

Managing Wastewater:

Prospects in Massachusetts for a Decentralized Approach

A discussion of options and requirements

Prepared for the

***ad hoc* Task Force for Decentralized Wastewater Management**

by

Frank C. Shephard

Waquoit Bay National Estuarine Research Reserve

Massachusetts Department of Environmental Management

Division of Forests and Parks - Region 1

P.O. Box 3092

Waquoit, MA 02536

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EXECUTIVE SUMMARY

Background

Decentralized wastewater management is shorthand for "the centralized management of dispersed onsite or 'near-site,' individual, or neighborhood and community, small-scale wastewater treatment systems." The concept carries the implications that small-scale systems require varying degrees of prescribed maintenance, for example, regularly scheduled inspection and pumping at the least; and that the planned and managed use of conventional and advanced small-scale systems might indefinitely forestall the need for a community to sewer and convey waste to a central treatment plant. In this context, "managed use" may often imply more than Title 5 management of conventional septic systems in terms of planning, permitting, and maintenance. But it may also imply *less*, in that the conservative, prescriptive standards for Title 5 systems might be replaced with performance- and environmentally-based standards that are altogether more flexible.

Decentralized management requires planning. In governmental literature, both state and federal, the term "facilities planning" originally referred to the mandated process by which a community could obtain a federal "construction grant" to build a centralized sewage treatment facility. There were three major steps to the process: Step 1, Planning; Step 2, Design; and Step 3, Implementation. The plan evolving from the Step 1 process was to have both administrative/institutional and environmental/technological components. The federal Environmental Protection Agency's "Construction Grants Program" has since been phased out, although formal planning is still mandated in certain contexts, for instance, if a community is seeking State Revolving Fund financing. However, most of the existing literature pertaining to such planning places emphasis on central facilities, even though both governmental and civic interest in decentralized wastewater management has increased.

By analogy, a process similar to centralized facilities planning can be established for the "alternative" of long-term, proactive decentralized wastewater planning. In varying degrees federal and state regulations have even come to require it because both the cost of centralization and its adequacy have come into question. Just this year (in January, 1996) the Massachusetts Department of Environmental Protection issued a new set of guidelines to communities, entitled *Guide to Comprehensive Wastewater Planning*, which suggests that onsite systems (as well as central systems) may be part of a 20-year plan sanctioned by the DEP, thus qualifying for several types of loans and grants.

Even so, it remains that much less has been provided in the way of planning guidance for decentralized alternatives. The DEP guidelines themselves comprise only 30 pages of advice for a process that may result in the expenditure of millions of dollars; only a portion of that advice concerns decentralization. Furthermore, the decentralized solution can be more complex than that of centralization alone, particularly if the planning is conducted comprehensively. Technologically, it involves the examination of many more variables, including the place (and type) of central facilities that may be part of an overall wastewater management plan. Administratively, the organizational and institutional structures required for management may need to be created, if not wholly from scratch, by modifying the charters of local governmental agencies. This isn't the case for public utilities, such as central treatment plants, where clear-cut instrumentalities already exist for their management. And, financially, state support of decentralized management is only now coming to be explored in sufficient ways.

Therefore, this document, and a companion to this one entitled *A Massachusetts Guide to Needs Assessment and Evaluation of Decentralized Wastewater Alternatives*, have been written to familiarize members of Wastewater Planning and Citizens Advisory committees with the issues that arise in the decentralized context, and to provide some guidance to their exploration during the planning process. It is hoped that this background will help such committees participate effectively in their dialogues with

consultants, planners, and state officials.

This, the "management document," is an elemental exploration of the kinds of administrative, regulatory, and financial structures that other states have created in order to proactively manage onsite and small-scale systems. The multistate inquiry was necessary because the very concept of a decentralized management program, particularly one that could substitute for, and perform as well as or better than, central treatment, is comparatively new to Massachusetts. The other, "planning document," is concerned more concretely with the actual environmental, regulatory, geographic, demographic, and technological variables that arise when considering decentralized management as an alternative to constructing a central facility.

The target readerships of both documents are local officials such as selectmen, members of boards of health, or others under whose general auspices planning takes shape. Engineers, professional planners, lawyers, and financial experts may find the discussions of interest, but insufficient to fully specify either an administrative or a technological construct. (Which, in any event, would not need to be fully specified in the "classic" context until Step 2, Design, was completed.)

Earlier versions of both documents were presented to attendees of a December 1-2, 1995, Assumption College (Worcester, Massachusetts) conference entitled "Managing Small-Scale, Alternative and On-site Wastewater Systems: Opportunities, Problems and Responsibilities." Proceedings from that conference are available from the ad hoc Task Force for Decentralized Wastewater Management.

A Summary of Options and Requirements for Decentralized Wastewater Management in Massachusetts

Chapter 1 provides a general background to issues associated with wastewater management; the pollution of surface- and groundwaters; and the differences between centralized treatment and decentralized approaches, and their histories. Levels of treatment are discussed: *primary* refers to the separation of fluid and solid components, and *secondary* to the further breakdown of organic compounds. *Tertiary* treatment results in essentially potable water, and includes the removal of nutrients, whose presence in high levels is deleterious to sensitive surface water environments as well as to public health.

New technology on all scales is discussed, as is the meaning of the terms *alternative* (novel but well tested) and *innovative* (novel and still experimental) in that context. At the small and individual scales, many of these new technologies are what makes the prospect of long-term decentralized management possible. However, most of them require more tending and maintenance than does the conventional septic system; more, in fact, than might reasonably be expected on a purely voluntary basis.

The advantages and disadvantages of central and distributed wastewater management strategies are outlined. The chief advantage of centralized treatment is its ease of management and regulation; that of decentralization is the restoration of water to the watersheds from which it came, and the dilution of remaining pollutants. The chief disadvantage of central treatment is that its per capita cost increases to unacceptable levels as the numbers or density of the population being serviced diminishes. That of decentralized management concerns the difficulty of assuring that multifarious systems are sited and maintained sufficiently to work as they are intended to. (The key idea of decentralized management, in fact, is to establish management and regulatory institutions that can assure that small systems are performing to standard.)

In Chapter 2, the background to laws and regulations concerning water resources protection and wastewater treatment is explored. Serious initiatives began at the federal level during the 1960s, an era of quickened environmental consciousness, brought about in part because of the sorry state of the environment. The main federal laws are mentioned, and traced to their implementation in Massachusetts state law. Particular attention is paid to the Massachusetts Clean Water Act which, through sections of 314-CMR, controls the discharges, by point-source permitting, of large subsurface systems (as well as systems of any size that discharge to surface waters). Sections of 310-CMR (Title 5) set minimum siting and design standards for groundwater-discharging systems that handle less than 10,000 gallons (previously, 15,000 gallons) per day (the daily wastewater generation of approximately 200 people).

Revisions to the Title 5 code in 1995 are discussed, especially in terms of their increased acknowledgment of the need for more site-specific siting and design criteria, and their accommodation of alternative and innovative technology.

Chapter 3 discusses the basic requirements of an onsite (or decentralized) wastewater management entity, particularly its administrative and jurisdictional aspects. The currently delegated entity for oversight of small systems is the local Board of Health; but its powers, funding, and staffing levels may be insufficient to manage an onsite program the way that it has been developed elsewhere around the country. The powers and authorities for these (other) entities are discussed, as are the institutional options for their creation. These include the possible, perhaps modified, use of existing institutions such as Boards of Health or Sewer Commissions, and newly created ones that may act on intermunicipal or regional levels, with charters more specifically tailored for proactive onsite management. Barriers and incentives to the creation of such programs are discussed, the chief barriers being those of the novelty of the concept and its (apparent) potential cost; the chief incentives are the cost savings over central sewerage (which in some

cases will be the only other alternative), and the planning flexibility imparted to communities. The prospects of cost savings through privatization of several management components are explored as well.

Chapter 4 deals more specifically with the tasks that an onsite agency would perform (or delegate) once it had the powers to do so. Planning, ownership of systems, program costs, and financing are explored generally. The programs themselves are then discussed in terms of their components, which include permitting and permit renewals attendant to inspection, routine maintenance, repair, and remediation; record keeping; enforcement; training and certification of system specialists; and public education.

Chapter 5 explores the question of how to evaluate the management and institutional choices that face a community considering a decentralized management program. The planning process (more fully described in the companion document to this one) is briefly outlined. Then the criteria by which the community may assess management and institutional options are itemized. Task division devolves on whether the community wants the program to operate similarly to a public utility, in which case the program assumes virtually all management tasks, collects user charges, and mandates betterments in a fashion similar to that of a sewer district. At the other extreme, it leaves virtually all such responsibility (and costs) with individual owners, except that the periodic renewal of operating permits may require proof that inspections, pumping, proper maintenance, and remediation have been performed. Between these extremes is the prospect of public-private partnerships or contracts in which inspection, pumping, and maintenance are performed by a single firm, much the way refuse is collected in some towns.

Institutional (administrative) evaluation and choice hinge on the match of an institution's jurisdiction with the planning or resource protection area under consideration, its administrative effectiveness and expertise, and, ultimately, on its political and public acceptability. It may also hinge on as yet unwritten Massachusetts authorizing legislation to establish such districts or commissions.

Chapter 6 presents ten "case studies" of onsite programs from around the country, and looks at their differences; then, four situations in Massachusetts are described where onsite programs are being considered, or have been modestly implemented.

PREFACE

In February 1992 the Waquoit Bay National Estuarine Research Reserve, which is part of the National Estuarine Research Reserve System administered nationally by U.S. NOAA, and locally by the Massachusetts Department of Environmental Management (DEM), held a conference on the problem of nitrogen removal from onsite wastewater systems.<WBNERR, 1992(b); (see references).>

(An "onsite" wastewater system is one that discharges at, or close to, the source of the wastewater. The typical onsite system serves an individual dwelling, but multibuilding, cluster, or communal systems may also be referred to as "onsite.")

The problem was hardly new. Concerns with nitrification and eutrophication of coastal embayments have been much discussed. Standard household, onsite septic systems, known in Massachusetts as "Title 5 systems" (after 310-CMR 15, The State Environmental Code, Title 5), to say nothing of older and more primitive cesspools, do not remove nitrogen effectively. Newer technology on both residential and larger scales can do so, but, at that time, the regulations governing Title 5 systems did not permit the use of nitrogen-removing alternative systems (innovations proven effective in other places), let alone experimental systems.

While the conference was initially envisioned as dealing only with the issues of nitrogen pollution, the mitigating onsite wastewater technologies to address it, and the managerial and institutional structures required to manage them, one clear outgrowth of the conference was the realization that these issues are intertwined with many others. As just one example, in a purely functional context the question was raised that if advanced technology removed more nitrogen, couldn't surface water setback distances for leaching fields then be reduced? That led immediately to questions concerning the performance of alternative systems in removing other contaminants such as bacteria and viruses. But that led to questioning the rationale for Title 5 setback specifications. What data were there on even how well conventional septic systems performed with regard to, for instance, virus elimination?

Another outgrowth of the conference was the formation of a statewide *ad hoc* Task Force for Decentralized Wastewater Management, which includes representatives from several towns, the Massachusetts Department of Environmental Protection (DEP), the Cape Cod Commission, the Waquoit Bay National Estuarine Research Reserve, the Massachusetts Bays Program, the Coalition for Alternative Wastewater Treatment, the Marine Studies Consortium, and others. It has been meeting for several years. Initially it was concerned with exploring the feasibility and prospects for innovative and alternative onsite technologies; but it quickly expanded its mission to that of more generally exploring and facilitating decentralized solutions to wastewater management.

("Decentralized wastewater management" is shorthand for the "centralized management of dispersed, onsite or `near-site,' individual, or neighborhood and community, small-scale wastewater treatment systems." It carries the twin implications that onsite systems require varying degrees of prescribed maintenance, e.g., pumping, and that the managed use of conventional and advanced small-scale systems might indefinitely forestall the need for a community to sewer and convey waste to a central treatment plant.)

In that context, many issues came to be raised. Around the state and the country, land-use planners have come increasingly to question the use of wastewater disposal regulations as default tools for land-use and planning. Conventionally the argument went that creating central municipal sewers might encourage unwanted development, and devices like the Title 5 minimum lot size requirements could be used to

prevent overdevelopment. But a more flexible approach to land-use planning will sometimes permit cluster development with the complementary preservation of open space; an approach that can prevent suburban sprawl and reduce total acreage needing to be paved, as well as providing more functional community open space. Denitrifying systems, cluster systems, small package plants, and other new wastewater disposal technologies could help with such flexibility.

On the other hand, it is easy to see how better decentralized wastewater management could also lead to overdevelopment. This concern has, for example, been expressed by the Massachusetts Audubon Society. <Massachusetts Audubon Society, 1991> Technological change may now suggest that wastewater and land management are best regarded as distinct issues.

Another set of concerns emerged which had to do with conventional centralized municipal sewerage. Ultimately driven by the Federal Water Pollution Control Act of 1948 and its Amendments of 1972, 1977 (the Clean Water Act), and 1987 (the Water Quality Act), the Environmental Protection Agency (EPA) had embarked on a campaign to clean up the nation's surface and subsurface waters. In some states directly, and in others, such as Massachusetts, through state environmental agencies, the order was going out to cities, and then towns, to stop polluting. Traditionally this has been handled by sewerage and central treatment plants.

Initially the federal government was prepared to reimburse up to 95 percent of the cost of this massive, multibillion dollar undertaking through EPA's Construction Grants Program. But the program was phased out in the mid-1980s to be replaced by loans to state-controlled revolving fund (SRF) programs. In recent years federal SRF funding has been drying up as well; but dozens of towns in Massachusetts, in the absence of grants, and not financially capable of sewerage on their own, are still under scrutiny and/or consent orders to solve their pollution problems. In addition to the cost issue, there can be strong environmental and planning-related arguments against traditional sewerage, especially in consideration of emergent alternative and advanced treatment options available on smaller scales.

Such issues are explored in this document. Central to all of them is a final set of considerations: the need for credible and capable institutions to plan, administer, manage, and coordinate multifarious wastewater strategies appropriate to differing towns and regions. Alternative technologies, for example, typically involve electrical and mechanical parts that require maintenance. But quite aside from alternative technology, it is the rare Title 5 system that is maintained properly by the homeowner. In critical areas, appropriate and provable maintenance could be the only alternative to sewerage. In areas not so critical, a local management program may offer other advantages, including that of a wastewater plan altogether more flexible than that permissible under Title 5.

Then there is the question of failing systems. The recently revised Title 5 code, requiring inspection only in the event of expanded use or title transfer, may be insufficient for environmentally sensitive or overdeveloped areas. But in order to address these problems, in order to do the planning and prioritizing required, there needs to be an administrative, management, and planning structure in place that fills the regulatory gap between the present Title 5 requirements and the municipal sewer.

In light of these many converging issues—nitrogen and other nutrients in watery areas; alternative and advanced individual and community wastewater treatment systems; comprehensive planning; land use; the general desire to find acceptable and viable, perhaps superior, alternatives to central sewerage; and the obvious need to administer and manage these many variables—the *ad hoc* Task Force and other organizations and agencies (such as the Massachusetts Association of Boards of Health, the Massachusetts Water Resources Authority, and the Department of Environmental Protection itself) have

called for further exploration of the mechanisms by which these issues might be addressed in ways that (1) answer the concerns of accountability and management important to Massachusetts laws and regulations, and (2) are acceptable to the municipalities.

The Task Force's first goal was to produce two discussion documents. One document <A. Arenovski, F. Shephard, 1996.> is concerned with how the recommended EPA/DEP facilities planning process, originally oriented toward centralized sewer planning, can be adapted to facilitate decentralized wastewater management. The other document—this one—has as its purpose providing a brief description of what decentralized management (or the centralized management of decentralized systems) means and entails, how it has been implemented in other states, and how it might be implemented in Massachusetts. Both documents are meant to help start and aid a process in which communities in Massachusetts or elsewhere can readily institute decentralized wastewater management if that is what makes the most sense in a given town or portion of a town or towns.

Please note that in both documents, and particularly this one, various provisions of various real programs from around the country are described. In those contexts various elements of the programs are compelled. But in discussing their use in Massachusetts, their very existence is only problematical. The net effect is that the use of *must*, *may*, *might*; *should*, *would*, and *could* is not always consistent in this document. All of the verbs should (or is that must?) be read in the conditional tenses.

On another terminological note, the terms *onsite wastewater management district* (OWMD), and *onsite wastewater management program* (OWMP) are used somewhat interchangeably. It is true that the term *district* can carry the connotation of a legally organized governmental entity, such entities being part of what is discussed here. But sometimes the term is also used to denote nothing more than the physically circumscribed area hypothetically being brought under the control of an OWMP. Moreover, the terms *onsite* and *decentralized* are used somewhat interchangeably.

Finally, note that, at their most fully developed, onsite or decentralized wastewater management programs, as well as the facilities and management planning process that may have preceded them, can be very complex. Neither document should be taken to imply that every aspect of every program or planning process need be adopted in order to adopt one or several of the ideas laid out here. Obviously, there is no need to "manage" wastewater to any degree more than what is necessary and sufficient—however that may be determined.

Chapter 1. BACKGROUND

"Most often it is totally unnecessary for the town to sewer up. Most septic tank surveys confuse 'failures' with problems of human neglect (like forgetting to pump). [But] everybody gets railroaded by high-profit construction companies and supertech engineering firms. Their representatives lobby the Health Departments, the Utilities Districts, and the government agencies.... There is no home-site lobby in Washington, D.C."

—Peter Warshall, *Septic Tank Practices* (1976)

Some General History

In many of the urban areas of the Third World today drinking water and wastewater still flow down the selfsame ditch at the side of the road, much as it did in medieval European cities. We may wonder at the mindset, the conceptual construct, that makes such a circumstance possible. The question being who, however uninformed, would not be squeamish about drinking human waste?

Part of the answer lies in obtaining stream dilution sufficient to satisfy the human eye. The ditches are not happenstance; they're an engineered system with a very low budget and an ancient history. But the more significant part lies in the act of decanting. The open water stream is dammed or pooled by the user so that solids settle to the bottom; one inserts the lip of the jug just under the surface and draws off the relatively clear surface flow. It still contains floatables such as leaves (to find a pleasant example), but they can be deflected with a surface "diverter," a stick, for example. At home, smaller floating particles can be lifted with a cloth. There may be a second decanting process at home anyway if the water is very turbid. There may even be "tertiary treatment" in which the water is filtered through the cloth. The result is relatively clear water, deemed clean by virtue of that clarity.

Viewed this way, there shouldn't be much difficulty in understanding such a mindset. Until passage of the Clean Water Act in 1977, many municipal sewage treatment plants only "decanted," a process called "primary treatment." The old-fashioned cesspool did a better job; at least it didn't discharge effluent to surface waters. During the course of the 19th and 20th centuries, it slowly came to be known that the decanted, but relatively clear, effluent carried microscopic health hazards, chemical and biological. But the initial retort to that got picked up in the slogan "dilution is the solution." The trouble is that a big river might act as the dilution solution for a whole series of towns and cities. If your town was at the bottom of the stream, things weren't so diluted. We were doing at a larger fractal scale what the streetside ditches of the Third World still do today. In 1996, completely untreated waste still flows into some Massachusetts waters.

