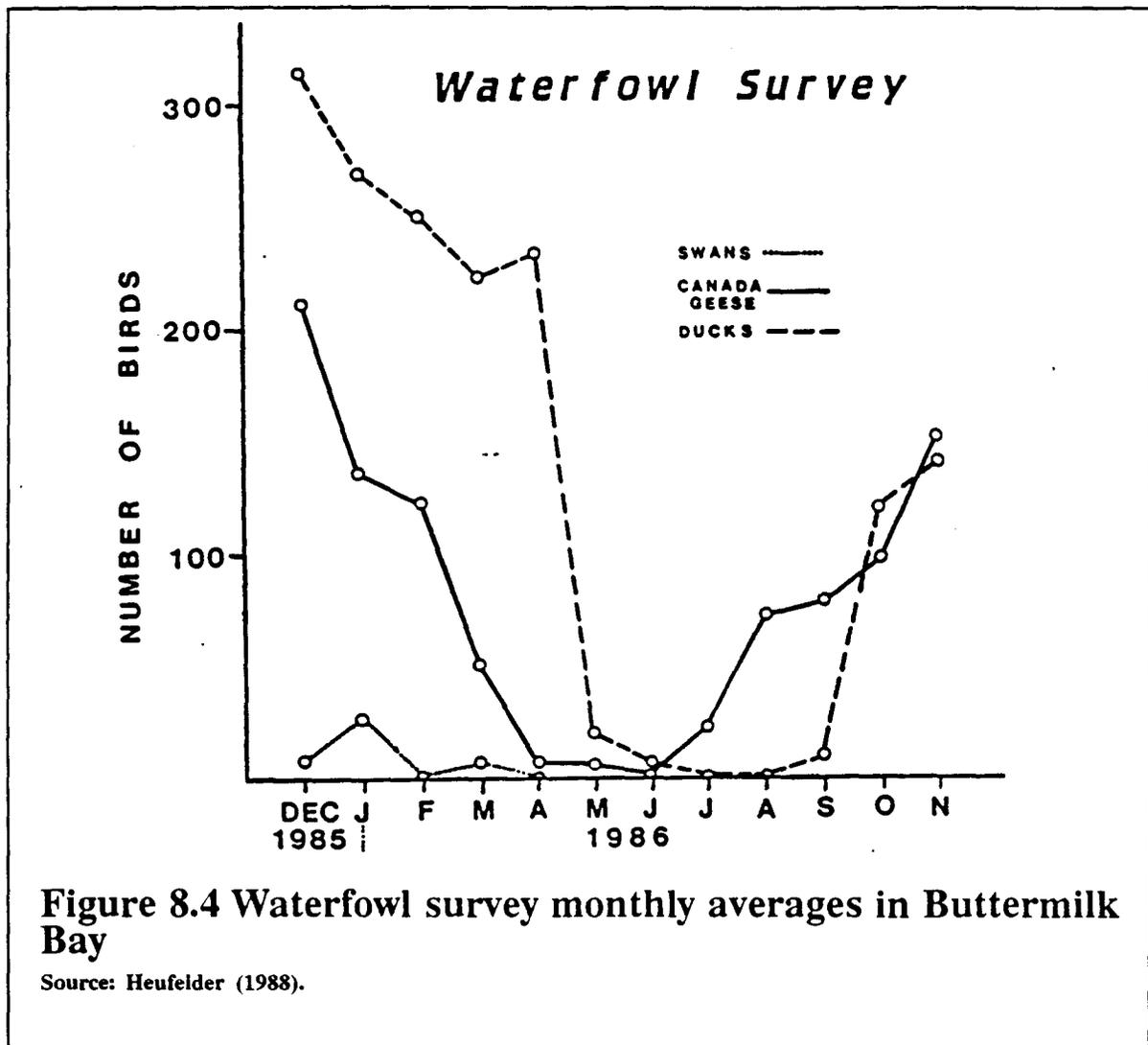
Research on several septic systems in Buttermilk Bay has shown that under dry weather conditions they are typically an insignificant source of fecal coliform to the Bay. This is not to say that septic systems never create bacterial problems. Several systems were found to overflow during rainy weather. These overflow conditions probably present the greatest threats to water quality and health due to surface ponding and surface breakout. Factors that affect the performance of septic systems (such as depth to water

table and effluent loading rate) may play a critical role in controlling the extent of contamination from any particular septic system.

