

Action Plan

Managing On-Site Wastewater Disposal Systems

Problem

In the Buzzards Bay drainage basin, 43% of the population, or more than 100,000 people, use on-site wastewater disposal systems. Moreover, most of the localized embayments are more affected by on-site wastewater disposal systems rather than by wastes from treatment plants. Thus, on-site systems represent a significant source of contaminants to the Bay itself, as well as to other resource areas within the drainage basin. Title 5 of the State Environmental Code (Minimum Requirements for the Subsurface Disposal of Sanitary Sewage) includes basic rules directed principally toward local boards of health for regulating on-site wastewater disposal. In the 13 years since Title 5 was promulgated in 1978, understanding of the way contaminants act within the subsurface has grown significantly.

Title 5 regulations were designed principally for the control of human pathogens, and for bacteria, at least, they are still adequate. However, scientific research has shown that viruses may not be adequately addressed by Title 5. In addition, the control of nitrogen from septic systems is not considered in the regulations. Other thorny issues, particularly those concerning the siting of systems, have also arisen over the years. Through minimum standards developed at the state level, or through supplements to Title 5 enacted locally, the program must be upgraded and expanded to better protect public health and the environment.

Background

Three primary components govern the placement of a septic system: (1) the elevation of the site above groundwater, (2) the lateral distance between the leaching component of the facility and a point of water use (well, watercourse, surface waters, etc.), and (3) the suitability of the soils or sediments to receive and treat the liquid effluent from the wastewater disposal system.

Pathogens in septic tank effluent are removed primarily through two mechanisms in the soil — physical retention or straining, and adsorption onto soil particles. The efficiency of these processes decreases as the moisture in the soil increases and drops drastically if the soil is saturated. For this reason, a minimum separation distance between the bottom of a leaching facility and groundwater has been adopted in most states. In Massachusetts, the minimum allowable distance is 4 ft.

Although distance to groundwater and treatment of wastes in the unsaturated zone is an important aspect of soil treatment, the lateral distance wastewater travels between entering the groundwater and intercepting a point of human contact is also important. For this reason, Massachusetts has adopted minimum lateral distances between the septic tank and leaching facility and points of water use or potential human exposure.

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The third major consideration in the placement of septic systems is the ability of the soils to allow infiltration of septic wastes. In Massachusetts, suitability is determined by examining a "deep observation hole" and performance of soil percolation tests that are witnessed by a representative of the local board of health. The purpose of the deep observation hole is to determine and record the kinds of soil in the proposed leaching area. In addition, deep observation holes are used to evaluate groundwater elevation. They are generally dug when groundwater is at or near its maximum elevation.

Percolation tests are performed at the proposed disposal site to determine the ability of the soil to accept water. Under present Massachusetts regulation, any soils with receiving rates slower than 30 minutes per inch (or 20 minutes per inch for larger systems) are deemed unsuitable for on-site wastewater disposal. In general, the "faster" the soil, the smaller the surface area required for the leaching facility.

The contamination of Buzzards Bay from on-site wastewater disposal systems can occur in at least three ways. Perhaps the most obvious public health threat occurs when a system experiences overt failure. Failure occurs when soils can no longer receive septic tank effluent, and sewage levels rise or back-up in the system, often breaking out onto the surface of the ground. This process is often more noticeable during periods when soils are saturated or very wet from heavy rains. When a system is near shore, this sewage, which may contain both bacterial and viral pathogens, can be transported to surface waters via stormwater drainage systems or overland flow. In general, systems experiencing overt failures are usually pumped out quickly because they are often offensive to the property owner and adjacent residents, but they may or may not be repaired. Pumping a failing system is not a viable long-term solution to the problem, and consideration should be given to system rehabilitation. The local board of health has full authority under Title 5 to require the repair of failing on-site wastewater disposal systems, but because of under reporting or lack of resources by boards of health, only a percentage of failing systems are addressed. It is unclear what role overt failures play in the overall pathogen contamination of Buzzards Bay, but they may be locally significant.

It is suspected that covert failures may play a more significant role in the pathogen contamination of specific embayments surrounding Buzzards Bay. Many on-site systems installed before 1978 had little or no separation from groundwater. Sewage from these systems is discharged directly to the groundwater, without the benefit of filtration through unsaturated soil. These systems are often assumed to be functioning effectively because no visible wastewater appears on the ground surface, but in reality they are adding pathogens directly to groundwater. Depending on the horizontal distance this contaminated groundwater flows before reaching surface waters, the potential for pathogens to reach coastal waters can be significant.