The origins of municipal wastewater sewers have their roots in the ancient storm drain systems built to prevent flooding in cities like London and Paris. London's storm sewers date to the 13th century, but weren't used for wastewater until the early 1800s. Paris built a municipal sewer in the 16th century. Still, by the turn of the 20th century, fewer than five percent of the households had connected to it. In this country, Boston had built a drainage system by the early 1700s. <This historical information is from The New Columbia Encyclopedia, 1975 edition, Columbia University Press.> That was the start of a problem that still defies complete solution to this day.

For the most part, it was only in the 20th century that indoor wastewater plumbing and municipal treatment became commonplace. As we've noted, what the cities did with the wastewater stream was initially primitive, and the whole vocabulary of primary, secondary, and tertiary treatment reflects, not only increasingly sophisticated levels of treatment, but history itself.

Outside of the cities a parallel evolution was taking place. Domestic flows advanced from outdoor pit privies to indoor toilets that drained first into cesspools, and later into "modern" septic systems.

However, the legacy of the sewer was quite naturally with us, and as outlying suburbs came to develop, particularly in the post-WWII era, it became commonplace to view the septic system as something temporary, something that would do only until housing densities were sufficient to warrant a central sewer. The central sewer is part of an era of ambitious, even audacious, "big" construction. The firms that knew how to build dams, bridges, highways, skyscrapers, and power plants could just as easily build plants that treated drinking water, or that collected and treated the waste stream. The fact that it was collected meant that, in principle, it could be treated to any degree, rather than left to the vagaries of nature, homeowners, and back-to-the-earth types. Engineering and planning schools reflected the legacy in their curricula. When it was first created in 1969, the EPA assumed the mantle of that legacy.

Advances in onsite treatment and "small systems" were initially left to agricultural schools, soil scientists, and rural agencies of one sort or another. The advances were being made. But they were also being ignored in the context of urban and suburban policy, planning and engineering. Later, the EPA itself took the initiative on small and alternative systems, bucking a tradition that its own studies were beginning to show is not always appropriate. <See, e.g., Connecticut Areawide Waste Treatment Management Planning Board, 1979, p. II-3.>

New Technology

One element clearly driving the fresh look at onsite and community systems is the host of new wastewater technologies now available at small and intermediate scales. These technologies have tended to evolve upward from the individual septic system, although a few have been derived from scaling the municipal treatment plant technology downward. At the individual site level, some have developed in response to the need to remediate failing traditional systems where soils are inadequate, or where there is insufficient space for a conventional drain field. Others have been developed because traditional septic systems remove nitrogen or phosphorus insufficiently for sensitive environments or dense housing.

Many, even most, of these new systems are *not* passive, gravity-driven designs. In addition to needing the regular removal of the solids, called septage (which even conventional systems require), they may have pumps, valves, and filters that need replacement, maintenance, or repair; and they may require drain field "tending," or alternation by diverter valves. Many of them clearly will require regular, professional maintenance in the same way, e.g., that a furnace requires professional maintenance if serious inefficiencies, and even hazards, are to be avoided.

Insofar as this paper mentions some of these systems, their performance and characteristics, as well as some of the concepts and terminology associated with them, are briefly reviewed.

Levels of treatment

Whether the discussion is of large treatment plants, individual onsite systems, or something in between, there generally is reference to three levels of treatment. Primary treatment refers to "decanting"; that is, separating liquid effluent from solids that settle and scum that floats. The tanks in which this occurs are biologically active, and can convert some portion of the solids into gas or liquid. Secondary treatment involves biological or chemical treatment of the liquid effluent to remove organic compounds. Unless

plants have been conditionally waived, the federal Clean Water Act of 1977 requires that all treatment plants upgrade to at least a secondary treatment level. Tertiary treatment, sometimes called advanced treatment, removes all other contaminants, including nutrients, to levels sufficient to result in potable water.

Treated wastewater may be discharged to the land surface or surface water, in which case typically it must be disinfected by chemical treatment, ultraviolet lamps, or sunlight and ozonation. Or it may be discharged below the surface, where (after disinfection if the plant is large) it percolates into the water table. Whatever the treatment process, whatever the scale, the solids left behind must also be disposed of safely.

While solids treatment and disposal is an essential part of decentralized management, it takes place at centralized facilities. Locating or building such facilities is an integral part of the planning process, and is addressed to some degree in the companion document. Detailed discussion of centralized facilities is not, however, the focus of either document, although a consent order to remediate a central treatment facility may well provide the impetus in a given town to undertake wastewater planning.

Aerobic and anaerobic treatment

Microbial degradation of wastewater can happen in oxygen-poor (anaerobic) or oxygen-rich (aerobic) environments; that is, in environments either poorly or well aerated. The biological and chemical processes are quite different. By accident or design, wastewater treatment is likely to involve some of both processes. However, treatment plants tend to rely chiefly on aerobic processes. In contrast, the "septic" tank is an anaerobic environment, as is the bottom of a settling lagoon that isn't stirred.

Advanced, or tertiary, wastewater treatment involves passing the water through both environments, perhaps several times, the reason having to do chiefly with nitrogen removal. Nitrogen's organic forms comprise the amino acids and proteins. Septic, anaerobic, environments convert some of the "organic" nitrogen to ammonium. The same environment will also convert nitrate compounds to nitrogen gas, returning it harmlessly to the atmosphere in a process called denitrification. The trouble is that the initial waste stream does not contain much nitrate to be denitrified. In order for that to happen the ammonium and organic nitrogen compounds must first be converted to nitrates in a process called nitrification. This is an aerobic process that occurs efficiently at a treatment plant during secondary treatment, or inefficiently, in a septic system, near the surface of the drain field.

However, unless onsite systems include an aerobic stage to generate nitrates, and unless, for both onsite systems and treatment plants, there is a tertiary or advanced treatment stage in which the nitrates are recycled through an anaerobic (septic) environment where denitrification can proceed, nitrate compounds will be discharged to surface and groundwaters.

Nitrates are water-soluble plant nutrients, no different from those sold commercially as fertilizers. If their concentration isn't too great, discharging them to the environment is not a problem. But excess nitrates can cause the childhood illness "blue baby syndrome," or methemoglobinemia, a form of suffocation. This is why an upper limit for nitrate concentrations in drinking water is specified, and is reflected in setback distances and effluent discharge volumes in surface and groundwater recharge areas.

Nutrient-rich surface and groundwater flow also can result in the "overfertilization" of brackish and coastal waters, ultimately choking them with algae which can lead to stagnant, oxygen-poor environments, deadly to animal life. The process is called eutrophication. To prevent eutrophication in

such nitrogen-sensitive zones, limits are put on allowable levels of "nitrogen loading" of groundwater, the limits based partially on the flushing rates of a given receiving body of surface water.

The other plant nutrient released by animal waste (and many detergents) is phosphorus. In freshwaters it can have eutrophic effects similar to those caused by nitrogen in coastal waters. The biological or chemical removal of phosphorus from an onsite wastewater stream is even more chemically delicate and complex than that of nitrogen removal, although advanced systems can incorporate such features.

However, phosphorus compounds are more readily absorbed by soil than are nitrogen compounds, thus they are not so often a problem. If sandy soils are not absorbing phosphorus sufficiently, limestone can be an added component of the soil absorption system. Such advanced features as nitrogen and phosphorus removal are precisely the kinds of considerations addressed in the site-specific planning process that accompanies decentralized management.<B.D. Burks, M.M. Minnis, 1994.>

Conventional sewers and treatment plants

The conventional sewer and plant are massive "public works." The typically concrete pipes are large in diameter, requiring major excavation accessed by manholes. Because they're large, wet, leaky, and messy, they must be the lowermost utility on the street, so when they are installed after the development of an area, they involve major disruption of the street and overlying electric, telephone, and gas utilities as well. They are gravity-fed for the most part, but at various nodes, the waste stream may be lifted at a pump station. The ultimate destination is the treatment plant, which may be either "natural" or "mechanical." Ultimately both are dependent on microbial processes. But natural systems rely on open air, vegetation, ponds, sunlight, lagoons, and perhaps artificial or "constructed" wetlands. Mechanical plants rely on tanks in which physical and chemical engineering are employed to augment biological processes, typically in less space.

All large systems (unless waived by the EPA) must now provide at least secondary treatment. Very few provide tertiary treatment. They require discharge permits, are carefully regulated by both federal and state laws, and are almost always operated as a public utility by a sewer or public works department, although in some states investor-owned private utilities, or user-owned cooperative utilities, will operate under public regulation.

Centralized systems are briefly mentioned here because a conventional municipal system can be part of the wastewater plan for a district or municipality, alleviating the problem for the densest areas or for areas not suited to onsite solutions. If they and their operating departments already exist, then there is a ready source of expertise to draw on for help with the decentralized part of the plan.

Conventional onsite systems

The onsite system typically, but not always, serves one dwelling with a conventional septic system; in Massachusetts, these are called Title 5 systems. They are typically gravity-fed, and have no moving parts. The septic system involves two stages of treatment, unlike the more primitive cesspool which, open at the bottom, simply drains effluent into the soil, leaving solids behind.

A (theoretically) watertight, anaerobic septic tank partially breaks down and settles solids. Grease and other light material, collectively called scum, floats to the top. Gases are vented to the roof by a conduit that comes off the building's sewer pipe. An outlet blocked off from the scum layer feeds effluent, by gravity, to a drainfield or other subsurface soil absorption area. Ideally the soils are moderately permeable, and well aerated in the upper layers. If so, further aerobic degradation as well as nitrification

will take place close to the surface, and, optimally, some degree of denitrification will follow at depth. Remaining particulates, pathogens, and other contaminants are filtered by the soil before the effluent stream percolates to the water table.

The understanding (and technology) of the absorption, or leaching, fields has advanced considerably, with modern systems relying on more thoroughly aerated, shallow, horizontally extensive areas that may be piped, artificially bedded in various ways, or even "dosed" with pumps. The required size of the fields, and the need to limit nitrogen loading of groundwater, generally dictate minimum lot size in areas served by individual onsite systems. While designs may vary, they tend to be prescriptively codified at state level. Design approval, construction inspection, and other aspects of management are delegated to local Boards of Health in Massachusetts, and to similar entities elsewhere.

Most septic systems are barely managed at all; many have been installed under unsuitable conditions marked by poor soils or high water tables. But a well-managed, well-sited system, periodically pumped, can last for decades; and a very well managed system, in which absorption fields can be dosed or alternated, can last indefinitely. <See, e.g., Environmental Law Institute, 1977, chapter 5; discussion of Fairfax County, Virginia.> Where nitrogen loading is not at issue, and housing densities are not too high, conventional septic systems can play a major role in a decentralized wastewater plan.

Innovative, alternative, and advanced technology

The term "advanced" is applied to systems, large or small, that provide either full tertiary treatment, resulting in potable water, or that at least reduce the level of nutrients in the effluent stream. The terms "innovative" and "alternative" have specific definitions in the EPA's (now discontinued) Innovative and Alternative Technology Program, created in 1977. At that time bonus incentives were provided in construction grants for communities opting such technologies. The hope was to explore the means for new approaches that would improve the level of wastewater treatment, conserve or recycle water, result in lower cost in comparison with conventional technology, or all three.

Innovative systems involved technology under development but not fully proven. Alternative technology was defined as proven but nontraditional. The terminology has lingered and even worked its way into state codes. While the original EPA program has been terminated, work on such systems has not. It is, in fact, just such systems that provide serious alternatives to central sewerage. Any combination of the systems described below can be part of a decentralized plan.

Alternative and advanced individual systems

These systems can provide for additional nitrogen removal when required, and provide satisfactory wastewater treatment on lots with insufficient space for conventional absorption fields or that have other problems such as high groundwater. Some, such as composting or waterless toilets, involve altogether new approaches.

Typically, however, advanced systems are not waterless, but are added downstream from a septic tank, and they provide more thorough aerobic treatment before discharging effluent into the ground. They take the form of sand, peat, or artificial media filters. The effluent may pass through just once upon intermittent discharge from the tank or be recirculated several times. Such filters provide additional levels of disinfection, clarification, and nitrification (the necessary first step to nitrogen removal). If, following such treatment, the effluent is then circulated or recirculated through an anaerobic tank, high levels of denitrification result. Some of the alternatives are quite passive, but more typically they involve pumps,

valves, timers, and float switches. Thus they require a higher level of monitoring and maintenance, more than might reasonably be expected of most householders.

Alternative collection (sewer) systems

The common element in "alternative collection" is that it uses small-diameter plastic pipe. It can be installed at shallow depths, woven around preexisting structures, etc. It can be considerably less expensive than conventional sewerage. What makes the small diameter possible is that typically such sewerage does not carry solids, but is used to hook up backyard septic tanks to draw off only the effluent. Thus the systems are "hybrid." They can be vacuum-forced, requiring only one pump and power supply at the collection point (plus regulator valves at the tanks); they may be forced by individual pumps (Septic Tank Effluent Pumps or STEPs); or, if topography allows, they can be gravity-drained.

Small-diameter piping can carry raw sewage as well, if heavier-duty grinder pumps, instead of effluent pumps, are used to homogenize and liquify the waste stream. Small-diameter sewers, perhaps serving a neighborhood or subdivision, can then feed either into a conventional sewer ending at a municipal plant, or instead to a community or local treatment facility. Clearly, however, such collection systems require considerable management and maintenance, especially when they are not gravity-driven.

Alternative community and cluster treatment

One of the most innovative concepts in wastewater treatment is that of the neighborhood or community intermediate-scale system. Such systems can be tailor-made for their locales, treating the water as may be required by local conditions. They permit cluster housing, and otherwise are flexible and adaptable to a variety of architectural or subdivision circumstances. One family of such systems, called cluster systems, typically collects only the effluent stream from a number of buildings (dozens, for example), and relies on subsurface discharge to a common drain field after, perhaps, sand filtration.

Another family of such facilities, called package plants, comprise prefabricated, aerobic treatment units that can serve apartment buildings, condominiums, office complexes, and up to a few hundred homes. Like their municipal big brothers, they tend to treat raw waste, are mechanically- and chemically-based, and disinfect the effluent prior to discharge.

As is the case with both large municipal systems and individual onsite systems, septage and sludge must be removed periodically for treatment at an approved and licensed facility.

Among the difficulties with community systems, unless they are going into brand-new developments, are where to locate the common plant or leaching field, who owns the land it's on, and what entity is to be responsible for its management. Clearly, all these systems are beyond the capacity of informal alliances to manage and maintain.

The Advantages and Disadvantages of Central Treatment

This document is concerned with exploring alternatives to centralized wastewater treatment. But central treatment does have its own place and role. In many of our cities and developments, building lots are too small, densities are too great, open space is too scarce to enable onsite solutions. In other areas, soils may be too sparse, topography too steep, groundwater levels too high, or surface and groundwater supplies endangered. In these situations standard Title 5 septic systems may be insufficient, and central sewerage the most cost-effective of any remedy.

Moreover, there is the "comfort" of the central sewer. The public generally regards a hookup as superior to something in the backyard, especially if the backyard septic system puts constraints on the householder regarding, e.g., the use of a kitchen sink garbage disposal unit, or the placement of a tree or patio. The central treatment plant involves tried and true technology that can be upgraded when there is concern. Discharge standards are monitored and can be revised; the effluent can be treated to any degree. A single point of discharge vastly simplifies the management problem. The plant is designed and operated by professionals. When there are failures they receive immediate attention. Finally, from one planning viewpoint, central treatment plants allow for orderly land-use planning and development. In fact, at the time the Clean Water Act was passed, it was the prevailing view in Congress, and presumably among the public, that all developed areas would eventually need to be sewered.

But that attitude is changing, both officially and publicly. Massive public works projects are enormously expensive. In high-density areas, finding space and excavating streets that already contain other utilities impose an expensive burden. In low-density areas, it's the extra miles of excavation, piping, and sometimes pumping that drive up the cost. The central plant is not adaptable to demographic changes. It can quickly become undersized, in part because of the incentives (both created and unanticipated) to develop within its service area, hastening its own obsolescence.

There can be other unwanted or unanticipated secondary effects, social, demographic, and environmental. For example, the high building densities and associated pavement area increase storm-water runoff, perhaps additionally loading the plant itself, as well as further contaminating the stream with heavy metals and other toxins. It steals, without replacing, groundwater from its locale. Finally, it is not guaranteed pollution-free itself. Centralized plants do not always operate as intended. Infiltration, inflow, and overloading are common problems. When mishaps or design failures do occur, they can involve major public health, environmental, or financial crises.

The Advantages and Disadvantages of Onsite Treatment

That central sewer problems can sometimes be intractable is what has driven the reexamination of onsite systems as permanent solutions. But neither has the history and development of onsite approaches been a glowing one. In fact, it was the failure of onsite systems that called attention to public health hazards that appeared to warrant sewerage all communities in the first place. Onsite technology was initially primitive, the first cesspools simply being equivalent to the pit privy with the addition of an indoor toilet attached to the cesspool by a sewer pipe. While the septic system provided an increase in sophistication, hydraulic (drainage) failures remained all too common. It wasn't until 1957 that the U.S. Public Health Service first published a manual on septic tank practice. <R.J. Otis, 1994.> Its suggestions slowly worked their way into building and design codes of various states, but by then the country was already in the middle of an unprecedented housing boom.

As subdivisions sprang up everywhere, it was simply assumed that one day they would be connected to central sewers. The cesspools, and later (typically in the 1970s), septic systems, were from the beginning envisioned as "temporary." Systems continued to fail, confirming and adding to their reputation as primitive, ephemeral, and undesirable devices. But their use had become so pervasive that collectively they had become a serious threat to both surface and groundwater. Even when they functioned properly, little was known about their ability to handle some pathogens.

Then, too, development of coastal areas was resulting in the eutrophication of coastal embayments by nitrogen nutrient enrichment. Some of this was undoubtedly due to lawn fertilizers, wildlife, domestic

animals and other sources. But a large fraction, 50 to 75 percent, <See, e.g., studies emanating from both the Buzzards Bay project and the Massachusetts Bays Program.> clearly is due to nitrogen enrichment in the effluent waters of septic systems, which remove very little nitrogen from the wastewater stream.

One outcome of looking into these problems is a clearer understanding of what caused the failures. The systems weren't all failing. Increasingly, it became understood that much of the failure could be attributed to the misapplication, misuse, and misunderstanding of prescriptive, invariant, state-level codes, which might better be replaced with site-specific design and performance-based standards. Many of the remaining failures could be attributed to negligent maintenance and misuse. <See, e.g., Environmental Law Institute, 1977.>

If those problems could be solved, onsite solutions in many instances might provide relief from the cost and disruption of centralized sewerage. Onsite solutions might even be superior for low-density areas. The systems are small and discharges are dispersed, both characteristics acting to mitigate the impact of any particular failure. Their designs can be adapted to individual sites, and are more flexible in terms of local and regional land-use planning. They return water to aquifers in the locale. They more easily allow a split into gray water (from drains) and black water (from toilets) components, and are otherwise more adapted to water reuse and conservation. They can enhance and stimulate the growth of local vegetation.