The transport distance of bacterial indicators through sandy soils is limited, but it has been documented that viruses may travel up to 220 ft in soils similar to those around Buttermilk Bay (see review in Heufelder, 1988). The transport of these potentially pathogenic organisms in groundwater has not been adequately addressed and is a management issue that must receive increased attention.

## Waterfowl

A waterfowl survey (Figure 8.4) was conducted to determine bacteriological impact. Field measurements indicated that, except in certain areas, the waterfowl has minimal direct impact on water quality. A long-term cumulative impact on water quality from fecal deposits on the beach areas was, however, suggested, because fecal coliform counts were high in beach wrack (Heufelder, 1988). The bird wastes accumulate in



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winter, and fecal coliforms survive until summer and may even multiply in wrack during warm months. With each high tide that inundates the wrack, the coliforms may then be released in a slow, diffuse pattern. This release of fecal coliform bacteria would then raise coliform bacterial contamination in the embayment.

### Marinas

A small marina operates in Buttermilk Bay, and a large marina operates just outside the Bay's entrance. No measurable contribution of fecal coliform bacteria was observed in Buttermilk Bay as a result of marina operations. These results must be interpreted with caution, however, because the mobility of boats makes it very difficult to determine actual impacts without continuous monitoring. In addition, the two marinas studied were atypical due to the lack of on-board heads on boats at the small marina (it could only handle small boats), and the presence of a pumpout facility at the other. In general, the extent of marina impact will be determined by many factors, including the level of convenience and cost associated with the proper handling of sanitary waste at each facility. The direct discharge of wastewater from boats could represent a significant health risk. Some studies have documented that marinas have the potential to significantly impact water quality. Sediment resuspension from boat prop wash may also resuspend coliforms deposited in sediments and contribute to coliform loads. The impact of boats on coliforms is further addressed in the action plan "Managing Boat Wastes."

### Streams

There are five significant surface water sources to Buttermilk Bay. Red Brook supplies the greatest volume of water and has a drainage area that is relatively undeveloped and composed mainly of cranberry bogs. Most of Red Brook's water originates from groundwater infiltration. Historical data and recent field investigations confirm that Red Brook's drainage into Buttermilk Bay is a consistent source of fecal coliform. Although no sources of pollution were identified, several possibilities exist for the consistently high fecal coliform densities recorded. Septic plumes may be entering the brook at undiscovered locations (although extensive survey work did not reveal any), and wildlife, stormwater, or both may contribute appreciable amounts of coliforms. Confounding the situation, it has been suggested that organic material in the extensive marsh area near Red Brook enhances the ability of fecal coliform to survive and produce. Two other streams in the Buttermilk Bay drainage basin show high coliform concentrations as well. One clearly is impacted by septic systems; the other, like Red Brook, has little development and is surrounded by marsh. This important topic requires further investigation.

### Point Sources

Buttermilk Bay is predominantly residential and only one point source discharge was identified (a pipe in a local fish market discharges water from lobster tanks directly into the lower portion of the Bay). Water samples from this discharge showed high coliform concentrations, but the impacts of the effluent were probably minimal because the discharge site is well flushed and effluent volume small.