Another type of covert failure is the problem of overflow pipes. Before the enactment of Title 5, these pipes were often used as backups to prevent overt failure of systems. They were designed to empty directly into a major body of water, or in some cases, into a connecting ditch, stream, or wetland. The practice of connecting overflow pipes is thought to have been quite common in past years. Today the installation of these connections is illegal. Many old overflow pipes undoubtedly still exist in Buzzards Bay and should be corrected. The amount of contamination entering the Bay from this source is uncertain. A series of sanitary surveys were conducted on the eastern shore

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of Buzzards Bay and the overflow pipes that were discovered are now being eliminated. Sanitary surveys have also been completed for much of the western shore and have resulted in the discovery of a number of pipes that are being investigated for illegal connections with on-site wastewater disposal systems.

The possibility of viral pathogens entering Buzzards Bay from properly designed and installed on-site systems is also of concern. Research conducted through the Buzzards Bay Project and elsewhere has suggested that, although fecal indicator organisms are adequately filtered out in the leaching component of on-site wastewater disposal systems, the virus component of sewage may pass through the unsaturated soil layer, reach groundwater, and travel great distances. As viruses travel with groundwater they become public health threats to any resource area (aquifer, shellfish area, swimming beach) intersected by the groundwater flow. Existing Title 5 setback requirements from on-site wastewater disposal systems to private wells, surface water bodies, and other areas are inadequate to provide protection against virus transport.

Title 5 regulations were originally written as minimum standards of protection. In recognition of this fact, some boards of health have adopted supplements to the regulations that offer extra protection to public health and enhance environmental protection. Some coastal communities have been quite aggressive in formulating supplements, but others have made few changes. Most of the Title 5 setback supplements have been developed on a town-by-town basis with little understanding as to why a specific setback was selected (Table 5.3).

In addition to considering virus transport, the siting of septic systems should recognize impacts from nitrogen. The cumulative impact from all septic systems contained in the drainage area to an embayment can be significant because nitrogen is not typically attenuated within the subsurface.

Table 5.3. Examples of leaching facility setbacks in Buzzards Bay

	WELL	SURFACE WATER SUPPLY	WATER COURSE	SUBSURFACE DRAIN
Title 5	100'	100'	50'	25'
Westport	100'	100'	100'	25'
Fairhaven	150'	100'	100'	25'
Marion	100'	100'	75-100'	25'
Carver	150'	100'	200'	25'
Plymouth	100-200'	200'	75'	25'

Title 5 does not address cumulative nitrogen impacts. Several communities have, however, initiated performance standards in an attempt to protect valuable coastal waters and other resource areas. These standards are based on the total loading, from septic systems and other minor sources of nitrogen within drainage areas, to coastal water bodies.

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Local boards of health possess enormous authority to protect public health and the environment. Chapter 111 of Massachusetts General Laws directs boards of health to examine, and make regulations to protect the public health and safety from, all nuisances and causes of sickness, and to destroy, remove, or prevent these nuisances as the case may require. Boards of health may also make other reasonable regulations that they believe are necessary to protect public health and safety. In addition, they have authority to prohibit activities that may result in a nuisance or are harmful to the inhabitants of the town. Some boards of health have used this authority extensively to protect public health and prohibit environmental degradation through far-reaching supplements to Title 5. These have invariably been upheld when challenged in court as long as the regulation was administered fairly. Finally, Title 5 is currently undergoing a thorough assessment at the state level and amendments are expected.

Major Issues

Existing setback requirements from on-site wastewater disposal systems to private wells, surface water bodies, and other areas are inadequate to provide protection against virus transport. During the Buzzards Bay Project's workshop on sewage treatment options, greater setback distances were suggested to protect resource areas from virus pollution. The Buzzards Bay Project followed this recommendation with development of a scientifically-based regulation for communities to adopt. This regulation suggests a 250 ft. setback from surface water and wetlands. Where this setback can not be met, changes in system design and application rate are required to ensure virus removal.