The septage from onsite systems, mostly household-derived, poses less of a disposal and treatment problem than municipal plant sludge because *domestic* septage is typically less contaminated with heavy metals. Their cost is potentially lower. Finally, stimulated by the EPA and other agencies, research and development into onsite technologies is beginning to pay off. "Innovative," "alternative," and "advanced" onsite treatment opens many possibilities that just a decade and a half ago simply did not exist.

Improving Onsite Performance

Thus "onsite" is getting a second look. Even if good planning presumed that all wastewater eventually would be collected and treated centrally, there is still a problem *today*. Some 25 million onsite systems exist nationwide. <B.D. Burks and M.M. Minnis, 1994, p.13.> About a quarter of the country, overall, uses them. And in some areas, New England being one, the rate is much higher than that. Many of them are failing. But the causes of the failures are often remediable, or otherwise addressable, because they are not so much systemic as systematic. They need individual management. In many cases, in areas where there are distinct health hazards or where natural resources, particularly water supplies, are in imminent danger, they need management *right now*, regardless of the prospects for some future central sewer. The prescriptive regulations of the state can be inadequate in this circumstance, but it is hard to imagine the state, itself, fielding the personnel for onsite management.

In addition to the need to better manage conventional individual systems, the host of intermediate scale technologies now available clearly need management. But the question arises as to who will manage them. In Massachusetts, if their flow exceeds 10,000 gallons per day (gpd), they are managed under the terms of a discharge permit issued directly by the state. But a municipality, town, or district might have many such plants, might even plan for them, as well as for systems whose flow is less than 10,000 gallons, but still significant.

Systems on all these scales need management, preferably concordant and consistent with a comprehensive wastewater plan. This is the idea of decentralized onsite management. The management entity is, in the words of Jennie Myers, the "small or rural community's answer to the city sewer department." <J. Myers,

1991.> J.T. Winneberger, an early advocate of onsite management, describes the concept this way:
"Provision of public responsibility and authority for management of all wastewater; and the return of
wastewater to an assimilative environment as close to the sources of generation as practical."<J.T.
Winneberger, 1977.>

The mechanisms of such "public responsibility and authority" are quite variable. Strategies used by
various communities in the U.S. and Canada are the subject of this inquiry.

Chapter 2. THE LAWS AND REGULATIONS

"Problems inevitably result from our division of governmental power into units that do not correspond with sharp divisions in either the environment or the economy. In partial compensation, however, we obtain the benefits of fuller local government."

—R.W. Findley and D.A. Farber, *Environmental Law in a Nutshell* (1992)

Some Recent History in National Law

In the 1950s and 1960s, the problem of pollution of all kinds was coming to be recognized as serious. Rachel Carson published *Silent Spring* in 1962, ushering in an era of deep public concern with these issues. The federal government responded with a series of extremely far-reaching laws to clean up the nation's air and water. They were also very expensive to implement, but for several decades had strong public support. Even if in the 1990s such support may be weakening, one way to strengthen it again is to find less costly ways to stay clean.

With respect to water pollution abatement and control, the laws started by focusing on major polluters whose point of discharge could either be identified or stipulated, and thence controlled. But as experience and knowledge were gained, increasing attention was paid to "nonpoint source pollution," including the pollution of groundwater by individual septic systems.

The federal laws that are of chief concern to this document include the following:

National Environmental Policy Act (1969)

Known as NEPA, this act sets the agenda for cleaning up existing, and preventing further, pollution. It established the President's Council on Environmental Quality, which annually makes an "Environmental Quality Report" to Congress. And it established and set guidelines for the planning procedure that results in the "Environmental Impact Statement" or EIS, a significant portion of which are the ample provisions for early public participation in the planning process. Finally, it created the Environmental Protection Agency (the EPA), the federal environmental regulatory agency, whose mission has grown over the ensuing years.

Clean Water Act (1977)

This act (in actuality, a set of further amendments to the earlier, 1948, Federal Water Pollution Control Act and its amendments of 1972) established the "National Pollutant Discharge Elimination System" (NPDES), under which all point source discharges from municipal and industrial facilities would come under a permitting process. Under EPA direction, it requires states to develop water quality standards and to administer the permit system, conditioning such permits with limitations on discharge volumes and particular pollutants, as well as with monitoring and reporting requirements.

In general, the act requires that municipal sewage treatment plants upgrade to a secondary treatment level, a step beyond decanting, subjecting the wastewater to a biological treatment process that further removes solids and organic wastes. It also provided \$18 billion for "Construction Grants" to cities and towns to help them build sewage treatment plants.

Another provision of the act requires that the states prepare water quality management plans, and identify and prioritize specially designated areas that have more substantial water quality control problems. It also requires the identification of control strategies and institutions that will implement the plans.

Water Quality Act (1987)

Section 319 of this act (actually a reauthorization and set of amendments to the Clean Water Act) established a national program to control nonpoint source pollution, and authorized grants to states for the establishment of such programs. Section 320 established the National Estuary Program to identify and prioritize problems in sensitive coastal areas, and create "Comprehensive Conservation and Management Plans" (CCMPs) to address the problems of multiuse in estuaries nominated by a given state. The plans must include consideration and control of both point source and nonpoint source pollution. Two such programs operate in Massachusetts, the Massachusetts Bays Program (which includes Cape Cod Bay and Massachusetts Bay), and the Buzzards Bay Project.

Coastal Zone Management Act (1972)

Under the administration of the U.S. National Oceanic and Atmospheric Administration (NOAA), this act encourages the states (it is a voluntary program) to create and implement a coastal zone management plan that balances economic development with environmental preservation, that promulgates criteria and regulations defining permissible uses, and that designates "Areas of Critical Environmental Concern" and special procedures to protect them. Once in place, the plan is to function so as to coordinate, expedite, and simplify permitting procedures. As with NEPA, there are strong provisions for early and meaningful public involvement in the planning process. It also established the National Estuarine Research Reserve program, designed to create environmental laboratories for coastal studies. Massachusetts is the site of one such reserve, Waquoit Bay, on Cape Cod.

The 1990 Reauthorization established provisions and requirements for the states to create "Coastal Nonpoint Pollution Control" programs, whose purpose is to assure at least minimal coastal water quality standards by utilizing "Best Available Technology" for handling nonpoint sources of pollution.

Safe Drinking Water Act and amendments (1974, 1986)

This act specifies minimum potable water standards, and establishes state programs to assess water quality, monitor it, and create and implement remediation plans. A state program can be administered directly by the EPA, but in Massachusetts is delegated to the Department of Environmental Protection. The act's groundwater protection provisions allow the EPA to designate "sole source aquifers," which, as such, are subject to especially vigilant protection. It also establishes nationwide wellhead protection programs.

Massachusetts Laws and Regulations

The general structure of the federal laws encourages their recapitulation at state level for implementation. Thus MEPA, the Massachusetts Environmental Policy Act (MGL c.30, ss.61-62H; 301-CMR 11), mirrors NEPA, as does the Massachusetts Coastal Zone Management Act (MGL c.21A, s.2[7]; 301-CMR 20.00) its federal predecessor. State executive agencies, as well, tend to be organized, or reorganized, along federal lines. Thus Massachusetts' Department of Environmental Protection (the DEP) carries out at the state level functions similar to the EPA, promulgating its regulations in the Code of Massachusetts Regulations, the CMR.

The DEP's Division of Water Pollution Control and Office of Watershed Management have the main responsibility for developing and implementing programs and regulations to prevent or clean up both

point and nonpoint source pollution of surface and groundwaters in the state, regulating and/or permitting groundwater and surface water discharges, sewer extensions and connections, water pollution control compliance, and wastewater pretreatment.

Other divisions of the DEP, such as the Division of Wetlands and Waterways, and other branches of the Executive Office of Environmental Affairs (under which the DEP is organized), such as the Department of Environmental Management, the Massachusetts Coastal Zone Management office, the MEPA office, and the Metropolitan District Commission/Massachusetts Water Resources Authority, have responsibilities and authorities that can overlap in matters of pollution control and water resources planning.

The Executive Office of Environmental Affairs and its Department of Environmental Protection derive their authority from several dozen state laws pertaining to the environment. Aside from the previously mentioned MEPA and the Massachusetts Coastal Zone Management Act, those of most concern to water and wastewater planning and management include:

! The *Massachusetts Ocean Sanctuaries Act* (MGL c.132A) which controls new or increased discharges, including sewage outfalls, in protected ocean areas.

! The *Wetlands Protection Act* (MGL c.131, s.40, regulated through 310-CMR 10.00) which controls polluting activities within buffer zones surrounding marshes, swamps, vernal pools, and other low-lying areas where groundwater may surface for all or part of the year.

! The *Public Waterfront Act* (MGL c.91, regulated through 310-CMR 9) which controls activities within tidelands and waterways and their surrounds.

! The *Massachusetts Safe Drinking Water Act* (MGL c. 111, ss. 5G, 8G, 17 & 159-174, regulated through 310-CMR 22) which parallels federal law and protects surface and groundwater drinking reserves by establishing three successive buffer zones (I-III) that surround them, where human activity and discharges are tightly regulated.

! The *Water Management Act* (MGL c.21, ss.25-53, regulated through 310-CMR 36, and 313-CMR 2.00, 4.00 and 5.00) which controls large-scale water withdrawals.

! Finally, *Land Application of Sewage and Sludge*, 310-CMR 32, regulates those activities.

All of these laws can factor into the water resources and wastewater disposal plans of a community or district, but the single most important law is discussed separately in the next section.

The Massachusetts Clean Waters Act, MGL c. 21, ss. 25-53 (regulated through 314-CMR 1.00-15.00, & 41.00)

Most regulations concerning water and wastewater fall under this act. Under the code, any wastewater facility of any size that discharges to surface waters requires a NPDES permit, issued by the DEP conjointly with the EPA under 314-CMR 3.00, so as to assure the meeting of Surface Water Quality Standards as defined in 314-CMR 4.00.

With regard to the subsurface discharge of wastewater effluent, the code makes a major distinction between large and small average daily flows. Under older versions of the code, the threshold for this distinction was 15,000 gallons per day (gpd). Under recent revisions to the code (discussed further below)

the threshold has been reduced to 10,000 gpd, with several grandfathering provisions for systems between 10,000 and 15,000 gpd, as well as a transition period to accommodate the change. (As a general rule of thumb, every individual is assumed to generate about 50 gallons of wastewater per day, thus the 10,000 gallon threshold assumes a facility that can handle the wastewater needs of approximately 200 or so people.)

The main distinction is that the larger-volume flows require groundwater discharge permits issued by the DEP, stipulating a higher-quality effluent. Most publicly-owned sewage treatment works (POTWs) and many privately-owned sewage treatment facilities (PSTFs) that handle the wastewater treatment needs of more than one building or lot require such permits.

More specifically, such facilities require a Groundwater Discharge Permit under 314-CMR 5.00, conditioned to assure the meeting of Groundwater Quality Standards as defined in 314-CMR 6.00. The permit will specify that the discharge be of potable water quality, and, even so, will not permit discharge within Zone 2 of a wellhead recharge area unless there is no other possible solution. Typically this would require a treatment plant, as opposed to a communal septic system. (See Chapter 1, "New Technology," for a discussion of these terms.) All permitted facilities are also subject to the Operation, Maintenance and Pretreatment Standards for Wastewater Treatment Works defined in 314-CMR 12.00.

The permits for these facilities define what pretreatment is required to control toxins entering the wastewater stream; allowable contaminant levels on discharge; volumes of discharge; conditions of operation of the plant; qualifications of plant personnel; and monitoring, testing, and reporting requirements. Whether the permitting of such facilities can be shifted to a local management agency is problematical, but if it could be, the local agency would need the expertise and authority to enforce standards that emanate from the federal government through state law.

Subsurface wastewater discharges of less than 10,000 gallons per day (previously, 15,000 gpd) are also regulated under the Clean Waters Act. They are called Title 5 systems, and are discussed below.

Massachusetts State Environmental Code, Title 5 (310-CMR-15.00)

Systems with design flows of less than 10,000 gpd (with grandfathering for existing 15,000 gpd systems), and which discharge to the ground, are regulated under this state-level, largely prescriptive code which governs their design, construction, operation, repair, alteration, and upgrading. The typical Title 5 system is an individually owned, single-household septic system (consisting of a septic tank and subsurface leaching field), although cesspools (no longer permitted) and communal systems or package plants that do not exceed the discharge permit threshold of 10,000 gpd are also governed by Title 5 regulations. (The details of these various technologies are discussed under "New Technology" in Chapter 1.) While the Title 5 code is written and revised by the state DEP, its enforcement and permitting, with exceptions, are left to local Boards of Health.

The Title 5 code had last been revised in 1978. But a new set of extensive revisions took effect on March 31, 1995, the main purpose being to further protect ground and surface waters from nonpoint source pollution, and to protect drinking water supplies and coastal areas from excessive nitrogen loading. In fact, one of the main incentives in revising the code is that, even in 1995, 40% of the state's fresh waters and 60% of its harbors and bays remain unfit for fishing or swimming.<Massachusetts DEP, 1994.> The most farreaching change in the code involves the requirement for mandatory inspections of existing systems in the circumstance of a property's sale or expansion of use, making Massachusetts the twenty-third state to provide for some form of mandatory inspection for existing systems.<*The Enterprise*

(Falmouth, Massachusetts), June 30, 1995.>

Provisions of the new code have been the subject of vociferous criticism from homeowners and real estate agents concerned about the costs of the new requirements, the time frames in which upgrades must be performed, and the allegedly "chilling" effects on the real estate market. In part, the effects have been real, even if induced by uncertainty, rumor, and exaggeration. Even so, the failure rate of one in four upon inspection has been high; BOHs have been inundated with a backlog of paperwork; and, reportedly, the price of inspections and repairs has increased because of the sudden demand for these services combined with a (presumably temporary) shortage of qualified jobbers. In consequence, since March, 1995, provisions of the code have been relaxed several times.

One of the most significant post-March executive office recommendations concerns the authority of the local Boards of Health. Under the original code, and under MGL c.111, s.31, local government has the authority to adopt more stringent regulations than those set forth in Title 5. However, as part of a bill now before the General Court, uniform standards could not be tightened by local government without DEP approval, in addition to hard scientific evidence that stricter standards are required to protect public health or the environment. The bill's proponents have argued that local BOHs sometimes have been overzealous. Paradoxically, however, much of the drive for tighter Title 5 regulations, as well as for decentralized management schemes, is based on the predication that local BOHs, for reasons of budget if no other, have been lax in the enforcement of Title 5 standards, even under the older 1978 rules. Taken together, the charges may suggest a degree of arbitrariness from board to board that might be reduced by performance-based standards; planning; and more state support, both technical and financial.

In any event, the apparent public response to the tightening of Title 5 regulations must be noted by any town contemplating an Onsite Wastewater Management Program, for much of such a district is likely to contain small and individual systems that the program might subject to stiffer requirements than those stipulated under Title 5. The public, which may be asked to vote for implementation of tightened management, will need to be convinced that the decentralized alternative is less expensive than otherwise mandated centralized sewerage. Or, given the community's circumstance (the need, for example, to protect coastal waters from eutrophication, or to prevent closure of shellfish beds or beaches), that the price of tight management is worth it. Or that a local onsite management program will provide for additional planning flexibility within the town, and for relief from some of Title 5's constraints. (As a single example of this latter point, under new Title 5 revisions, inspection of a system will not be required at the time of title transfer if the system is subject to a local plan for onsite septic system inspection and maintenance approved by the DEP.)

In Chapter 4, typical management and maintenance provisions for wastewater facilities in a "true" Onsite Wastewater Management District are discussed. By way of both review and contrast, the provisions for small systems as stipulated under the revised Title 5 are briefly (if incompletely) outlined below. Many of them take a step in the direction of more fully defined decentralized management programs. In some communities, or areas within a community, the revised Title 5 may fully address the needs for wastewater disposal.

Siting. Setbacks have been increased to protect drinking water in particular, and all water resources generally. Nitrogen-sensitive areas are subject to additional siting and design restrictions. For new systems there must be acreage available for alternate leaching fields. Four separate soil types have been identified, and the soil type, as well as the percolation rate and depth to groundwater, must be accounted for in design of the system. New systems are not permitted if a central sewer hookup is available.

Inspections. Aside from inspection on installation, systems must be inspected on expansion of use or transfer of a property and, if found to fail, upgraded (with exceptions) within two years to the "maximum feasible extent." As noted, there are exemptions from the requirement of inspection at the time of property transfer, the most interesting one being the case in which a local inspection and maintenance program is in place. Alternative and shared systems (see below) must be inspected at least annually. Existing systems originally could "fail by definition" if their setbacks were insufficient in various ways, although some of those provisions have since been relaxed. When a system is found to be failing, the BOH ultimately has the power to issue an order to comply, enforceable by financial penalties and other administrative means.

Pumping. Pumping schedules are recommended, but typically are not made mandatory. (This is in distinct contrast to the requirements of most onsite districts, where pumping, either periodic or as needed, is part of the program. Pumping only when inspection warrants it is the more desired approach, both technically and economically. Nevertheless, inspections will be regularly scheduled and overall pumping frequency would rise over that demanded by homeowners alone. For these reasons, facilities for adequate septage treatment and disposal need to be part of a decentralized program's plans.)

Records. Local BOHs are to maintain records for each system including application and plans, permits, as-built plans, reports of inspections, certificates of compliance (issued or denied), inspection forms and plans, pumping records, letters of noncompliance, and local enforcement actions taken.

Professional qualifications. Soil Evaluators and System Inspectors are two new categories of professional recognized under Title 5. System Inspectors are prequalified when they belong to any of several previously licensed groups such as Registered Engineers and Registered Sanitarians. The same groups can qualify as Soil Evaluators by passing a written examination. Others, with related experience, may be certified by the DEP in either capacity upon taking a course and/or passing a written examination.

Large systems. Existing systems with flows greater than 10,000 gpd must be inspected within two years, and must be upgraded to treatment plant standards if they are jeopardizing drinking water. New systems handling over 2000 gpd require a recirculating sand filter (or equivalent advanced technology) if they are located in well-water recharge, or nitrogen-sensitive, areas. Septic systems with shared leaching fields are permitted, but are limited in daily flow to what could be accommodated with individual systems. All shared systems require a "Title 5 Covenant and Easement," which stipulates ownership and owner responsibilities, financial assurance, inspection, maintenance, and pumping requirements.

New technology. Revisions to Title 5 encourage the development of new technology, permitting its use in successively less restrictive settings designated as *remedial*, *pilot*, *provisional*, and *general*. Such systems must be inspected annually, and are permitted directly by the DEP with the idea of field testing and approving more of them over time. At present, more than ten types of new or advanced technology are recognized in at least one of the categories listed above. (These technologies are generally discussed in Chapter 1, as well as in the companion document to this one.)