## **Beach Wrack Impacts**

Beach wrack, which in Buttermilk Bay consists largely of decaying eelgrass and algae, appears to act as a protected repository for fecal coliform. This wrack has been found to be an important source of fecal coliform. The relationship between wrack and the fecal indicator was studied in the field as well as under simulated conditions in the laboratory. Laboratory experiments showed that (1) fecal indicators are present and dissociate from wrack and (2) incubation in wrack piles along the shoreline prolongs survival, and possibly induces growth, of fecal coliform.

Field testing involved removing wrack from four beaches and monitoring bacteria before and after removal. At one of four sites, bacterial counts on outgoing tides were distinctly lower than counts prior to removal. Both laboratory experiments and field observations clearly show the potential for wrack to be a significant factor influencing fecal coliform levels in the bay. However, it is probably only in poorly flushed areas that removing the wrack will show major water quality improvement. Because the efficiency of this strategy is questionable and probably impractical on a large scale, it does not appear that this is a priority management option.

## **Bottom Sediments**

There is mounting evidence that fecal coliform accumulates and possibly reproduces in Buttermilk Bay sediments. This phenomenon appears to be related to changes caused by nitrogen loading (e.g., decreased water transparency, more organic matter in the water). During storms, coliform in the sediments may be resuspended and contribute to high coliform concentrations that result in shellfish-bed closures. Although other sources of coliform (e.g., stormwater, overflowing septic systems) remain the root cause of coliform contamination, the survival and possible reproduction of coliform in sediments needs to be carefully assessed and addressed.

## **Synergistic Effects with Nitrogen Pollution**

Research suggests a link between nutrient enrichment and bacteriological contamination. Experiments have shown that solar radiation is a prime determinant of fecal coliform survival in Buttermilk Bay waters. In areas with higher nutrient concentrations, ultraviolet light penetration may be blocked, which in turn increases survival of fecal coliform. Moreover, laboratory investigations suggest that algae may release sugars and nutrients that promote the growth of fecal indicator bacteria.

The survival and reproduction of fecal coliform in wrack deposits was noted above. Increased amounts of wrack from algal blooms may be contributing to the problem. In addition, the possibility exists that the indicator may be surviving, and possibly multiplying, outside a host in the marshes and bogs of the watershed.

Subsurface soils around septic systems adequately trap bacterial indicators within tens of feet, but viruses travel much greater distances. Thus, bacterial indicators may not adequately represent the health risk from viruses. This possibility has obvious health implications for shellfish beds and bathing beaches near unsewered residential areas.

## **Nitrogen-Loading Impacts and Management**

Impacts from nitrogen loading are mostly a localized phenomenon in the network of shallow embayments that border Buzzards Bay. Consequently, the Buzzards Bay Project has targeted "nitrogen-sensitive embayments" for management action. The activities that were undertaken in Buttermilk Bay should serve as a model to protect these embayments.

Managing nitrogen loading in an embayment requires a different approach than managing the sources of bacterial contamination. All possible sources within the drainage basin must be weighed, not just nearshore sources. Controlling nitrogen requires more long-term efforts devoted to preventing the water body from reaching eutrophic conditions. It involves a proactive strategy that requires knowing how much nitrogen is entering an embayment and how much can be tolerated.

Eutrophication of coastal water occurs when nitrogen triggers excessive plant growth. This is not only aesthetically displeasing but represents a threat to environmental quality. Eutrophic conditions can also result in decreased dissolved oxygen levels that lead to fish and shellfish kills.

An assessment of nitrogen loading for Buttermilk Bay indicates that freshwater drainage into the basin contributes nearly all nitrogen entering the Bay. In Buttermilk Bay, groundwater contributes 60% of the fresh water entering the Bay and transports over 85% of the projected nitrogen load. According to Valiela and Costa (1988) most of the nitrogen that enters Buttermilk Bay originates from septic systems. The same authors identify the leaching of fertilizers as the second largest source.