Title 5 does not address the issue of how nitrogen contamination can be reduced to preserve water quality in sensitive coastal embayments and protect drinking water supplies. Nitrogen is present in septic system effluent at significant concentrations. It is known that soil infiltration primarily converts ammonia nitrogen to nitrate nitrogen with very little removal. If the nitrate nitrogen reaches drinking water supplies, it may cause them to exceed drinking water standards. Excessive nitrates reaching near-coastal waters will accelerate eutrophication and contribute to a decline in overall water quality.

Velocity zones, as defined by the Federal Emergency Management Agency's Flood Insurance Rate Maps, are not suitable locations for mounded septic systems. In the event of a severe storm, an unstabilized, mounded system may be uncovered and torn loose by wave action, becoming a safety hazard. Sludge collected in a dislodged system may leach out during and after a storm, causing a danger to public health. When mounded systems are stabilized (armored), they cause another set of problems by deflecting wave energy around the system and increasing erosion of these areas.

Consideration should be given to the rise in sea level, and the accompanying rise in groundwater, expected to occur over the next 25 to 50 years. A rise will reduce the distance from the bottom of leaching facilities to the groundwater. Therefore, systems currently designed and installed with the minimum 4-ft separation will not be adequate as groundwater levels rise.

Many boards of health do not administer Title 5 effectively. In some towns, variances become commonplace rather than special exceptions, due in large part to a lack of knowledge.

Goal

Prevent public health threats and environmental degradation from on-site wastewater disposal systems.

Objectives

1. To enforce the provisions contained in Title 5 regulations.
2. To upgrade pre-Title 5 systems suspected of contaminating groundwater or surface waters.
3. To address the inadequacies of Title 5 through board-of-health regulations.
4. To improve the Title 5 code through recognition of nitrogen impacts, virus transport, and sensitive areas.
5. To promote innovative technology that will reduce nitrogen.

CCMP Commitments

Buzzards Bay Municipalities

Falmouth, Bourne, Wareham, Marion and Westport will pursue amending their Board of Health regulations to allow for better treatment and removal of viruses from on-site wastewater (See Appendix E).

Target date: 1991-1992

Other Recommended CCMP Actions

1. DEP should amend the Title 5 Code so that it becomes a more comprehensive environmental regulation.

Target date: 1992.

The present initiative to bring Title 5 up to date with current knowledge should be pursued aggressively. The code should be amended to (1) require a DEP review of all resource setback and groundwater separation variances in sensitive coastal resource areas such as within the coastal velocity zone; (2) require increased setbacks from resource areas or special designs and loading rates to minimize potential virus transport; (3) address, at least in general policy terms, problems with the cumulative impact of nitrogen from septic systems; (4) address considerations of sea-level rise; (5)

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allow installation of denitrifying septic systems and require them in nitrogen-sensitive embayments that are designated outstanding resource waters.

2. DEP should elevate the priority of the Title 5 Program.

Target date: 1992.

Staff positions should be added and the threshold for state review (currently 15,000 gallons per day) should be reduced so that state personnel review more systems. In addition, more regularly scheduled training sessions should be provided by DEP to assist boards of health in administering Title 5 regulations. DEP should develop a group of qualified staffers who not only hold training sessions, but also offer direct assistance on difficult cases.

3. All boards of health should employ a full-time qualified health agent.

Target date: 1992-1994.

All Buzzards Bay towns now employ at least a part-time health agent. Each town should strive for a full-time agent so that boards of health can expand their programs to require certified septic system inspections in cases such as the sale of a house or the conversion of a seasonal dwelling to year-round use.

4. All boards of health should adopt a series of regulations that address the placement of septic systems in special resource areas.

Target date: 1991-1993.

The boards should consider a prohibition on variances to their regulations in environmentally sensitive areas. In addition, they should not allow mounded septic systems in velocity zones. Also, the 4-ft. separation distances to groundwater in coastal areas should be increased to account for sea-level rise.

5. All boards of health should amend their regulations by increasing the setback distance required between on-site wastewater disposal systems and resource areas or requiring adjustments to the system design and application rate to account for virus transport.

Target date: 1991-1993.

The Buzzards Bay Project will provide technical assistance to boards of health on how to determine setback distances and when variances may be allowed without causing environmental or health threats. A model bylaw covering these subjects will be produced and direct technical assistance will also be provided.

Implementation Costs

Preliminary cost estimates for activities related to on-site septic systems can be found in the Financial Plan, Chapter 2. Topics include costs for health agents, inspections, system upgrades, maintenance, tight tank installation and pumpout, denitrification technology and limited sewerage alternatives.