Financial assistance. Part of the strong resistance to the March, 1995 revisions in the Title 5 code came from the lack of any financial assistance for those requiring septic system upgrades or replacements. In response, in June, the Commonwealth made \$10 million available as grants to applying municipalities under the terms of the Septic System Repair Program administered jointly by the DEP and the Executive Office of Community **Development**. Municipalities, in turn, can make low-interest loans available to homeowners as either junior mortgages, or as betterment loans under terms of the newly enacted Betterment Bill (MGL c.111 s.127B 1/2). Under the terms of the bill towns can provide financing mechanisms for ISDS upgrades similar to those used for sewer hookups. While assessments for public improvements such as sewer construction are mandatory, under the Betterment Bill a voluntary agreement

is made between the town and individual homeowners. The town advances the funds, putting a municipal lien on the property, and homeowners pay them back through charges on their real estate tax bills. (Betterment revolving funds can be established by local bond issues, as well as by grants or loans from the state.)

Since that time, revisions to the Betterment Bill have been proposed because some of the original provisions were too restrictive to interest municipalities. Moreover, restructuring of the State Revolving Fund (SRF), which provides municipalities with low-interest loans for central sewage treatment, has been proposed. The new rules would free significant portions of these funds for nonpoint source pollution control, including septic system upgrades. As much as \$30 million, attached to the Open Space Bond Bill, may become available to the Septic System Repair Program. Also pending in the state legislature is a proposal of Governor Weld's to provide \$2500 direct tax rebates to homeowners who remediate failing septic systems.

As of this writing, much in these proposals is still in flux, but they are a signal of the state's interest in helping with the financing of onsite upgrades and programs.

All such mechanisms (and others not discussed here) are part of a "community-based approach" to the financing of resource and public health protection, made necessary by dwindling federal grant programs. But they can readily be incorporated in onsite management programs, the financing of which is discussed further in Chapter 4. It should be clear from the Title 5 experience, however, that any onsite remediation program must have adequate financing available for affected homeowners, on easy terms and without regard to their financial "need."

Review and revision. In recognition of some of the new and untested provisions of the revised Title 5 code, sections 15.040-15.041 provide for an assessment and review of accumulated experience with percolation rates, soils suitability analysis, nitrogen loading limits, new technologies, and the feasibility of basing siting and design criteria on the performance-based specifics of these factors and on pollutant loadings, rather than on daily flow and purely prescriptive criteria. This review is to lead to another round of code revisions by the year 1999. In matter of fact, there have already been several revisions to the Title 5 code. With rapid changes in wastewater technology, politics, and governmental funding that are now transpiring, fundamental change in wastewater policy may come well before 1999.

The Legal Matrix

There has always been a problem of overlap, thus sometimes unnecessary red tape and confusion, in unravelling the roles of federal, state, and local pollution control laws, regulations, and agencies. In response, as federal and state environmental laws have evolved in their amendments and reauthorizations, there is ever clearer specification of procedural elements designed to eliminate redundancy or conflict. Pollution control and land-use programs have been increasingly keyed to comprehensive planning, with simultaneous participation of all relevant state, federal, and local agencies. Such comprehensive planning may not be a *necessary* requirement of a decentralized wastewater program, but it can be a profitable approach. And it is clearly necessary if a consent decree is involved, or if wastewater planning is part of a broader effort such as coastal zone management. In these cases, proposed wastewater plans need to be systematically examined for consistency with laws and regulations at all levels of government.

Also contributing to the sometimes confusing governmental matrix is federal recognition of the difference and variety of state and local problems, and of the agencies that might solve them. Within the federal laws there is strong encouragement to identify and utilize existing institutional structures whenever possible.

In turn, state agencies, in relinquishing control to local ones, make similar allowances, while still seeking assurance that whatever the local agencies may be, they have the authority, expertise, and wherewithal to execute their tasks effectively. Adequate wastewater management may involve no more than a modest BOH initiative for regular inspection and pumping. In more complex situations it may involve an iterative but fruitful process that involves a comprehensive look at the municipality's resources and desires; and participation of state, regional and local agencies, as well as private and civic groups. It may end with the proposal to establish an altogether new institution. Such a planning process is discussed more fully in the companion to this document.<A. Arenovski & F. Shephard, 1996.>

Chapter 3. THE WASTEWATER MANAGEMENT ENTITY

"The problem is not that onsite systems are inadequate; it is that we have not accepted the fact that onsite systems are treatment plants that must be designed and maintained by qualified people."

—R.J. Otis, *Onsite Wastewater Treatment* (1994)

Basic Concept of a Wastewater Management Entity

Until fairly recently wastewater management really has been handled on only two scales. Municipal sewers were built for urban areas. Nonurban wastewater disposal was handled onsite, with passive, subsurface ("out of sight, out of mind") plumbing that discharged into the ground. Municipal sewer systems were managed by municipal agencies such as a Department of Public Works, or a Sewer Department or Commission. In nonsewered areas, state agencies stipulated the specifications and design of onsite systems prescriptively or generically. The enforcement of such regulations was left to local Boards of Health, which typically had only limited authority, expertise, and staff. It is in part because of those limitations that onsite system specifications were written with universal and inflexible standards, and passive, relatively maintenance-free designs in mind.

In cities, the expansion, extension, and upgrading of centralized sewers were already coming to pose horrific planning, construction, and disposal problems, even as smaller cities and towns were wrestling with the question of central sewerage for the first time.

As discussed, newer technologies were being introduced on spatial and construction scales intermediate between the individual onsite system and the central treatment plant. And in the smaller towns and suburbs, increasing population densities were coming to imply that if sewerage was to be avoided, some program more sophisticated than the homeowner/BOH-managed (essentially, unmaintained) septic system was required.

Fairfax County, Virginia, is often credited with first introducing the concept of proactive, decentralized wastewater management in 1954.< Environmental Law Institute, 1977; also see the case study in Chapter 6 of this document.> Since then the concept has been fully developed there and elsewhere on county, town, and community scales. The district formed in 1971 by Georgetown Divide, California, to manage wastewater in a small subdivision called Auburn Lake is one of the first such schemes to be *fully* implemented in the management terms described here.<See the case study, Chapter 6 of this document.> Thus the concept is hardly brand new. The successes and problems that these other areas have experienced are part of the subject matter of this account.

The concept is not complicated. The premise is that onsite wastewater systems, whether for individual homes; clusters of homes; or small complexes; need to be managed from the moment of their technological selection, through design; siting; installation; and maintenance, to the moment of their removal, in order to ensure that surface and groundwaters remain safe. The management entity must be defined in space and in law, and empowered in all necessary ways to accomplish its tasks.

At its most complete, both (1) the planning process leading to the establishment of a decentralized management program, and (2) the functionalities of the resulting program are diagrammed in Figure 1. Effective planning and programs may not have to be as comprehensive as those outlined in the figure. However, if the situation is complex, and requires significant expenditures, the sort of orderly examination outlined is worth the effort. If the community is under a consent agreement, it may be required. The subject matter of this (management) document is mainly laid out in the five central boxes.

The companion (planning) document is more focused on the boxes at the periphery of the diagram.

Barriers and Incentives to Decentralized Management

There can be resistance to decentralized wastewater management. While it isn't exactly a new concept, it is not widely employed, and certainly novel in Massachusetts. There have been failures of alternative systems, and failures of their management too. There have been large cost overruns. (Not that similar failures and cost overruns have not occurred with central sewerage as well.)

Prevailing attitudes, among both homeowners and professionals, can hold that septic systems are cost-effective and maintenance-free. Prescriptive codes imply as much again, and provide for little in the way of required maintenance, or the enforcement of such requirements. Permitting individual systems that *do* require maintenance can pose a headache for the regulators, who then have to establish the means by which such maintenance will get done without provoking charges of government intrusion.

If conditions might readily warrant centralization, then decentralized management, even if shown to be as workable, can appear second best to homeowners who, while chary of the costs of sewerage, may see it as increasing the value of their property, particularly if they believe that their onsite systems were installed only as temporary devices. To regulators and the engineers on whom they rely, some degree of control is lost with decentralization. There is inherent conservatism, as questions of professional reputation, liability, and public responsibility arise. And there is wariness borne of inexperience, and lack of training and education in the design and management of alternative and decentralized approaches.

Finally, when communities are "put under the gun," time frames for compliance may well force the consultants, on whom such communities rely, into standard renditions of central sewer planning with which they are already familiar, where costs are relatively known quantities; and profits, large.

Indeed, comprehensive planning for decentralized management *can be* time-consuming and complicated. In Massachusetts, there is a lack of clear guidance on planning and design procedures for decentralized management; the required performance and environmental standards; and the establishment of administrative, managerial, and ownership structures acceptable to the DEP. Public funding for privately-owned systems or their upgrades remains problematical. Clearly, model legislation and state funding provisions for communities that elect this route is essential.

Nevertheless, decentralized management is coming to be. First, in spite of the fact that EPA's Construction Grants program terminated in the mid-1980s and funding for its replacement State Revolving Loan program has dwindled, the federal and state laws protecting surface and groundwater are still in place. Mandates to remediate and to plan are still being handed down by both the EPA (in some states) and state agencies such as the Massachusetts DEP (in others). Moreover, with or without mandates, the threat to resources is not just hypothetical. Shellfish beds, bathing beaches, or other resources may have been closed or may need to be closed unless the wastewater situation is corrected. Better decentralized management is likely to be the least costly solution. In fact, it was the EPA itself that, in 1975, first came to study and recognize the diseconomy and unaffordability of traditional sewerage in small communities. <EPA, 1987, *It's your choice...*, p.18.> This situation is now widely recognized, at least in principle, even as the hunt for satisfactory onsite technological and management alternatives proceeds.

There are benefits other than cost savings as well. However, because the concept is new, public education may be essential to their full understanding. Often, for example, it is not perceived that the effects of

individual septic systems are cumulative. It isn't that any single one of them, in itself, is harmful; only that in sum they worsen water quality, lead to the closure of shellfish beds, etc. And thus in sum, the cost of remediation becomes worth it in terms of the perceived and real value of their homes and community, or opportunities for livelihood and recreation, or both. In this way the value of remediation may vastly exceed its cost.

The benefit of flexibility may also be pointed out. Stricter requirements in areas of concern might be balanced with more flexible ones in others. Communal and cluster systems, package plants, and other new alternatives more readily permit the community to be flexible in planning and zoning by clustering development, preserving open space, providing for affordable housing, or accomplishing other community or planning goals.

Another benefit to an onsite program is that of relieving the individual owners from responsibilities that under Title 5 are now wholly theirs, often with little in the way of guidance or help. If a mandated process is in place for inspection, pumping, and remediation, the plight of the owner trying to sell will not be that said to have occurred with the tightening of Title 5, and will not loom as a sudden obstacle to selling a piece of property; it might, in fact, even better the value of the property in the way a central hookup is supposed to do. <See, e.g., the Cass County case study in Chapter 6; like the situation in many coastal communities here, what were originally vacation dwellings with cesspools were increasingly being used year round; selling such dwellings was difficult, however, in that the cesspools had become illegal.>

Furthermore, the betterment of individual systems, typically done by local contractors, is likely to result in local economic benefit, whereas a central plant is more likely to be constructed by a more distant firm that draws on more distant labor pools.

The subtlety of these factors explains why consensus on a plan will depend, in part, on the leadership qualities, credibility, and dedication of the group initiating the exploration of decentralized management alternatives; and on how well it has done its "homework" in discovering and communicating the facts.

Finally, there is federal support for decentralized management. As mentioned previously, the EPA started promoting and providing grant incentives for alternative programs in 1977. While the so-called Innovative/Alternative (I/A) program has been terminated, to some degree its ideas are being continued by a new Environmental Technology Initiatives program. EPA itself has conducted seminars and produced educational materials encouraging alternative technology; and EPA guidelines recommend that communities and their engineers consider alternative approaches, including the examination of managed septic and alternative individual systems, cluster systems, alternative sewers, and low-cost alternative biologically- or naturally-based central treatment.

In spite of these recommendations, it is often (if not always) citizen groups that have had to demand that local officials, when under consent orders, *genuinely* examine alternatives, which otherwise can receive only the most cursory look from the town's consultants. We have identified some of the reasons for this state of affairs. But the most compelling one, in Massachusetts, is probably the present lack of clear legal authority from the state to establish decentralized management in ways neither trivial nor redundant with other modes of regulatory oversight. A description follows of the variables that arise in creating an Onsite Wastewater Management Program or District.

Boundaries

There are many kinds of boundaries and borders, and planning for the creation of an Onsite Wastewater Management Program (OWM Program) involves the consideration of several of them. This is discussed

more thoroughly in the accompanying planning document, <Andrea Arenovski and F. Shephard, 1996.> but briefly the two major sets of boundaries are (1) environmental, and (2) jurisdictional, administrative, or "institutional." In matters of resource protection, it would be ideal if the natural environmental features or barriers to be considered coincided with the jurisdictional boundaries. Sometimes they can be made to coincide; in other cases, there may be political obstacles to optimizing that kind of coincidence, however desirable.

Onsite wastewater management is driven mainly by environmental and public health concerns relating to the contamination of surface and groundwater. It makes sense if the locale to be managed corresponds with the physiographic and environmental features that affect surface and groundwater transport and replenishment. If the replenishment is through surface waters, the corresponding area is known as a watershed. If replenishment is through groundwater, an aquifer or a zone of contribution to a water supply may be identified. Groundwater meets surface water, of course, and the hydrology of both would typically be considered together.

The adequacy of effluent treatment is dependent on its volume, as well as on soil types, which may vary, even on small scales; and on the depth to groundwater, the top of whose saturated zone is called the water table. Finally, the sensitivity of the receiving waters themselves is variable; for example, a coastal embayment poorly flushed by tides and currents will be more sensitive to additional nitrogen input than one that is well flushed. All or any of these criteria may factor into defining the area to be managed. And indeed, the area delineated for onsite management may be defined to correspond in space with some area *previously* designated as environmentally sensitive or protectable, such as a watershed or resource protection district or zone.

But obviously factors other than environmental ones will also come into play. For example, most of the kinds of areas described above have been, or would need to be, legally defined in one fashion or another. That means that regulations already do, or would need to, pertain to them. And that, in turn, means that some administrative or governmental entity exists, or would need to exist, to oversee the regulations and their enforcement. Jurisdictions have boundaries too, and in the wastewater management context, or any other resource protection context, it is ideal if the jurisdictional boundaries correspond with the boundaries of the resource to be protected. However, if otherwise desirable administrative units already exist that do not precisely correspond with the resource to be protected, they may, nevertheless, be the overriding factor in determining the boundaries of the decentralized wastewater program.

If predetermined jurisdictions don't exist, a town or area may turn to specially created administrative/governmental and zoning units, which are a common feature of state law and local ordinance. At scales smaller than those of a town, zoning and overlay districts are used to define land use and any special provisions or constraints on it. Service areas in a town also may be delimited—such as those that will be hooked up to a central system, and those that will not be. During comprehensive wastewater planning, environmentally sensitive "areas of concern" within the town may be identified. Nova Scotia is unique in permitting, where randomly-distributed ancient systems or poor soil conditions warrant, the establishment of "noncontiguous" wastewater districts for advanced treatment technology. <See case studies in Chapter 6.>

At scales that cross town boundaries, the "district" device provides for the creation of regional entities that involve more than one town so as to allow coordinated planning, economies of scale, and the sharing of monies, natural or human resources, or treatment facilities. Less formally, towns may make "intermunicipal agreements" that coordinate zoning or regulations. More formally, regional agencies such as the Cape Cod or Martha's Vineyard commissions, or the Massachusetts Water Resources Authority,

can designate, demarcate, and specially protect portions of their jurisdictions.

Entire watersheds or aquifers can be designated for special protection by the state's Executive Office of Environmental Affairs, driving the coordination of wastewater management throughout the region. The Massachusetts Coastal Zone Management Office works similarly, driving planning efforts by facilitating the designation of Areas of Critical Environmental Concern, and through programs such as its "Coastal Nonpoint Source Pollution Control Program," and federal/state/local partnerships such as the Buzzards Bay Project and the Massachusetts Bays Program.

A hypothetical Onsite Wastewater Management district or program can work on any of these scales, exactly corresponding with the boundaries of a town<See, for example, the Paradise case study.> or several towns,<See the Tri-town case study.> defined to incorporate just portions of one or more towns, addressing only, for example, unsewered sections.<See the Barnstable case study.> It might include an entire region, such as a watershed.<See the Lake Keuka case study, for example.> (The Massachusetts Watershed Initiative called "the Clean Water Strategy" is discussed later in this report.)

Furthermore, the administrative charge might be more general, hence the name of the district more general, than that of dealing solely with wastewater management. For example, in Washington State, funds derived from Shellfish Protection Districts are used, in part, to inspect and remediate failing septic systems;<Nonpoint Source News-Notes, August-September, 1995, No. 42; Terrene Institute, Washington, D.C.> and at a recent meeting in Rhode Island<Informal meeting on septic system maintenance, November 6, 1995, at RIDEM.> it was the general conclusion of those in attendance that districts whose focus was on resource protection, rather than wastewater management *per se*, would probably hold more public appeal and carry more public support than does focus on sewage. What powers such programs need, and how they might be organized are discussed next.

Powers and Authority of the Administrative Entity

Whatever the institution is called, and however set up, it is charged with two general sets of activities. The first has to do with necessary governmental powers and responsibilities, which here are called administrative responsibilities. The other has to do with either conducting or overseeing the operational functions for which the institution was originally created (namely, wastewater control), which here are called management tasks.

The execution of both sets of tasks could, in an extreme case, be assumed entirely internally, requiring correspondingly large staffing and budget for the administrative institution. Alternatively, some or all of the management tasks might be readily, even traditionally, contracted out to private firms. Management tasks are discussed more fully in the next chapter, while the remainder of this section is concerned with the necessary administrative powers and functions that the governmental entity might hold. At their *most extensive*, and undistributed or unshared, these include the authorization to:

! Create an overall wastewater policy and plan for the district (if not already done). Such a plan would delineate areas of the district to be handled in particular ways, whether by central sewer, package plants, community or individual systems; and whether with conventional, or preapproved alternative or experimental/innovative systems.

! Modify its plans through prescribed procedures.

! Coordinate its plans with other governmental agencies; seek necessary approvals and certifications; and participate in environmental monitoring, by itself or in conjunction with other agencies.

- ! Require and be empowered to make and enforce regulations and standards regarding wastewater management on all scales, which may either complement or replace other regulations and standards.
- ! Approve and permit system technologies, designs, subplans and proposals.
- ! Fix and collect licensing fees, and user fees or betterment assessments.
- ! Issue bonds, take and make loans, and receive federal and state grants.
- ! Purchase and otherwise make transactions regarding real property.
- ! Enter into other kinds of contracts, e.g., with service suppliers.

More closely related to its management tasks, it would be charged with:

- ! Implementing its plan (directly or via contractors), including such tasks as inspection, pumping, and maintenance of systems.
- ! Providing related services, directly or indirectly, such as public outreach and education, and technical advice and training.

In these capacities the administrative entity specifies the wastewater requirements of new developments, oversees the remediation or replacement of failing or substandard systems, and facilitates and encourages the use of advanced systems at both the individual and communal level. But the entity can not be created, nor its plan be implemented, without the confidence of state-level regulatory agencies that the public health and environment will be satisfactorily protected; or without the confidence of the voters that its implementation is both cost-effective and fair.