At present Buttermilk Bay, because of its extremely high flushing rate, is not displaying baywide eutrophication problems. However, a study of all existing sources of nitrogen in the drainage basin, along with the loadings that each source represents, indicates that Buttermilk Bay is close to surpassing its carrying capacity for nitrogen. Some localized areas of dense development are already exhibiting symptoms of eutrophication. A growth management strategy for the entire drainage basin is the proper course for ensuring the long-term health of Buttermilk Bay.

## **Future Conditions**

A study of all developable property in the drainage basin indicates that additional growth will eventually overburden the Bay's capacity to avoid adverse impacts and will result in eutrophication. Only 55% of the drainage basin has been developed, mostly for residential use. This translates to approximately 55% of the total potential nitrogen loading. In addition, because groundwater moves at such a slow rate (about 1 ft per day), only a portion of the existing nitrogen load has already reached the Bay.

The developable lot survey or "buildout" analysis was conducted to compute nitrogen loading under various buildout conditions. The analysis suggests an increase of 30-130% in the amount of nitrogen entering Buttermilk Bay under existing conditions.

The actions required to manage future nitrogen problems in Buttermilk Bay present a challenge, but one that can be met. The primary responsibility for managing what is essentially a problem of land use and development lies with the local communities.

This sensitive growth issue is complicated in Buttermilk Bay by the need for coordination and cooperation among Bourne, Wareham, and Plymouth, who share the drainage basin. Management strategies must be crafted with a regional perspective or risk ultimate failure.

Several options are available for controlling the long-term nitrogen loading within the drainage basin. Managing growth, reducing fertilizer use, and promoting treatment capable of reducing nitrogen in wastewater through a denitrification process are all effective approaches. The Buzzards Bay Project worked with Bourne, Wareham, and Plymouth to implement a program in Buttermilk Bay that focuses primarily on growth management.

## **Public Involvement**

Public involvement is a vital part of an embayment-management program. The commitment of the citizens who live near the Bay is essential for success. Although the problems are often technical, much of the solution relies on local and personal involvement. The research in Buttermilk Bay was conducted by federal and state agencies, but was brought to life by citizens' groups who conducted public information campaigns to educate the Buttermilk Bay community.

The Coalition for Buzzards Bay served the essential role of catalyst and organized public education and involvement projects within the Buttermilk Bay area. By bringing together existing neighborhood associations and other groups that frequent particular beaches, the Coalition helped local residents identify Buttermilk Bay as a common resource.

Staff from the Buzzards Bay Project, together with key researchers, instructed Coalition personnel in the scientific background necessary to understand and communicate the issues facing Buttermilk Bay.

The Coalition managed an extensive canvassing program that reached nearly 1,000 households and 20 businesses. Over 400 residences and businesses were contacted in person, and the rest received printed information about the project and its preliminary results. The objective of the canvassing was to inform a wide audience and receive feedback. About 70 percent of the respondents were supportive of the project's efforts, and 30 percent ranged from apathetic to skeptical. Unfortunately, only 1 percent indicated they were ready for active participation.

The activities that garnered the most favorable response were those that involved concrete examples of water quality improvement. Both the planned construction of stormwater treatment facilities and the beach wrack cleanup project were favorably received. Problems associated with the safe collection and disposal of household and commercial hazardous waste were a major concern to many area residents. The Coalition has reacted to this message and is establishing hazardous waste management as a major part of its ongoing public education program.

Another productive result of public involvement in the Buttermilk Bay Project has been the interaction between policy makers, researchers, and the general public. Neighborhood conferences, public meetings, and other interactions between representatives of government agencies, the consulting engineer, and homeowners

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helped in the design and acceptance of best management practices for treating stormwater. Once the purpose and method of treatment was understood, the project received the full support of the neighborhood. This was critical because installation of part of the treatment system required the donation of land.

In addition, the direct involvement of the public in removing beach wrack from several beaches and participating in the monitoring program was extremely valuable. Citizens were informed of the hypothesis concerning wrack impacts upon bacterial counts, and then participated in testing the hypothesis. The public involvement program for Buttermilk Bay should serve as a model for other state and federal projects in the future.