One function of this entity is to plug the regulatory gap between municipal treatment plants, regulated directly by the DEP, and the small system, prescriptively codified at state level but (sometimes insufficiently) managed locally by the property owner and the Board of Health. In this fashion the agency is charged, at the local level, with regulatory and enforcement functions similar to, for example, the DEP. However, unlike the DEP, the entity may also be charged with hands-on operational and service-oriented tasks, much like a local sewer authority or DPW.

If the entity assumes these twin roles (operator and regulator of operators) there can be the potential for conflict, although there need not be. The Georgetown Divide experience<See the case study, Chapter 6.> is that in tight, *integrated, public control* lies the secret of a well-functioning decentralized system. However, if it were desired that regulatory and operational functions be separate, many of the operational tasks lend themselves to being contracted to private parties. Such is the case in the Tri-Town plan<See the case study, Chapter 6.> and many other districts as well.

Indeed, having itemized the *totality* of powers necessary to "run" a decentralized district or program, it does not have to follow that all power resides in one institution. Even aside from the division of roles as operator and regulator, the powers described above can be separated in other ways as well.

One particular partition of responsibility that many Massachusetts municipalities might choose is the one

between Title 5 systems, historically controlled locally by BOHs, and individually permitted 314-CMR systems, typically already under the direct regulation of the state DEP, and the direct management of a local DPW. There is no reason why BOHs might not be delegated to assume broader management of Title 5s, while some other local institution, such as a preexisting Sewer Commission or DPW, assumes oversight of both publicly-owned and privately-owned 314-CMR treatment works. But whether it is the BOH or some newly created entity that manages small systems, the entity could still operate in parallel with a separate entity that managed 314-CMR systems. Overall planning and coordination would then fall to a committee representing both entities and other town departments as well. Institutional partition and alternatives are discussed more fully below.

Institutional Alternatives

If a community has concluded that regular inspections and maintenance (such as tank pumping) are necessary to prevent pollution, then the public will require assurance that these tasks are performed competently, equitably, and at reasonable cost, meaning that in the first instance there must be a governmental body whose charge is to oversee and regulate these functions. The powers and authorities such an agency or agencies require already have been discussed. However, the way in which the agency is structured, what its jurisdiction is, and how it gets its job done are widely variable.

It may be a preexisting agency, already sufficiently enabled. It may be a preexisting agency for which modifications in enabling legislation or town bylaws are required to sufficiently empower it. It may be a new agency created in replica of model decentralized wastewater district legislation. Such legislation already exists in several states including, for example, Rhode Island<See, e.g., S. Millar, 1987; and Environmental Law Institute, 1977.> and California.<See all the California case studies.> Or it may be an altogether new creation.

Although institutions may be classified as preexisting, preexisting but modified, or altogether new, what is meant by preexisting is somewhat ambiguous. Does it pre-exist, in fact, in the municipality or area in question, or does it preexist in state statutes that can be adopted by a town or area? In general, if the institution preexists *in fact*, and has the necessary powers, selecting it as the management agency will entail the least headache. But, for example, if a municipality is comprehensively planning for wastewater, and part of the plan involves a newly-created central plant, it will want to newly create a sewer department or commission; the mechanisms to do so already (pre)exist, and the powers of such commissions or departments are already, in a general way, spelled out. The most complicated approach is that of creating an *altogether new* kind of entity authorized by special or new state legislation. Making these choices is discussed somewhat further in the section on institutional evaluation. In the section that follows, several different types of institutions are discussed.

Municipal entities

Municipalities that already have central facilities already have administrative entities that run them, whether it be the Department of Public Works, a more specialized Sewer Department, or an altogether more independent Sewer Commission, the distinction of the latter being the independent nature of this instrumentality and its bonding and rate-setting authority. The powers of these agencies generally are limited to the management of Publicly Owned Treatment Works (POTWs), but do include the power to collect user, or service area, fees. Municipalities also already have Boards of Health or Health Commissions, which generally have authority to regulate Privately Owned Sewage Treatment Facilities (PSTFs) that qualify as Title 5 systems. Larger, 314-CMR systems are regulated directly by the DEP.

In the decentralized management context several questions arise. Can the charge of a Sewer Commission readily be extended to the oversight of privately-owned treatment facilities, both individual and communal? Perhaps it can, given the fact that enabling legislation, Chapter 40N of the Massachusetts General Laws (Chapter 343 of the Acts of 1992), permits the establishment of Septage Commissions, carrying the implication that part of septage management is the management of the very facilities that generate it. Another question: If BOHs are asked to more proactively manage Title 5s, how can they do so when they presently have no rate-setting or fee assignment authority? Modification to enabling laws and bylaws is one answer. The writing of specific wastewater district legislation is another. Many approaches to the problem are presented in the case studies at the end of this document.

One scenario, however, may require little or no change in the present laws. It applies particularly to municipalities that either do not own treatment works or, when they do, whose management is considered as a separate issue; it also assumes that the DEP will continue to oversee the running of private 314-CMR systems. In short, the scenario applies only to a Title 5 frame-work and the BOHs that regulate them. It goes simply like this: BOHs *already have* sufficient authority in all necessary ways to more tightly manage Title 5 systems; they simply need to put a plan in place that relies on user *proof* of compliance with inspections and pumping, and that makes remediation feasible for all homeowners through the use of the Betterment Bill. This is a modest scenario, and much of the more involved activity described in this study could not be accomplished with this simple model. Nor does it provide the flexibility or freedom from prescriptive standards that a more comprehensive onsite program would typically provide.

Finally, this approach does not consider the need in some areas for the *integration* of wastewater planning on all levels, from the ISDS, to the STEP sewer and communal system, to the PSTF, to the POTW, designed for either septage or sewage treatment. In those more complex cases, some central oversight agency or board would still need to be created in order to coordinate the planning of centralized and decentralized portions of the district, as well as to assure equity in rate setting and other matters. The BOH scenario described above does, however, carry the benefits of simplicity, immediacy, and applicability to many communities.

Intermunicipal and regional entities

The simplest form of intermunicipal cooperation is that of an "intermunicipal agreement," under which towns (through "home rule" provisions) may undertake to do jointly anything that they can do separately without any special authority from the state. Eight separate towns surrounding Keuka Lake, New York, undertook this approach to stiffen and unify the regulation of ISDS's.<See case studies in Chapter 6.>

Similarly, if more modestly, the Buzzards Bay Project sought intermunicipal cooperation from Plymouth, Bourne, and Wareham to control nitrogen inputs to Buttermilk Bay by the joint creation of "nitrogen management overlay districts," which specify minimum lot sizes. All three towns readily adopted the required zoning bylaws.<Buzzards Bay Project Fact Sheet, Draft 2/91, and Buzzards Bay Project "Bay Watch," May, 1991, 6(1).> Much study, headed by the Buzzards Bay Project, went into this effort; and other alternatives, including the creation of a more formal District of Critical Planning Concern (as well as central sewerage), were considered. But, as with the modest BOH scenario discussed above, zoning and a simple agreement were chosen for their simplicity and immediacy.

More formal than intermunicipal agreements are district and district commission instrumentalities. Such devices confer varying degrees of autonomy on the district governance, and often give it independence in issuing bonds and charging user fees for services provided. A district need not cross town boundaries, but it is the device by which neighboring towns can share resources and engage in joint planning.

In Massachusetts there are already provisions for the creation of Board of Health districts (in which several towns can share health agent staffing and other resources), water supply, groundwater, or aquifer protection districts and septage districts, to name a few. There is also a more general provision for a town or towns to create "improvement" districts. And on Martha's Vineyard and Cape Cod, which are regulated by regional planning commissions, there is provision for "Districts of Critical Planning Concern." Regulations in these districts override the grandfathering provisions of ordinary zoning.

Use or modification of existing district or commission legislation

It is possible in Massachusetts that a town or towns can use the provisions for groundwater, septage, or general improvement districts to set up an onsite wastewater management district. But, as is the case in stretching the interpretation of either Sewer Commission or Board of Health charters, there is some risk in doing so because no existing model legislation specifically addresses every particular concern of OWM programs.

However, one particularly adaptable district might be Massachusetts' "Water Pollution Abatement District" These are unique in that their initiation is supposed to come from the DEP, not from the towns, although there is nothing to stop a town from petitioning the DEP to create one. Even so, the legislation is tailor-made to address the management of treatment plants, not OWMDs. Thus it is unlikely that the DEP would initiate the use of Water Pollution Abatement Districts in such a fashion, absent a specific proposal from local officials. Even so, this law's existence suggests the possibility of creating exactly what is needed by amendments to this legislation.

Towns also, of course, may petition the legislature to *modify* in various ways the provisions of "model" legislation. For example, the Town of Wayland passed an article in the spring of 1995 to authorize the Selectmen to petition the state legislature to adopt proposed legislation entitled "Wayland Wastewater Management District." <Sources are the 1995 Town of Wayland Annual Town Meeting Warrant, and members of the town's Wastewater Management Committee.> In spite of the title, the legislation is drawn from the previously mentioned Chapter 40N that creates a model water and sewer (or septage) *commission* with independent bonding and rate-setting authority. In Wayland's case they wanted to create an administrative body capable of financing, building, owning, and operating small-scale wastewater projects, while otherwise limiting and closely defining its purpose and activities. Wayland passed the article. Presently the exact wording of the proposed legislation is undergoing public review and comment in Wayland, and no petition has yet been forwarded to the General Court.

Creating new and specific model legislation

Many models exist, from around the country, of tailor-made Onsite Wastewater District legislation. Much of the text in this document is, in fact, based on their content.<See, e.g., Scott Millar et al., 1987, or David Venhuizen, 1988.> Massachusetts has yet to adopt such legislation, but several efforts are underway, including that of the Town of Wayland just discussed. The Metropolitan District Commission/Massachusetts Water Resources Authority is also exploring the concept, and the DEP is presently exploring the legal instruments to unambiguously empower Boards of Health to establish simple inspection and maintenance programs for Title 5 systems. Similar discussions, even if their goal is not *specifically* the creation of model districts, are underway among the Massachusetts Association of Boards of Health, the Coalition for Wastewater Treatment, the *ad hoc* Task Force for Decentralized Wastewater Management (publishers of this document), and others.

Once an administrative institution is selected or created, the next question to which we turn is how many of its tasks and responsibilities must be executed "internally," and which may be passed on to others to carry out. And, when they are passed on to others, what provisions then need be made to assure that the tasks get done.

Task Division and Public–Private Partnerships

Task division

However the administrative agency is created, it must assure that the management tasks get done either through the use of its own facilities and staff, or by delegating some or many of the tasks to contractors, or to owners. In the latter two cases, regulatory and/or contractual terms must preserve the administrative institution's oversight, including its power to intervene when and if expectations are not met.

At its **most** comprehensive and internalized, the agency might assume the role of a *public utility*, performing virtually all the management tasks with its own staff. Parallel in concept, the agency might contract for an equally comprehensive, privately-created entity to perform virtually every task except that of the utility's own regulation and oversight.

At the **least** comprehensive and internalized, the agency might put the burden of getting most management tasks done on the multifarious individual system owners, then requiring that they periodically submit sufficient proof that the jobs were done in order to renew an operating permit.

More likely than either of these extremes is something in between, in which the division of management tasks will be handled idiosyncratically, depending on the locality, the political will, the mix of ownerships, and the mix of system sizes and technologies. Some plants might be publicly-owned, and run traditionally; the operation of privately-owned 314-CMR plants might be overseen jointly by the local Sewer Department or DPW and the DEP; individual and communal Title 5 systems might be managed by the Board of Health or a district device, but with modification to the Title 5 structure. All this would be spelled out in a comprehensive wastewater management plan if that is what is called for.<The case studies of Gloucester and Barnstable show the sorts of problems that can arise in "city" situations.>

Public–private partnerships

In recent years there has increasingly been a movement to "privatize" the owner-ship, production, and delivery of services that traditionally have been thought of as public responsibilities. From the public's standpoint, the advantages of privatization include the prospects that:

- ! the public may not have to provide capitalization;
- ! responsibility and guarantees rest with parties other than the administrators;
- ! private companies may bring with them cost savings in the form of expertise, experience, and competitive bids;
- ! private companies prevent a drain on limited governmental resources;
- ! the public and private parties can act as checks and balances on each other, the two sectors driven by separate motivations.

In the context of decentralization, there can be the additional advantage of separating public and private roles by preventing a situation in which government agents have routine access to private property, a circumstance that may not be popular with voters.

In the environmental area, this movement is formalized in the EPA's "Public-Private Partnership Initiatives" program. Essentially, such a partnership involves an agreement between a government entity and a private company that will provide services on behalf of the government, under its direction, and as stipulated in the contract's terms. As the EPA classifies such arrangements, they can be: (1) *contract*, meaning that a specific activity, such as inspections or pumping, is carried out on behalf of the government; (2) *turnkey*, where a facility is built and operated by private parties, but owned by the public; and (3) *fully private*, where the government role is strictly one of oversight.

With regard to decentralized wastewater management, very few examples, on a district scale, are *purely* private or public in their ownership and operation. Although Auburn Trails (Georgetown Divide Public Utility) <See the case study, Chapter 6.> is about as completely public as they come, it was planned that way from the beginning. The Mayo Peninsula plan <See the case study, Chapter 6.> no longer calls for public ownership of individual systems, although at one time it had done so.

The implementation of decentralized management is more likely to take place as part of a remediation program in communities already serviced and owned in various ways. A mix of ownership, and a mix of public and private services, is more likely to apply. Thus the public may wholly own and operate some portions of the system. For other portions, especially residential areas served by ISDSs, it may well need to accept private ownership, but regulate their performance through indirect means. For routine tasks, such as inspection and maintenance, it might well be strategically important to save some functions for the public entity, such as inspection, while letting private contractors deliver services such as pumping and maintenance, reported and certified by various mechanisms. To be sure, managing such a complex mixture is costly and complicated. But then so is central sewerage.

While privatization has its advantages, there is a downside to an overly privatized system. Control, and with it some degree of compliance, is likely to be lost. Also, private facilities in the present scheme of things typically are not eligible, or as eligible, for state or federal grants. Finally, the public entity must assure that, in the letting of contracts, it hasn't given away anything that it can't take back quickly if the system isn't working. At the outset of the planning process, there should be an assessment of the needs and desires of the community with regard to the privatization of services, and the degree to which "owners" participate as "managers."

Decentralized Wastewater Management and the Massachusetts DEP

The DEP is quite aware that in the last decade the concept of decentralized management has been promoted and supported around the nation, in part as a result of its own shifting focus to the wastewater problems of smaller and less urbanized communities, and in part because of its own increasing attention paid to nonpoint source pollution and the problem of eutrophication by nutrient loading of saltwater embayments and shorelines. "Overdevelopment" in such areas may be spotty, often not warranting a municipality-wide central sewer. At the same time, the development of such shorelines often has started with seasonal dwellings possessing only crude onsite systems installed in sandy soils that percolate too fast. Surface waters may be close by, and groundwater levels often too elevated for such systems, leading to very high failure rates. Even nonfailing conventional septic systems, because they do little in the way of nutrient removal, may offer insufficient protection to nutrient-sensitive areas. Much of Cape Cod can be so characterized.

Aside from central sewerage (which may be unworkable), the only options for failing or insufficiently protected areas are those that are most often considered within the onsite management concept: (1) tighter control of conventional individual systems, including mandatory inspections and pumping schedules; (2) the use of advanced individual systems if required; and (3) neighborhood or communal systems that may also involve advanced technology. All these options require operational and management expertise and responsibility.

The 1995 Title 5 code revisions for the first time acknowledge the place of alternative, advanced, and innovative solutions, which are the key to the success of decentralized systems in overdeveloped or underprotected areas. The new code encourages the use of proven alternative systems, and encourages the proving of unproven ones. Not surprisingly, it is the sites of failed conventional systems that are regarded under the code as the safest proving grounds; for in that context, an experimental system is better than one that isn't working at all.

Even in the absence of model onsite wastewater management program legislation, the DEP is encouraging and participating in exploration of this concept. What is required by the DEP is: (1) comprehensive wastewater planning; (2) a local governmental entity that has the power to implement and enforce its plan; and (3) the demonstration that the ownership arrangements, particularly of community systems, include the financial, legal, and contingency assurances for safe long-term operation, monitoring, and maintenance. <This reading of the DEP's position is based on the Title 5 code revisions of 1995; a series of letters in the appendix to WBNERR, 1992(b); and personal communication with DEP members of the *ad hoc* Task Force for Decentralized Wastewater Management. Any errors of interpretation are those of the author.>

The Massachusetts Watershed Initiative

While revisions to Title 5 go some distance in recognizing the need to replace prescriptive standards with performance-based standards, and in recognizing the need to test and approve alternative and advanced technologies, the Massachusetts DEP, and more generally the Executive Office of Environmental Affairs, is in the process of reengineering its water resources planning and permitting approaches. A watershed-based Clean Water Strategy will be phased in over the next 10 years. The approach has been developed in part by the Watershed Initiative Steering Committee, an outgrowth of various Massachusetts watershed associations, but which now formally advises the Secretary of Environmental Affairs.

Under this approach, the river basin, or watershed, is proposed to be the fundamental water resources planning unit. On the civic side the approach would emphasize "bottom-up" (local), rather than "top-down" (state), environmental planning and management. Planning for the watersheds would be led by Watershed Community Councils representing municipalities, businesses, landowners, citizen groups and recreational users, as well as state and federal agencies that have roles in decisions affecting the watershed. These councils will be eligible for Nonpoint Source Pollution grants under Section 319 of the Clean Water Act. On the regulatory side, the DEP, under the Office of Watershed Management, will be assigning multidisciplinary teams of specialists to each watershed, some of whom may come from other divisions of the Executive Office of Environmental Protection, such as the Department of Fisheries, Wildlife and Environmental Law Enforcement.

Underlying the approach is the idea of comprehensive water and wastewater planning, as well as that of synchronizing the separate functions of water monitoring and assessment, water withdrawals, nonpoint source pollution control and point source groundwater and NPDES permitting. Identifying and targeting

priority areas for Best Management Practices will be part of the initial assessment phase for each water basin.

The development of GIS computer models that will help predict the outcomes of various pollution control strategies and their cost-effectiveness will be part of a strategy meant to accurately target both problems and dollars. With real world "truthing" of the models, this opens the way for outcome-based, or environmentally-based, flexible standards. <This information has been drawn from two draft documents, probably available from the Water Policy and Planning Division of the Executive Office of Environmental Affairs; one, by Arleen O'Donnell and Michael Domenica, is entitled "Implementation of the Watershed Approach in Massachusetts"; the other, by the Watershed Initiative Steering Committee, is entitled "The Massachusetts Watershed Approach and its Implementation.">

The development of this initiative speaks directly to the need for decentralized wastewater planning and management, and to its recognition by the DEP. Nevertheless, specific model legislation could smooth the way for communities opting decentralized programs.

Chapter 4. RESPONSIBILITIES AND CONSIDERATIONS OF THE MANAGEMENT PROGRAM

"Shit happens."

—Forest Gump and others

For those areas and regions which by conventional measures need sewerage in order to protect public health or sensitive environments, it is unlikely that a state-level environmental agency would ever seriously consider an alternative decentralized plan unless the anticipated degree of protection was comparable to that offered by centralization. Part of any enabling legislation may well preserve the power of the state agency to intervene if it appears that the decentralization program is not functioning as intended.

However, the purpose of a comprehensive and well-implemented program is to prevent such an eventuality. In the context of the oversight of the entire life cycle (installation to retirement) of all wastewater facilities, the main management considerations need to include planning, ownership, financing and budget, regulation, and education/training.

These are discussed below, at which point it may also be helpful to refer again to Figure 1. However, there are three items to mention that aren't dealt with further in order to limit the scope of this discussion. First, comprehensive wastewater planning must make provisions for septage and/or sludge disposal, and for storm water runoff. Second, there may be components within the district that require surface- or groundwater discharge permits. The regulation of these elements must obviously be done in coordination with DEP and EPA regulations. Third, a district, in cooperation with other agencies, would need to participate in overall environmental monitoring for surface and groundwater quality.

Planning Considerations

The degree of planning necessary for decentralized wastewater management can vary. Boards of Health (if the law doesn't change) have the power to regulate the management of Title 5 systems more stringently than the minimum requirements laid out in Title 5. Nevertheless, any proposal to tighten maintenance/pumping regulations or requirements for advanced treatment, etc., must be justified in terms of threat to public health or the environment. Such justification will require study and planning in some degree.

More complex are cases where towns wish to incorporate wastewater planning in more comprehensive plans; or wish to plan septage or sewage treatment jointly with other towns; or are proposing the creation of a municipal or regional district; or have undertaken the planning as part of a DEP consent decree. In the latter case, as well as any case involving federal or state financing, the process becomes formalized and complicated. It typically will involve professional help. The process, previously called "facilities planning," but now called "comprehensive wastewater planning," is the subject of the companion to this document. Note that comprehensive planning may include provisions for central, as well as decentralized, wastewater treatment.

Briefly, the starting point is a plan for a plan, what is called a "plan of study." Perhaps typically the impetus would have been a mandate from the state, compelled by the community's situation or circumstance. It may have been compelled by a town's own zoning and planning ordinances. It may have been initiated locally in order to head off the prospect of a mandate, or to increase flexibility in town land-use planning.

However it is initiated, the very next step is to identify the lead agency that will begin the assessment and planning process. It may be as local as the Board of Health, or it may be a preexisting district or other regional entity. It may be a Wastewater Planning Committee established by a Board of Selectmen. It may or may not continue on as the "management entity." Its very first task is to develop a program to preliminarily explore the community's, and perhaps neighboring communities', needs and options. Very early on it will need to seek community participation.

In a state that already had model onsite wastewater legislation, or if it is determined that preexisting statutes are sufficient, the next step might be the legal formation (institutionalization) of the program or district by public vote. The program agency would then continue the planning. Otherwise, institutional considerations may become part of the overall planning process. The process will loop, each cycle becoming more refined as the community's needs, capabilities, legalities, and consensus are explored and established. It is most efficient to assure that all relevant public agencies become involved early on, that the public be involved early on, and that competent consideration is given to applicable law and regulation. If, for example, compliance with the Massachusetts Environmental Protection Act will ultimately be required, the early involvement of that office is important to saving both time and money. So, too, would be apprising the DEP of the plan's successive drafts. Ultimately the plan requires embodiment in local bylaws, and institutionally may require state legislation as well.

Ownership Considerations

Under centralized sewer management, ownership is not a thorny issue. Typically, the treatment plant and sewers are owned and operated by the municipal government as a public utility. The utility would be at liberty to contract with a private party to operate the plant, assuring performance through its contractual terms, and through conditions of the discharge permit.

Publicly-owned and operated or publicly- owned and contractually-operated systems may well be part of the decentralized management entity too. Especially when a management plan is established retroactively, several types of ownership are likely to already exist within the district. The difficulty in decentralization arises with the ownership of individual or small community systems, and package plants. In itself, ownership may not be the central issue; but the question of ownership is tied to those of legal responsibility, access, and financing.

Such questions are not fully resolved. EPA guidelines do not insist on public ownership, but they do stipulate that access be provided to EPA-financed facilities for purposes of inspection and maintenance. Boards of Health and state level agencies already have powers of access under limited circumstances. Decentralized district legislation and regulations would need to more comprehensively spell out such powers and their limits.

In Massachusetts, the DEP prefers public ownership of multiparty facilities, or otherwise, single-entity ownership (such as condominium trusts). But homeowners' associations may own and operate shared Title 5 systems, and the DEP is reviewing other acceptable forms of private ownership permissible in consideration of the type and size of the facility. All, in their individual creation, would need to satisfy the DEP that sufficient accountability, reliability, longevity, and financial capability and guarantees were there. The DEP's present criteria<The discussion of DEP criteria is based on ICF, Inc., 1990; and personal communication with DEP members of the *ad hoc* Task Force for Decentralized Wastewater Management.> require that an entity identical to its users is fully accountable and owns the land on which the treatment facility is sited; that all users share operational and financial responsibility; that user charges and the power to enforce them exist; and that the entity have reserve funds for emergencies and capital

replacement that are secured through financial instruments such as loan guaranties, letters of credit, and escrow accounts.

Wastewater management districts, in their legislation or their plans, would sustain similar criteria. They, too, may prefer public ownership when possible, and in the case of new subdivisions might require that the developer convey title to the community system and its land.

In districts established retroactively, ownership of small system components might often remain private. Third party access to the components then would need to be assured through easements or covenants that run with the land, as with any other utility. In starting up such a district, the issuance of the first operating permit typically is made conditional on the granting of such an easement or other form of legal access. Private owners of single or multiple systems then become members of the district, subject to its regulations.

With regard to financing, there are legal questions as to whether state and federal grants and loans can be used to "better" private property. However, betterment bills, authorizing town and district loans for "betterments" of privately-owned individual septic systems, exist in Massachusetts, Rhode Island, <Buzzards Bay Action Committee, 1995; and the Warwick, Rhode Island, case study in Chapter 6.> and elsewhere. These issues are discussed further in the next section.

Financial Considerations

Costs

Financial considerations regarding conventional Title 5 management by local BOHs require only that BOH expenditures be approved by the municipality as part of its general budget. Costs of systems, repair, inspection, pumping, and upgrades are borne almost wholly by the owner, although various forms of financial help can be made available through state or town programs briefly discussed in the section on Title 5. The situation in the case of OWMDs is very different, in many ways paralleling the kinds of financial considerations that go into centralized facility planning. These may include the cost of planning itself, capital costs if systems are to be replaced or upgraded, and operational costs, including debt retirement and a capital replacement fund. If an onsite program is being proposed to the DEP to address a consent decree, or if state funds are sought as part of the program, a carefully analyzed financial plan will be part of the wastewater plan to be submitted. The process, including cost-effectiveness analysis, is discussed more fully in the companion document to this one. However, even in the absence of any DEP requirements, careful consideration of costs and financing is still required.

While it is often argued to be the case, it is not always clear whether decentralized management is less expensive than centralization. It depends on the needs and circumstances. If centralization is a necessary part of the plan for a downtown area, decentralization will almost always follow at the outskirts, and then the question (if not environmentally dictated) becomes one of where the cost "crossover" locus occurs as population density diminishes, available leachfield area increases, and proposed sewer lines lengthen. The crossover point also, of course, would be dependent on the degree of treatment (conventional or advanced) required on the "outskirts" side.

If centralization and decentralization are opposing alternatives, rather than co-components, the cost-effectiveness of one or the other is dependent on the details of the technological choices and needs. If at first glance it appears that decentralization is less expensive, but it then emerges that a septage treatment facility must be built, looking again at centralization for some portion of the town may be warranted,

because sewage and septage can be treated at the same facility.

But even "advanced" decentralized management need not be prohibitively expensive, and often can be less expensive than conventional central treatment. If a program for inspection and pumping is all that's required, it can be slight indeed, amounting to annual costs per household on the order of \$100. If the construction of a septage treatment facility is needed, or widespread replacement of failing systems is required, or package plants are needed, costs obviously increase, but may still show savings over central sewerage.

Analyses of situations in southeastern Massachusetts<See Pratt and Luttrell, 1993, and Pratt, 1996.> that may require neighborhood-wide remedial system replacement suggest that betterment and annual charges in such districts or subdistricts are certainly no *worse* than central sewerage. And that, coupled with the injection of cash through local upgrade contracts, and the increase in property values that results from the resolution of septic system problems, remediation would actually result in substantial *economic*, as well as public health and environmental benefits. Such systematic remediation requires a program and a plan, however, and it is during the planning process that the cost discoveries will be made.

Funds

In wastewater districts operational costs typically are covered by wastewater permit and inspection fees, or by annual user fees based on the size of the system or other proportional-use criteria. One convenient surrogate measure of wastewater generation is that of the water meter, which holds the additional benefit of encouraging water conservation. Other sources of operational revenue can include local taxes, septage discharge fees, professional licensing fees, and fines and penalties. Such mechanisms are well established in law and practice, and would translate directly to the district jurisdictional entity.

One difficulty with decentralization is whether and how to assure equity in user charges for onsite portions of the system with those on a sewer line. The basic concept of a wastewater district is that *all* the waste will, in one form or another, be managed by the public. Thus equitable treatment must be at the forefront of the discussion. The public needs to bear that in mind as it explores its sense of what is fair and equitable in the circumstance of a district which contains failing, old, new, and "future" hardware components.

It is on the issue of equity where the most convenient case for total public "ownership" or, at least, direct and total public management of systems, including full responsibility for the upgrade of individual onsite systems, can be made. In this context, each component is maintained and replaced as required. User fees are invariant with respect to hardware, and are based, for example, on the water meter, number of bedrooms, usage projections, or other objective criteria.

But voters may be wary of the concept that large boxes sitting on, or under, their private property "belong" to the government. If that is unacceptable, then the public has to be prepared to wrangle over the equitability of capital and operational costs among public and private components of the system. Uniform user fees might still be charged in such a case, going into a capital replacement fund available for both public and private owners according to criteria laid out in the management plan.

In any event, if financial management and user charges for the small systems are set up in a fashion that parallels as closely as possible the central system (if there is one), then the chances of approval by district voters will increase. If the district is organized to recognize privately-owned/privately-maintained schemes, it can collect its inspection and administrative costs in the form of operating permits and septage

discharge permits. The cost of replacement and repair would fall to the owner, who would sometimes need to be able to borrow money through some public mechanism, and pay over time on a betterment basis.

If the district is organized to recognize privately-owned/publicly-maintained schemes, it can collect revenues from a combination of permit and user fees.

If the public entity is to own every piece of the hardware except the sewer pipe leading from the building, it can function exactly the way public utilities do, simply charging uniform user fees, and capitalizing replacement parts with traditional public mechanisms such as betterments.

Financing

As with ownership, the financing of decentralized but publicly-owned facilities, however difficult to achieve in practice, is not legally troublesome because public sources of funds may then be sought. Historically, public funding mechanisms could be used only in such fashions although change is underway "as community-based approaches" to solving environmental programs become the norm. (See the section on Title 5.) For the construction phase or major upgrades, federal or state funds, if available, are applied for and used. While the EPA's Construction Grants Program has been terminated, other potential sources of federal grants include the U.S. Department of Housing and Urban Development, and the Farmers Home Administration Rural Development Authority. There are other state and federal sources of grants as well, and researching them will be part of the planning process.

The EPA still helps finance State Revolving Funds from which municipalities can borrow, paying back into a reserve account through betterment assessments that accompany hookups. State bond banks of other types may also be a source of capital. Local bond issues may be floated as well, similarly retired through betterment assessments.

The financing of private system construction can take several routes. In new developments, building complexes, or individual homes, construction costs are presently borne by the owner or developer, and that might be expected to continue. Retroactively financing private, especially communal, systems is more problematical. However, while there are various constraints on the use of public funds for the financing of "improvements" to private property, the obvious public gains in terms of cleaner water suggest ways around these constraints. For example, Massachusetts is presently fine-tuning the restructuring of SRF regulations so that these funds may be transferred to a local public entity, such as a town or district commission, which itself can then set up a local revolving fund not as subject to the constraints on the Commonwealth. Likewise, while the provisions of the 1994 Massachusetts Betterment Bill are designed to capitalize the upgrading of *individual* cesspools and failing systems, modifications to the bill could be made that permit the financing of small community systems and package plants as well. None of the financing mechanisms discussed, however, completely solve the problem of how to finance environmental improvements in an era of dwindling government funding.

Pratt and Luttrell<See references.> make the case that the entire question of public policy on financing environmental initiatives needs reexamination from the federal level downward. They argue that altogether new sources of capital are required, chiefly private; and that new incentives need to be provided to create it. They discuss several possible devices. One is marketable "Betterment Backed Securities," whose value would exceed that of general municipal bonds because the payback is secured by a lien and guaranteed for the life of the loan, regardless of annual revenue-raising outcomes in the town. Another is "Environmental Revenue Bonds," which would function similarly to Industrial Revenue Bonds, through which tax breaks provide incentives for investment. Still another is tradeable tax credits

or discounts offered in exchange for land or development rights. Finally, they make the general case that tax credit mechanisms can replace block grants and similar programs where funds must first be collected and redistributed, with the costs that entails, by the grantor.

Because the authors are directly involved in discussion of public policy in Massachusetts, these ideas may not be as distant as they seem. But the case still needs making that the small changes already being made in the workings of devices like the SRF and the Betterment Bill may be sufficient to finance an OWM Program.

One final note. The district most probably will need to establish a fund that provides outright grants for upgrades in cases of clearly demonstrated financial distress. Such funds may be set aside as small percentages of capital or operating funds obtained for more general purposes.<See, e.g., the Wisconsin case study in Chapter 6.>

Regulatory Considerations

Of course all the administrative functions as well as considerations of ownership and financing are simply necessary parts of a structure that enables the close regulation of sewage disposal systems. It isn't that such systems don't already have regulations associated with them. But regulations for small systems can be, as we have noted, minimal, distant, inflexible, and often inappropriate; in some cases variances are all too readily granted and, aside from the issuing of an initial permit, rarely enforced.

For example, even the 1978 version of Massachusetts' Title 5 regulations required the mandatory pumping of septic tanks every year. But it wasn't enforced, and therefore was rarely carried out. Moreover, mandatory annual pumping is not actually the best management practice for septic systems, because too frequent pumping can interfere with maximal treatment in the tank. Thus, at one and the same time we have an example of a code requirement that was both unenforceable and inappropriate. It is precisely the function of an OWM Program to establish inspection, maintenance, and enforcement mechanisms appropriate for each situation.

The intermediate-scale technologies (cluster systems, package plants, and STEP systems) are new enough that for some time a regulatory regime will need to be made cooperatively with state/DEP-level involvement on a case-by-case basis. Requirements for ongoing monitoring of such systems could well remain quite stiff until a sufficient body of data and experience is acquired to sensibly loosen them. Indeed, one way to commence decentralized management programs in Massachusetts may be to accept them only provisionally, while permitting some experimental latitude in their management detail.

In any event, the regulatory framework of an OWM Program begins with a permit to install and operate a system, or after the initial approval and inspection of an old or upgraded system. But it does not end with such a permit as, functionally, it might be said to do under Title 5. Instead, it will, typically, require the periodic renewal of the permit attendant to various other provisions. These include: (1) regular inspections and pumping, (2) maintenance and repair, and (3) record keeping. These and related tasks, such as enforcement, are discussed below. Before turning to them, however, a brief review, further to the Chapter 3 discussion of task division, is in order.

Separation of responsibilities

With respect to the tasks outlined above, permitting and enforcement will almost certainly fall to the overseeing local administrative entity. And although a record keeping system might initially be designed

and installed by a specialized computer firm, its day-to-day operation is also likely to fall to the governmental entity. In Massachusetts, the job of inspecting newly installed or upgraded systems presently falls to local BOHs or the DEP, depending on the size of the system. In a proposed OWM Program, agency staff would most likely continue to perform those jobs as well; in part as a check on the work of private firms because the design and installation of wastewater systems, even public treatment plants, is typically executed by private firms or contractors here in Massachusetts. (Design would not *have* to be done by private parties, and in Georgetown Divide, as one example, is not, although installation is performed by closely supervised contractors.<See the case study in Chapter 6.>)

In almost any circumstance, several tasks could be executed readily by *either* a government agency or private parties. These are ongoing inspections, pumping, maintenance (other than pumping), and repair. With respect to the division of these tasks, the agency has a sliding scale of choices, ranging from total public responsibility to total private responsibility. The tasks may be parsed differently as well, depending on whether the systems are individual or communal; newly installed or preexisting; conventional or advanced; and, if advanced, whether generic or proprietary (patented and licensed by a manufacturer).

In the most public form of management, the district effectively establishes a public utility that undertakes the total task of inspection, pumping, and maintenance. Users are assessed uniform fees and notified of inspection and pumping dates. The most obvious advantage of this scheme is the high degree of control retained, meaning in practice that compliance is high, maintenance of the systems is orderly and complete, record keeping is easier, and the qualifications and competence of employees is easily assured. It would also more uniformly distribute costs.

Potential disadvantages include the sometime tendency of government bodies to become overemployed and inefficient; voter resistance to burgeoning government; and to the intrusion of government personnel onto private property.

Alternatively, the district may retain the same philosophy of total management, but effectively franchise the task to a private contractor, in a scheme akin to a single private utility.<The towns of Dennis and Yarmouth, e.g., have contracted with a single engineering firm to conduct septic system inspections. The same firm also operates (but does not own) the Yarmouth-Dennis Septage Treatment Facility.> Uniform user fees would still be charged and other advantages of public management retained, but the size of the bureaucracy can be contained, and the potential efficiencies of competitive bidding might work to the advantage of the ratepayer. At the least, "group rates" would have the potential to assure reasonable rates because the volume of business that is guaranteed to the monopolistic (utility) servicer is large. The disadvantage is the loss of some degree of control over the qualifications and competence of personnel, or, indeed, the overall performance of the contractor.

In the most *laissez faire* model of the management concept, the regulations remain but responsibilities fall entirely to the property owner. The administrative entity mails reminders to individual owners, who must comply with the order to inspect or pump, and forward proof back to the issuer, directly or via an independent service provider with whom the owner contracts. There need not be user fees. The property owner pays the service provider directly after seeking however many competitive bids may be desired. In this model, yet more control is lost, but it may be the most palatable to the voter and citizen. At the same time, owners would need to be protected from unscrupulous service providers who may be tempted to perform unnecessary services, or to overcharge. Homeowner education can help in this circumstance, as can the publishing of average rates for services.

Under this model the administrative entity has a more difficult task in assuring qualifications and

competence of providers. It must also employ devices in its local or state licensing requirements that forbid discriminatory pricing or services. And it may be more difficult still to prevent an inspector from having a potential financial stake in the outcome of an inspection. In this model, too, adequate means to discipline or decertify individual licensed professionals, and the will to employ them, are essential.

In the U.S. of the 1990s, with its emphasis on governmental devolution and privatization, versions of the second or third models may be easier to pass and implement. If so, were the governmental entity to retain for itself the single task of inspection, effective quality control of the remaining tasks might more readily be assured.

Whatever model is opted, it is worth considering that while the kinds of inspection and maintenance described here may seem onerous, such requirements are, in varying degrees, *already* made of system owners, regardless of whether or not a local management program exists. One clear advantage of a district program is *relief* to the homeowner if a public entity takes over some of the responsibility.