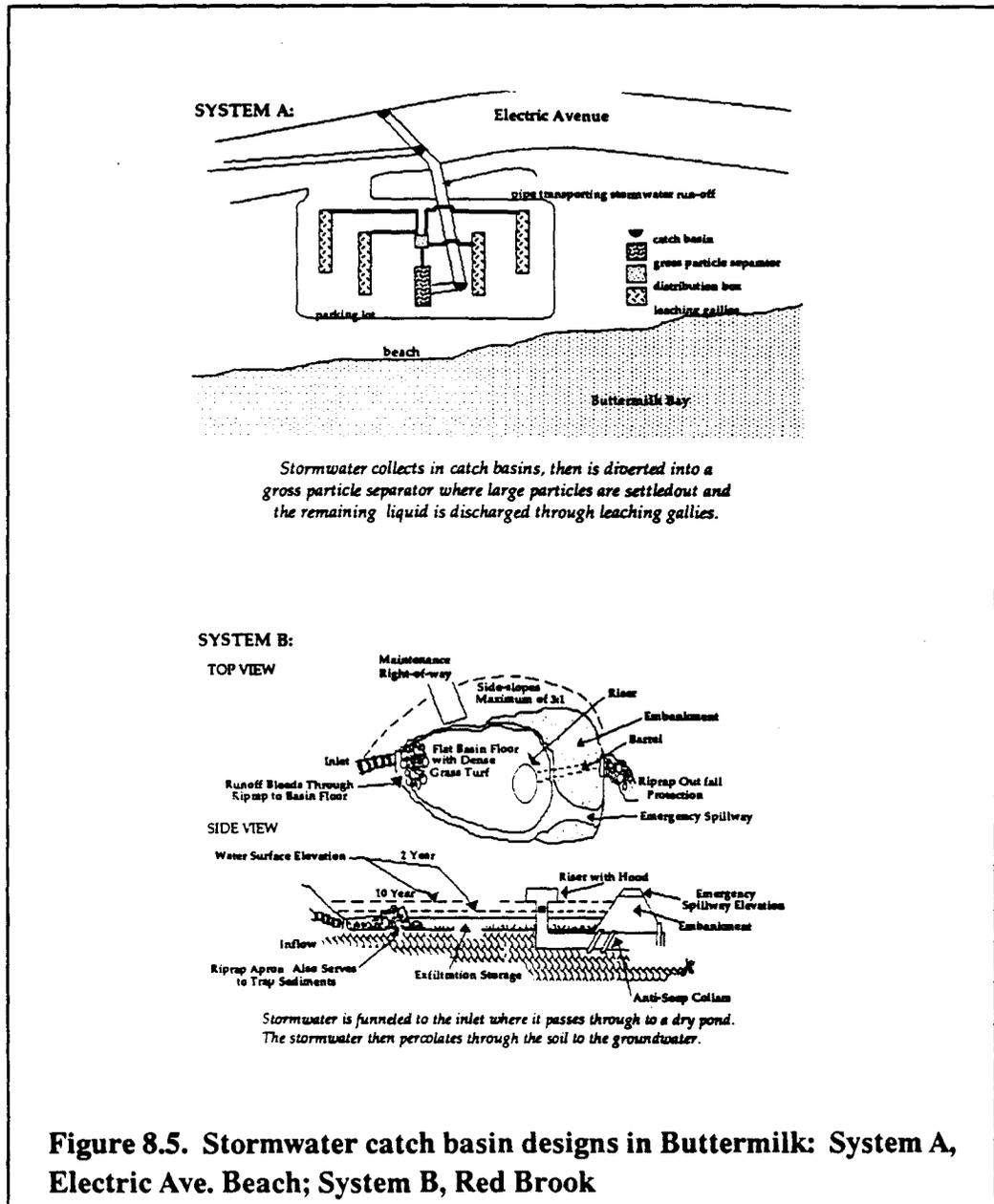


Figure 8.5. Stormwater catch basin designs in Buttermilk: System A, Electric Ave. Beach; System B, Red Brook