Permitting and renewal of permits

Installation and operating permits will have been an outgrowth of the wastewater management plan; the conditions for the permit will be consistent with the whole district, or with overlays within the district, that depend on hydrogeology, population density, proximity to surface waters, wellheads, recharge areas, and so on. At the same time such conditions must be intelligently flexible.

Preexisting systems would be granted conditional operating permits (or have upgrades ordered) at the time the district is first established, and as part of an initial sanitary survey of every system in the district. Depending on the budget, such a survey may take several years. For example, the Tri-Town plan<See the case study in Chapter 6.> allowed three years for a full survey.

For new systems, design and siting typically would not rely on percolation tests alone, but would also consider soil characteristics and profile, drainage patterns, topography, seasonal variations in the water table, vegetation, and other environmental factors that will influence the performance of the system. Even statewide codes, such as Massachusetts' revised Title 5 regulations, increasingly make provisions for more site-specific design and siting criteria.

Special provisions would be made for alternative systems in both new and pre-existing but nonconforming situations. While tougher in inspection and maintenance requirements, the provisions should not be so tough as to discourage innovation and new approaches. As the systems become larger, the need for anticipating and providing for replacement or alternating leaching fields will grow correspondingly, and is a factor to take into account in system specifications.

Permit renewals would be linked to criteria discussed below.

Inspection of new and upgraded systems

In Massachusetts, there already are provisions for the inspection of new and upgraded systems of any size under the State Environmental Code. (The term "upgraded" is used here to refer to any preexisting system sufficiently changed to have required the filing of a plan.) Essentially the purpose of the initial inspection is to assure that competent installation has been performed in accordance with a preapproved plan, and that any changes are approved and noted on an "as built" plan which becomes part of the system's record.

The design details of particular systems and the environmentally-dependent specifications required of site plans are obviously beyond the scope of this document. However, the tight management presumed by an overall wastewater management plan, including the requirements for regular inspections, pumping, and maintenance, imply several features of the district's new or rebuilt systems that may not be typical elsewhere. These may include performance-based, rather than prescriptively-based, design criteria; environmentally-based site criteria; and set-aside locations for alternative drainfields. Technological criteria may include the installation of "plumbing" for an alternative drainfield and a diverter valve to shunt effluent to it. There may also be requirements for inspection, sampling and pumping risers and ports or, in their absence, aboveground markers for system access.

In any event, approval during the initial inspection results in the issuance of a permit to use and operate the system in most district entities. The permit would typically be subject to renewal, may have conditions attached to it, and may be contingent on the owner's granting of an easement (or lesser form of legal access) for further inspections and/or maintenance.

Routine inspections and pumping

The main purpose of routine inspections is to assure that the system is operating as expected. One inspector should be capable of inspecting and reporting on several hundred systems a year, putting the cost of each inspection in the range of fifty to several hundred dollars, depending on its thoroughness. <See, e.g., several of the case studies in Chapter 6.> Owners would be notified well in advance of the inspection date, or may be asked to make an appointment, although appointment-based inspections might be more difficult to make efficient with respect to travel time from site to site. Owners may be asked to uncover the system ports and otherwise prepare for the inspector's visit. The inspector is chiefly looking for overt signs of failure, although, if the inspection is part of an initial "sanitary survey" of a district, the first inspection may also involve the documentation of the system's components, and their dimensions and locations.

Typically the inspection would involve an assessment of the system's integrity, and a measurement of sludge and scum layers to estimate the state of the tank. Tank pH and other physical and chemical measurements relating to proper functioning may be made. Overt surface breakouts, odors, or anomalously lush growth in the drainfield area would be noted. Impermissible trees and other growth or impermeable coverings in the drainfield area would be reported. Residents may be asked to report on slow drainage or seasonal problems. The owner may be given a verbal report with a written report to follow. The owner will be told if the system is in compliance or not, and if it needs pumping. If the inspector is accompanied by a pump truck, the pumpout may be done on the spot; otherwise, the owner is given reasonable time to schedule pumping or perform and report on maintenance or repairs.

In some districts pumping may be regularly required at intervals of one to several years, depending on circumstance. In this case (which may be overzealous), inspection is done simultaneously. In other districts, pumping is only demanded when regular inspections show that it is warranted. The use of truly tight septic tanks and pressure dosing of leach fields can extend the required pumping interval for individual systems to 12 years or even more. <Bounds, 199?>

Maintenance and repair

Aside from pumping, requirements for routine and nonroutine maintenance will vary enormously from system type to system type, and pose one of the more difficult and multidimensional problems for the district. If the district employs a "total management" model, the district staff or contracted utility can be

expected or required to hold the internal expertise and versatility to tend to many different system designs. If a less ambitious plan is employed, the initial permit for each system will need to contain maintenance conditions specific to the type of system, with responsibility then falling to owners and parties they contract with. The permit for communal and package plants may require the services of an onsite professional operator, even if just part-time.

Advanced individual systems with electrical/mechanical parts or drainfield plumbing may require regular flushing, and the removal, cleaning, and possible replacement of components. Such routine tasks could be performed at the same time pumping or inspection is done. If the systems are proprietary, the district may require that the installer or manufacturer provide a renewable maintenance contract, and that the initial installation be covered by warranties. Performance bonds or other assurances regarding proprietary systems, as well as communal systems, may be desired by the district.

Record keeping

Decentralized wastewater management as it is described here is greatly facilitated by computerized record keeping. Such systems can be simple and inexpensive, using software available from other public agencies around the nation. If sophisticated, the system may be tied into a regional geographic information system (GIS), in which data reduction and averaging can be used to show wastewater and groundwater flow, nitrogen loads, etc. But whether or not it is tied to a GIS, it acts as a repository of data on the specifications and description of every system in the district; their performance as revealed by monitoring and inspections; and their record of septage pumping, alterations, and repairs. The record system can also trigger or cue staff as to which systems are due for inspections and which systems have indicators in the data of possible or imminent failure (such as overly frequent septage pumping).

The great advantage of computerized record keeping, however, is the economy that can result from using the system to perform administrative and clerical functions as well, including the printing of bills, and the issuance of notification letters, permits, and other documents.

The initial record on a system would be created at the time its plan was approved or, in the case of a preexisting system, at the time it was first scheduled for inspection and assessment. Thereafter, any modifications to the system, including "as built" plan modifications on installation, would be recorded. Inspectors, pumpers, and maintenance workers would ideally all be provided with telephone access and data entry protocols, so that the acquisition of data and its subsequent use could happen in near real time.

A complete system could also automatically identify and flag cases that require orders to comply, citations, and other enforcement actions; track the enforcement process; and generate the required documents.

Compliance and Enforcement

Enforcement may well be considered the crux of the wastewater dilemma. If wastewater is collected by a central sewer system, treated, and discharged at a single point, requiring a permit to do so; then the permit can be conditioned in any fashion desired by the regulators, the effluent stream can be easily monitored, and compliance can readily be obtained through the power of the state agency and the attorney general's office. Indeed the whole purpose of the EPA's National Pollutant Discharge Elimination System is to bring large wastewater discharges under such ready and effective control.

However, even in the centralized context there were always limits on construction dollars and agency budgets. As problem areas are identified they are inevitably prioritized, the bottom of the list possibly

never being addressed, and the least of the problems possibly never being listed. But "least" individually is not necessarily least collectively. The contribution of individual systems to the collective waste stream may be the most diffuse, but it is estimated to account for about 25% of the total.<B.D. Burks and M.M. Minnis, 1984, p.13.> There isn't nearly enough manpower to treat each of these as a point source requiring a discharge permit from the state.

Yet essentially the whole concept of the OWM Program is to create a "local," scaled-down "Department of Environmental Protection" that deals with smaller-scale systems in a fashion somewhat parallel to that in which NPDES systems are administered—albeit at lower levels of intensity, befitting the smaller individual risk of each smaller system.

There are several ways to minimize enforcement costs and maximize compliance, sometimes already employed in building and septic system codes. The most important involve conditioning of subdivision plans and building permits with wastewater disposal operations permits; and, in cases of preexisting structures, the conditioning of property transfers to inspection and upgrade requirements, whether done at the time of transfer or in some reasonable time frame thereafter. In these cases, the enforcement process then enlists the cooperation of owners, buyers, real estate agents, and banks. If more frequent inspections are required, operating permits can stipulate renewal at set time intervals, and be conditioned to inspection or pumping schedules and the presentation of proof by real-time or mail-in means.

Where inspections reveal violations, orders to correct the situation would be issued through an automated record system. In cases where owners refuse to make corrections, a noncriminal citation, with the warning of fines to come and accrue, would follow. Ultimately the management entity would be empowered and budgeted to revoke an operating permit, and in extreme cases to make the correction itself, the cost of repairs becoming a lien on the property, as, in fact, is already the case with Boards of Health.

When homeowners refuse to comply with local administrative actions, and enforcement is then sought through the courts, the process can be cumbersome, unpopular, and expensive. Revoking an operating permit or even an occupancy permit does not automatically result in compliance. Stinson Beach has solved the problem by the threat of shutting off the water supply at the street, which doesn't require entering private property or even serving papers. Fortunately, it rarely has had to take such drastic recourse.<See Stinson Beach case study.>

One important measure to help increase public compliance and decrease the need for enforcement actions is public education, which is discussed next.

Educational and Training Considerations

No move to establish a formal decentralized program, or for that matter, even to tighten control over individual systems, is likely to succeed in the absence of ongoing public education that starts early in the planning process. Many months or years can go into an effort that simply comes to naught on voting day. Public involvement requires not only early participation in the form of Citizen Advisory Committees and hearings; it also requires the concerted effort to arrange briefings and presentations, write articles for the local newspapers, and cultivate media contacts. After the establishment of the district, efforts at public outreach must continue.

The first task of the outreach effort is to convince voters of the need for onsite management. This involves educating them in surface and groundwater pollution, nitrogen loading and water quality, pathogens and public health, and the long-term consequences of neglect, perhaps even to their individual pocketbooks, because property values will fall where areas are known to be polluted, or where onsite systems are

clearly failing.

To have credibility, the effort must be accurate; it must also candidly raise uncertainties when they exist. In particular, the costs and benefits, short- and long-term, of various alternatives must be accurately calculated and presented as part of the planning process. The Lead Agency, itself, needs to stay openminded and uncommitted to any particular path as its plan of study begins; and later to remain flexible as new technologies and approaches develop.

Aside from the public at large, two groups, owners and professionals, require special attention after a plan is implemented. With respect to owners, there is a shortage of publicity on maintenance and care even of conventional systems. Further-more, the cooperation of homeowners must be elicited to assure that inspection procedures are efficient, particularly when they may require that owners locate the system, or uncover it. Publicity, brochures, telephone helplines, and other forms of information not only will help enlist public support, but will ultimately result in cost savings, increase cooperation, and minimize compliance problems.

An inspection program may be accompanied by "onsite" briefings and handouts that explain the basics of system maintenance and the responsibilities of owners as stipulated in the regulations. There needs to be staff ready to field questions and otherwise provide help and advice.

With respect to professionals, licensing and existing certification programs may be dated or insufficient in terms of the requirements of the program. Several classes of professionals may need certification and licensing. In Massachusetts, programs for them already exist at state level, but this could be augmented within district pro-grams, particularly if the district, or devices within it, are permitted conditionally with the idea that the state itself is building a body of knowledge concerning alternative systems or performance standards. Such programs require the development of courses, handbooks, and manuals for both technical and policy readerships.

Often there are grants available to help develop such programs, which in some states already exist. In Minnesota, to cite one that is often praised, a program was developed in 1971.<B.D. Burks, 1994.> It is executed by the Minnesota Extension Service, and provides 3-day workshops at basic and advanced levels for onsite inspection and maintenance certification. Continued certification requires 3 days of additional education every 3 years. While certification is not mandatory throughout Minnesota, 35 counties and most cities there now require it. Participants in the course have come from 20 other states, and a handful of other countries.

Here in New England, the Cooperative Extension Program at the University of Rhode Island, in cooperation with the Rhode Island Department of Environmental Management, established a similar program in 1994.<University of Rhode Island, 1995.> It runs an in-field training program, chiefly for alterative systems; and so far is the only training facility in New England for such systems. Its curricula also include briefings on regulation and administration.

The EPA runs a National Onsite Demonstration Project to research and showcase advanced and alternative individual onsite systems. In Massachusetts, both Gloucester and the Waquoit Bay National Estuarine Research Reserve participate in such programs, whose systems are accessible for training and educational purposes.

Chapter 5. EVALUATION OF OPTIONS

"State, local, and areawide governments have assets and capabilities which differ....The answer to the question of which level of government should regulate is that ALL should...sharing responsibilities so that each level performs the functions that it handles best."

—Environmental Law Institute, *Legal and Institutional Approaches* (1997)

The process by which, first, a few individuals close to the situation, and then later, the majority of a community's voters come to explore and decide on instituting decentralized wastewater management is not likely to be happenstance. There will have been a problem identified by someone who then wants to do something about it.

For example, William B. Golden, solicitor for the City of Quincy, is commonly credited with precipitating the cleanup of Boston Harbor and Quincy Bay.<P.F. Levy et al., 1993, p.77.> It is said that after stepping in human waste while jogging on one of Quincy's beaches, he ran straight to the Mayor's office, resting his soiled shoe on the desk to make his point. The City of Quincy brought a nuisance action against the Metropolitan District Commission and the Commonwealth of Massachusetts.<In fact, other individuals and groups, including the Conservation Law Foundation and the EPA, had even earlier applied pressure to clean up Boston Harbor. The point being made here is that the action of individuals and/or grassroots or civic organizations is often what precipitates the correctional steps required, or gets them past an endless discussion phase.> In other cases, it is the state which has identified a pollution problem in a region or town, and has applied pressure for its solution locally.

Within the affected area, technological solutions may range from the one extreme of centrally sewerage one locale to the other extreme of indefinitely accepting no more than Title 5 management in another locale. If either of these is the case, no onerous consideration of management structure is required, because provisions for their management already exist.

But between the two extremes is the large range of alternatives discussed in this document, any one of them conceivably optimal to some locale within the affected area. However, for these cases there aren't well established management precedents. Even if model legislation existed, many of the details of a management plan would be left to the individual communities. No two plans need, or would, be exactly the same, either technologically or managerially.

Pollution control in the U.S. is mainly achieved through a bargaining process that ends with a local vote. For that reason, the electorate has considerable power to frustrate the desires of regulators, or to slow their progress almost indefinitely.<Most of the discussion in this chapter derives from P.A. Ciotoli, 1982; Environmental Law Institute, 1977; D. Niehus, 1988; and Lombardo and Associates, 19??.> Thus, for success, the entire planning process requires public education and input. The planning process is also formalized to some degree through government laws, regulations, and rules of procedure. In any event, the process is not very different from any other deliberate study meant to result in selecting a specific course of action.

A problem is identified, a group such as a task force is formed to study it, study goals are stipulated, alternatives are formulated and evaluated for feasibility, and a course of action is recommended. In the case of wastewater management, the alternatives are both technological and managerial, with linkages between the two. The process of identifying the dimensions of the problem, the technological options for solving it, and the managerial options to assure its solution is necessarily an iterative or recursive one that circles ever closer to its "target." This is because additional levels of knowledge and input are acquired;

all of the various elements and their interactions come to be better understood; and unworkable alternatives are identified and rejected.

In the context of the older Construction Grants program of the EPA, the procedure was first referred to as "facilities planning," the emphasis historically being on central facilities. With modifications, however, the same or similar processes can be employed in the planning of decentralized system management. In fact the latest set of guidelines from the Massachusetts DEP refers not to *facilities planning* but to *comprehensive wastewater planning*. The companion document to this one more thoroughly outlines details of this planning procedure. Below, however, some of the planning process is briefly outlined and some of the evaluative requirements and criteria are discussed, this time with an emphasis on institutional and management considerations.

Management Planning

Initiation

The initiative for wastewater management planning can arise in several different contexts. It may result from a state order to a municipality, in which case the Board of Selectmen or the City Council may designate a preexisting municipal department or committee to initiate study and discussion. Alternatively, it may create an interdepartmental task force. If the dimensions of the pollution problem extend across town lines, or if solving it might have impacts on neighboring towns, an intergovernmental advisory group may be established to explore the possibility of a regional solution. (See Figure 1, as well as the companion document, for an overview of the planning process.)

Initiative does not have to come from the state, however. It could come from a regional planning agency, or even from a civic group such as a watershed association, which petitions for more formal governmental study of the problem.

The first task of any initially designated group is to identify all the remaining institutional and civic players that should be involved. At the local level these will include Boards of Health, and may also include planning boards, conservation commissions, departments of public works, or their equivalents. At the state level, they may include such offices as the DEP, the DEM, and the Office of Coastal Zone Management. The first job of these players will be to establish a plan of study, including a preliminary analysis of planning requirements and their funding. The initial task force will also create or delegate a Lead Agency, such as a Wastewater Advisory Committee, to assure the orderly and timely progression of the effort, as well as inter- and intragovernmental coordination and communication across agency or town boundaries and with civic groups and the public at large. The task force or original committee itself could continue as Lead Agency, but would not have to.

If the plan involves upgrading preexisting systems, and if federal or state funds are sought, then the DEP will insist on certain minimum requirements of the plan. These requirements make good sense in any context. They will stipulate that the plan include an analysis of the existing problem (a "needs analysis") and the requirements to remediate it, including a systematic examination of all alternatives, a description of proposed facilities, documentation of public involvement, and a cost-effectiveness analysis that shows that the proposal is the optimal solution to the pollution problem while adequately recognizing other environmental and social impacts. What emerges will be subplans for financing, implementation, operations, and administration. The proposed administrative entity must be demonstrated to have adequate authority, and legal, financial, and institutional resources sufficient to its charge.

If decentralized components are to be part of the plan, then there must be provisions for design plan

review, construction inspection, periodic performance inspections, maintenance, and site monitoring. Legal access for such purposes must be demonstrated.

Finally, the DEP (again, if SRF funds are sought or if the plan is part of a consent order) will stipulate that the plan be consistent with existing laws and regulations, land-use and resource management plans. It may recommend that comprehensive water quality planning and regional coordination be sought if they aren't in place, and that there be a program for public education.

The planning process

Once a Lead Agency has been selected and a plan of study made, a procedure that might be called the first iteration, the real planning work will begin—itself to be cycled several times as experience is gained. At several junctures there will be opportunity for public participation, informally at area or neighborhood meetings; formally, at advertised public hearings. The steps, not detailed in this document, include:

(1) **Assessing the current state of affairs.** This will start with the drawing up of a community profile, and perhaps a profile of neighboring communities or of an entire watershed. The profile examines the community's demographics, population densities, projected buildouts, zoning, and natural resources protected (or to be protected). It will document how waste is presently handled in various locales or subdivisions, where wastewater problems and pollution presently exist, and where they are likely to develop. Currently existing and available institutional, professional, and financial resources are assessed. Particular problem areas ("Areas of Concern") are identified, such as dense downtown areas; or shoreside neighborhoods where nitrification is an issue; or aging, previously seasonal developments with large numbers of cesspools or failing systems. The boundaries of these areas are set tentatively and may later be modified.