## Implementation

### Controlling Stormwater

Research in Buttermilk Bay has identified stormwater runoff as the most significant source of fecal coliform bacteria. Approximately 30 storm drains discharge runoff into the Bay, forcing the closure of shellfish beds following rainfall. Thus, the central part of the project was to demonstrate practical and effective ways to treat stormwater and maintain water quality for shellfishing as well as bathing. Stormwater discharges at Electric Avenue Beach in Bourne and Red Brook in Wareham were selected for treatment (Figure 8.5). Both sites were confirmed as significant contributors of bacterial contamination, and officials from both towns agreed that they were high priorities. The outlet pipe at Electric Avenue Beach discharged directly into the water at a bathing beach and was a visible, hazardous object protruding through the sand at low tide. The perception of the local officials and area residents was that elimination of the stormwater discharge would benefit water quality and enhance recreational bathing.

A settling tank and leaching chambers were installed for the Electric Avenue Beach site, and a detention-recharge basin will be installed at Red Brook. These methods were chosen based upon information from the National Urban Runoff Program and the results of site investigation. Both systems rely on infiltration, which provides high removal levels of coliform bacteria and insignificant groundwater degradation when facilities are properly located, sized, and installed. These facilities not only remove bacteria, but also significantly reduce concentrations of heavy metals, pesticides, and hydrocarbons. This project demonstrates that these systems work well using the subsurface soils of the Buttermilk Bay area.

The tank and leaching chambers installed at Electric Avenue Beach have achieved the high degree of treatment that was expected. Over 98% of the fecal coliform entering the system is being removed prior to discharge. Once the detention-recharge basin is completed for the Red Brook area, fecal coliform levels after rainfall should remain below the shellfish standard and allow shellfish harvesting. The Red Brook system has been significantly delayed due to an archaeological investigation.

Acquiring the appropriate local and state permits required for construction took months and required the involvement and active participation of all relevant local boards and departments. This sort of delay should be anticipated for similar projects elsewhere in Buzzards Bay. In Bourne, wetlands and floodplain permits were required, as well as a state underground injection permit from the Department of Environmental Protection. The project was further reviewed through the Massachusetts Environmental Policy Act provisions, by the Massachusetts Historical Commission, and by the Bourne Board of Health.

Other major considerations were (1) acquiring a site for disposing sludge that accumulated in the basin and (2) ensuring that the installation of the basin did not interfere with underground utilities. Because the land area necessary for construction and treatment of stormwater is not always town property, additional complications may be encountered. Land purchases or easements must often be considered. The Bourne

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facility required formal approval at Town Meeting for the use of publicly owned land. For the Wareham facility, survey work, deed restriction language, landowner acceptance, and recording of deeds were required for attaining easement rights. The Wareham facility also required an easement because the system will be installed on private land.

Obviously, stormwater management for a large developed area requires a well-conceived plan. The Bourne project represents a typical situation in which all the land was privately owned except for roads and the beach parking area. Existing drains in developed areas are difficult to locate and the many utilities running under the street limit construction. The Electric Avenue Beach site demonstrates that, with cooperation and creative planning and design, treatment facilities can be installed and can be effective.

Although every community is different, the following is a general strategy that may be useful in designing a stormwater management plan.

- Inventory and identify the location of all drains and their drainage areas. Drains that receive discharges from the most heavily travelled roads usually carry the most pollution.
- Check for dry-weather discharges or illegal connections, for example, from washing machines or drainage sumps.
- Sample the discharge 15 minutes after the first runoff flush and at least 3 days after the previous rainfall to identify major sources of coliform.
- Implement best management practices to control the first flush, which often carries sizeable amounts of coliform bacteria. (A variety of designs are available, and in general, larger designs are more costly. Decisions on the appropriate technology should involve the local departments, typically public works, who are responsible for operation and maintenance. Problems from clogging by coarse sediments, road sand, etc., must be considered if infiltration using a settling tank is the treatment technology chosen.)
- In developing areas, insistence upon proper land-use measures is the most effective approach. In these areas, extending or adding to existing storm drains is a common problem that must be addressed.

Model criteria have been developed to help communities set priorities to repair, replace, or eliminate storm drains. Factors to be evaluated include

- Rate and volume of stormwater discharge
- Impervious area drained
- Best management practices available
- Installation problems
- Relative cost to implement
- Expected treatment effectiveness
- Maintenance requirements.

The town of Bourne has already expanded the Buttermilk Bay approach to other areas and is rapidly developing a comprehensive understanding of townwide stormwater problems. The Buzzards Bay Project is working directly with Bourne, Wareham, and Plymouth (a town that does not border Buttermilk Bay, but contains most of the land

in this drainage basin) to review, and possibly improve, each town's regulations and bylaws for managing stormwater. This will be accomplished through strengthening zoning bylaws, subdivision rules and regulations, health regulations, and wetlands bylaws and regulations.

In addition to stormwater management, the Project will be assisting the towns in the development of regulatory tools for controlling other sources of bacterial contamination, especially on-site septic systems. Areas that will be addressed are Title 5 upgrades, system maintenance, setbacks from watercourses and marine waters, and distance to groundwater. This strategy, in conjunction with other actions, will reopen shellfish beds in Buttermilk Bay.

## **Controlling Nitrogen Loading**

Controlling long-term nitrogen loading to Buttermilk Bay is critical to the future health of the embayment. The Project calculated future loadings to this Bay based upon growth that would occur under existing zoning rules. The nitrogen that would be added to the system from the increased residential use would seriously jeopardize the health of Buttermilk Bay.

This information served as background for Bourne, Wareham, and Plymouth in evaluating the need for nitrogen-loading standards. With the assistance of the Project, the three towns examined options for managing nitrogen impacts from future development that would eliminate the excessive nitrogen load which would cause Buttermilk Bay to exceed its nitrogen carrying capacity.

The Buzzards Bay Project recommended a tri-town nitrogen management overlay district for the drainage basin surrounding Buttermilk Bay. Within the overlay district, two of the towns, Bourne and Plymouth decreased their zoning densities. By doing this they eliminated over 400 potential house lots (with their accompanying nitrogen contributions). Wareham already had large sized lots which did not require a zoning change. However, Wareham did adopt the overlay district with strong language that discouraged the granting of variances that could increase the nitrogen load. It is believed that this is the first time an overlay district has been used to protect a coastal embayment. Details of managing nitrogen-sensitive embayments are included in an action plan in Chapter 5.

## **Summary and Conclusions**

Most of the sources of contamination in the Buzzards Bay drainage basin are small, nonpoint sources that will probably never receive the full regulatory response of state and federal agencies. Local governments and concerned citizens will be primarily responsible for protecting the Bay from these small yet cumulatively significant sources. The Buzzards Bay Project, through its work in Buttermilk Bay, has tried to demonstrate that an embayment-management approach is the most effective means for mitigating pollution from nonpoint sources. The Project hopes that the process that was used in Buttermilk Bay will serve as a model to be transferred to other embayments.

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Embayment management as conducted in Buttermilk Bay has the following major components:

- Delineation of the drainage basin
- Research and monitoring of water quality and living resources to identify sources, loadings, and impacts of pollutants
- Analysis of full-growth potential (buildout)
- Calculation of nitrogen loading and embayment carrying capacity to avoid adverse impacts
- Involvement of the public
- Implementation of remediation projects and best management practices
- Establishment of local bylaws and long term planning.

Although each embayment has its own characteristics and conditions, the process outlined above should provide a starting point for local and regional action.