Jurisdictional boundaries for the entire planning region can also tentatively be drawn, perhaps based on politics, such as a town's zoning or borders; but if opportunity presents (something to be explored), perhaps based instead on physiographic entireties such as watersheds or aquifers. It may emerge that some aspects of the plan will be regional (such as septage treatment), but that others will remain strictly intratown or local.

(2) **Assessing what is missing, and therefore what is needed.** Formally, this process is called "needs analysis." Needs will vary from problem area to problem area. The analysis starts with the kinds of technology (or mix of technologies) that can solve the specific environmental problems being addressed. But once those have been identified, the managerial, financial, and service requirements for those technologies must be identified as well. Eventually, the focus must shift from the individual problem areas or locales to a regional or community-wide viewpoint. What mix of technologies will work overall? How will equity be assured? What resources can the community presently bring to the management question? Public participation and discussion is likely to result in the rejection of several of the early schemes, regardless of how good they look on paper. Technical and political realities will act to filter out the least workable proposals.

(3) **Examining in more detail the feasibility of the remaining alternatives.** At this juncture, more careful consideration needs to be paid to the overall plan mix, the community's resources, the ways and means of financing the implementation of various alternatives; and particularly to the examination of existing or prospective administrative or institutional structures required of each alternative, and how these structures will divide the management tasks among themselves and others.

The first and second steps are likely to be repeated several times as priorities are assigned, unacceptable or unworkable elements are rejected, and compromises are made. In this way, as the draft plan is presented to the public and the media, taken back for revision, and presented again, it slowly takes on flesh, reality, and realizability.

Institutional Evaluation

Criteria

A major part of the overall plan will be a subplan for the administrative and managerial implementation, execution, and oversight of the technical and facilities plans. A workable scheme for institutional and management arrangements needs to be assessed with respect to their geographical effectiveness, administrative effectiveness, comprehensiveness, compatibility, political acceptability, and accountability.

These terms overlap in meaning, but geographical effectiveness is chiefly a matter of the boundaries of the jurisdiction; whether they correspond with the physiographic boundaries of the pollution problem and the water resources to be protected; whether there is the possibility that external problems ("spillovers") are posed for any neighboring jurisdiction; and whether there are internal diseconomies in the form of undesirable environmental, developmental or social impacts.

Administrative effectiveness concerns the ability of the agency to get the job done; whether it has (or must be given) the necessary powers and funds; whether it has (or must acquire) the necessary professional expertise; and finally, whether it is sufficiently flexible to adjust to changing circumstances and evolving plan modification.

Comprehensiveness is related to both of the above, but refers to the context in which a wastewater plan is developed. If such a plan is part of a more comprehensive land-use and resource protection plan, its elements will have been more successfully meshed with other needs of the community, and its compromises will have been made in a cooperative rather than an adversarial mode. A plan produced in this way will only have come about after the investment of much time and discussion on the part of professionals, politicians, and citizens. In consequence, it will contain a greater degree of political mass and inertia, rendering it less vulnerable to assault.

Compatibility is a quality of both the management agency and the plan. With regard to the former, the question is whether the proposed agency has mechanisms and qualities that help assure its likelihood of working well with other agencies, local, regional, or state, whose responsibilities overlap; and with neighboring polities. With regard to the plan, the question is whether it has factored into account the missions and regulations that flow from other agencies and their plans. With regard to the citizens, a well-integrated plan will streamline the permitting and inspection process, avoiding a situation in which an individual must repeatedly appear before separate permitting agencies, each time presenting essentially the same information.

Political acceptability follows, in part, from the planning process itself, and how genuinely, openly, and accommodatingly the planners have welcomed public input and built public support. If the task force or lead agency has conducted its business in a fashion that has made it unpopular, the chance of voters giving their approval is greatly diminished. However, political acceptability also follows from other very strong factors such as cost and the perception of equity. Moreover, the institutional structure and how it divides its tasks between public and private parties are factors in acceptability. Institutional structures that are familiar, and which reflect a community's governmental "style," are more likely of passage than

structures that are unfamiliar, or worse, radically unfamiliar, to the electorate.

Accountability is the measure of how closely and directly the electorate can communicate with the administrative entity, and of how much control they have over the makeup of its governance. If the governance is elected, accountability (and responsiveness) may be high, but administrative firmness may diminish. If the governance is appointed, administrative resolve may be greater, but political acceptability correspondingly is diminished. The issue of an elected versus appointed policy-making body will need to be explored by each community in light of its own history and experience. Accountability is also a measure of the degree of power, authority, and responsibility that has been delegated or entrusted to the administrative entity with regard to its discretion and flexibility in assuring compliance with state pollution and public health laws.

Another criterion that can bear on assessing institutional entities which already exist is their degree of experience. Obviously, if a new entity is being proposed, it will not have a history. But if a new role is being asked of a preexisting agency, then the nature of its older mission, its performance, its ability to provide continuity, and its popularity in the community are all important factors in assessing the suitability of the agency to assume new tasks. In short, the "who" of the question may be just as important as the "what" of it.<Environmental Law Institute, 1977.>

For example, a sewer authority might be thought to have the most appropriate mix of professional expertise in wastewater management. However, it may not have any regulatory and enforcement experience at all, whereas planning agencies and Boards of Health will have had such experience. Still other agencies, such as wetlands or natural resources regulatory bodies, are likely to have some degree of both knowledge and regulatory experience with the management of nonpoint source pollution. In assessing which institution is best positioned for the new tasks, its previous mission; orientation (policy making, regulation, or service); mix of professional expertise; internal resources, powers, and authorities; scope of geographic jurisdiction relative to the problem; and relationship with other agencies, political entities, and the public must all be factored. How these factors affect a decision will depend on the unique history, politics, desires, and experience of a given community.

One important consideration is whether, in the end, it will be necessary to create a new (typically regional) special-purpose entity. This is a basic decision, its outcome likely to affect the details of the management structure and task allocation that follow. Yet there is no ready answer to the question, again because it will flow from details of the particular circumstance, and history and experience of the local polities.

Preexisting agencies can have the advantages of being more publicly responsive, politically attuned, and thus politically acceptable. Their institutional life experience may result in their being more efficient in terms of eliciting intragovernmental cooperation; more equitable; more considered in rendering decisions; and more comprehensively understanding of local issues.

They can have the disadvantages of being physiographically or geographically inappropriate to the scope of the problem; unable or unwilling to consider deleterious impacts external to the town's boundaries; insufficient in staff or expertise; and unable to take advantage of any economies of scale. Finally, their governing boards may be unwilling to take on any new responsibilities, and may not have any clearly defined authority to do so.

Newly created, special purpose, local or regional agencies have the advantage of their dedicated mission. They can recruit precisely the expertise and staff required, not diluting their requirements with other responsibilities. Their boundaries can be created so as to prevent external "spillover" effects, and with the

physiographic dimensions of the pollution problem and water resources in mind. Typically they will encompass a large enough area and financial base to enable adequate staffing and to otherwise take advantage of economies of scale. They may be more immune to political machinations that weaken their effort, and may be more likely to apply their regulations objectively and uniformly.

On the disadvantage side of the ledger, they may result in yet another layer of governmental bureaucracy, further fragmenting an already cumbersome governmental overburden of red tape, and procedural and permitting requirements. They are likely to be more removed and less involved in comprehensive planning and coordinated intragovernmental action and interaction, and less interested in balancing a community's overall objectives. They may become too powerful, tolerate inefficiencies, and be susceptible to overstaffing and other forms of self-administered largesse. Their regional scale may result in less public scrutiny and interest, and a higher degree of voter disinterest or apathy, both tendencies making them more susceptible to lobbying and alliances of special interests. Finally, their possibly nontraditional nature may not be acceptable to voters.

Washington is one of several states that permit onsite wastewater management districts. (It requires them, in fact, for all new subdivisions above a certain size that can't be sewerred.)<Environmental Law Institute, 1977.> Its experience is that preexisting agencies are to be strongly preferred. Its guidelines for district creation stipulate oversight by a sewer authority if there is one, or otherwise a county or municipal department. Only when no local authority is able or willing to assume oversight will the state permit the formation of a new administrative entity.

Selection

What works best in one state won't necessarily work best in another. What works in one part of a state may not be applicable to another part; for even within a state preexisting governmental structures vary widely, and there may or may not be local or regional agencies or commissions logically positioned to assume decentralized wastewater management. Local attitudes differ as well. The creative use of an existing agency, its charter possibly modified through legislation, bylaws, or interagency or intertown agreements, is more likely of support than the establishment of an entirely new and untested governmental entity.

Even when new entities are required, voters may be more comfortable with creations such as intermunicipal agreements that do not require state approval. Nevertheless, the state could provide incentives for local efforts, so that when communities want to do more, they have the tools to do so. In any event, whatever the details, power and responsibility will always be shared between the state and local agencies. The state, for example, could (and Massachusetts does) establish minimum legal standards for wastewater management, including those of accountability. It also could (and does) establish minimum legal standards for resource protection. But it may not need to establish any more encompassing prescriptions about how these standards are to be attained. The state could also, again profitably to all parties, provide consultative expertise, testing laboratories, and other forms of support, such as ecological surveys, not economically sustainable at the local level.

Finally, it could review and evaluate the performance of the local institutions with regard to whether minimum legal standards were maintained. Particularly in a state new to the concept of onsite management, such as Massachusetts, the first programs or districts may well be regarded as experimental, the outcome of such experiments then to be reflected in amendments to standards of performance or accountability, or in provisions of any authorizing legislation.

Whether or not decentralized district legislation comes to pass, it is still likely to provide institutional choices. The selection among them will emerge by consensus during the planning process. But it is the institution's social rather than its structural qualities that are likely to be important to the voters, who will have the final say. They will have been looking at the leadership, good will, and other human dimensions of those attempting to persuade them. They will want such qualities reflected in the administering agency, and will be sensitive as to how the planning process itself was conducted by the Lead Agency. They will want to perceive that the entity is going to be accessible; fair, even if firm; and both reasonable and equitable in its negotiations, decisions, and the handling of permitting and appeals. If the jurisdiction crosses town boundaries, the voters in each town will want assurance of adequate representation and the accountability of their own representatives.

Finally, regardless of the institution, voters are unlikely to approve any plan that appears unreasonably expensive or expansive. For that reason, if no other, a modest plan may be the most politically acceptable, hence most viable, in arresting the contribution of individual onsite systems to the collective problem of nonpoint source pollution.

Such incremental programs are not to be discouraged. Gains in public and environmental health and safety are associated with very long time scales for their realization—as studies of improvements in automobile safety and emissions control, or the social and political economics of smoking, would show. First the public becomes informed. The information may be provided by researchers and policy analysts, but it is the media that bring the message home. Then attitudes change.

Ultimately the public, not policy analysts, drives the political implementation of higher standards. There must have been a time when requiring indoor plumbing seemed altogether radical. Just as there was a time, in the memory of many us, when a layer of blue smoke hung head-high in the cafeteria at the National Institutes of Health.

Chapter 6. CASE STUDIES

"General propositions do not decide concrete cases. The decision will depend on...an intuition more subtle than any...premise."

—Oliver Wendell Holmes, Jr., *Lochner v. New York*, 198 U.S. 45,75 (1905)

Please note that the case studies that follow are not systematic. They do not lay out in any orderly, matrix-like way the paths, junctures, and options in creating an onsite wastewater management program. Instead, they present selected examples of problems, solutions to problems, and, sometimes, problems with the solution. They are simply meant to provoke thought.

The section opens with several early examples of proactive onsite management. Then other examples and approaches from around the United States and Canada are examined. Some of these have unusual or unique features. Finally, the current situation and various efforts underway in Massachusetts are explored.

While the sources have often been persons familiar with the location being discussed, the write-ups themselves have mostly been done by this author, and may well include errors of fact, interpretation, or emphasis. (FCS)

Fairfax County, Virginia

The birth of a concept

Fairfax County is marked by many areas in which soils do not percolate adequately or where there is insufficient soil cover altogether to handle conventional septic tank/soil absorption systems. In 1954–55 county officials, alarmed at the high number of system failures, systematically mapped its soils and seasonal water table levels, correlating the data with percolation rates and identifying areas unsuitable for the installation of such systems. They then proceeded to rewrite septic system design and siting regulations—filling, for the first time, the regulatory gap that had permitted installation with nothing more than a percolation test and uniform state-level codes. Application for a septic tank permit was to include not only the results of percolation tests, but a soil profile description and information on drainage patterns, with the absorption field size adjusted to those measures. Later, the county required provision for twin absorption fields and diversion valves to alternate the flow between them. A statistical study done by the county in 1972 indicated that conventional systems were surviving 20 to 30 years; with drain field alternation, systems could be expected to function 30 to 50 years or even indefinitely. Other communities around the nation have since followed Fairfax County's lead in imposing proactive, site-specific regulations concerning the septic tank.

Sidenote—a homeowner's NPDES permit

The entire state of Virginia is marked by many areas with poor drainage where local authorities have forbidden conventional system installation. If such a system is not approved, or if an existing one is failing, the homeowner can apply to the Virginia Water Control Board for a Virginia Pollutant Discharge Elimination System (VPDES) permit for an onsite discharging system that treats the wastewater with a sand filter. The permits are conditioned with other performance, monitoring, and maintenance requirements.

Sources

Fairfax County is discussed at length in Chapter 5, Environmental Law Institute, 1977 (see references); but it is also mentioned in much of the literature as the first entity to require site specific septic system design.

Georgetown, California

The full-fledged concept

The Georgetown Divide Public Utility District created perhaps the oldest *comprehensive* onsite management program in the U.S. The "Zone" was formed in 1971 and concerns a then fledgling subdivision called Lake Auburn Trails. The situation was classic. While the subdivision would ultimately contain more than 1000 homes, it would begin with only a few hundred units. Thus, a treatment plant designed for buildout would initially have insufficient flow to function properly. The subdivider proposed onsite systems as an interim measure. However, the district was concerned about ultimate housing density; the thin, poor soils; and steep topography. Unmanaged onsite systems would not be acceptable. John T. Winneberger, a consulting engineer, and William Anderman, then Director for Environmental Health for El Dorado County, proposed the onsite public management concept to the Georgetown Divide District. The District was prepared to accept the responsibility for monitoring and maintaining the onsite systems; and, in consequence, sought and received authorization in law from state and county governments.

A central treatment plant is no longer envisioned for Lake Auburn Trails. "Cradle to grave" management of individual systems has evolved into a highly successful program with minimal environmental or financial impacts. The district does not "own" the systems, but it comes to as much insofar as it has all necessary access to them, and full decision-making authority regarding their acceptability in siting and performance. Nor does it install them, although it closely supervises installation by private contractors. It assumes virtually all other management responsibilities. The granting of an onsite permit is conditioned with authorization by the owner for the District to monitor and maintain the system. Systems are designed by District staff, using computer-aided drafting and mapping tools. Both conventional and alternative designs may be employed. Each unit is tailored to soil and slope conditions at the site. Inspection devices are built into the units; the site plan also incorporates landscaping and grading provisions to control erosion. Onsite environmental monitoring includes sampling, testing, and flow measurements of the leaching areas. In cooperation with the USGS, watershed monitoring is also performed.

A part time staff of four, helped by a computer system that schedules maintenance and pumpouts, oversee, in this thorough fashion, more than 800 systems. An initial design and permit fee of about \$550, and annual fees of about \$170 on dwellings and \$80 on unbuilt lots, are sufficient to fully cover the cost of the program, whose success is attributed to "intimate" public agency involvement and in-house expertise.

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Mayo Peninsula and Anne Arundel County, Maryland

A classic—on Mayo Peninsula, community systems are opted to slow development

The Mayo Peninsula, Anne Arundel County, is a tiny (8 square miles) spit of land that juts into the Chesapeake Bay. Presently it contains about 2200 dwellings and, with buildout, could have as many again. The community started as a seasonal and weekend retreat, and onsite disposal was often primitive. Increasingly, the buildings are now occupied year round. County officials had known there were pollution problems for decades, and the community itself had debated and rejected numerous proposals to build a conventional treatment facility. The chief reason for the rejections had been fear of a development wave that would follow. In 1980 the state intervened and ordered the Anne Arundel Department of Utilities (now called the Department of Public Works) to install sewers. Further debate and the formation of a citizens' advisory group ultimately led to an alternative plan, for which construction began in 1985.

The peninsula was divided into three regions, depending on the density of present and planned development, as well as environmental conditions. The densest region would be served by a communal septic tank effluent plant, partially pumped and partially gravity-fed. The plant is a 5-step biological (sand) system with UV disinfection; it ultimately discharges to Chesapeake Bay. Another area, serving some eighty prospective homes, would share subsurface community leaching fields fed by household septic tanks. And a third area, also serving a hundred-odd homes, would continue with monitored individual onsite systems. As *originally* envisioned, the subdistrict would own all components of all systems, except the building sewer leading to the onsite tanks. Blanket easements, tied to the location of new system components, would preclude the need to specify each easement individually.

The plan required the creation of a wastewater management district, the Mayo Water Reclamation Subdistrict, that would answer to the county's Department of Utilities, but operate independently within it. Enabling legislation and regulations had to be created at both state and county government levels. The subdistrict would be responsible for financing, management, operation, maintenance, inspection, rehabilitation, and repair of every facility on the peninsula. Politically, this turned out not to be possible in the case of the individual septic systems, which are no longer managed by the district but by the county.

Federal and state grants covered approximately 80% of construction costs; the remainder is financed by homeowners, through a capital connection charge of \$3270. A flat rate of about \$260 per annum is assessed to cover maintenance costs.

The Mayo Subdistrict has not been without problems. Management of the individual onsite area ran into enough resistance (particularly with regard to the stipulation that those homeowners also pay annual fees) that (aside from cases where hookup to the larger systems was feasible) authority for them reverted to the homeowner and the county. There were engineering problems at the STEP plant. Phosphorous was insufficiently removed by the biological system, and is now removed chemically. The system was subject to inflow and infiltration problems. At the communal drainfields there was ponding in some of the trenches, which were not dug deep enough to hit permeable soils, and whose gravel was insufficiently clean. These problems, aggravated by the low-lying topography of the area, are either fixed or being worked on, but not without cost overruns. However, considering the innovative nature of the program, problems might be expected to develop; it's part of the process of acquiring experience with what works and what doesn't, managerially, technically, and politically.

As for the county. . .

The Anne Arundel County Health Department, responsible for individual onsite systems, has been experimenting with, and promoting the use of, recirculating sand filters since 1987. Its plumbing code is

stricter than the state's; and many of the older neighborhoods have homes with individual wells, and primitive waste systems on lots now deemed unsuitable for conventional onsite treatment. More than 150 systems are now in use in situations that would otherwise require holding tanks because lots are too small for drainfields. The county permits a 50% reduction in drainfield size for a home with a sand filter. Responsibility for installation and maintenance rests with the homeowner, although the county is presently acquiring data on system longevity and need for repair. So far, maintenance requirements have seemed minimal.

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Westboro, Wisconsin

Answers from the University of Wisconsin

Westboro, Wisconsin, was one of the first communities to participate in the Small Scale Waste Management Project run by the University of Wisconsin. (The project had already developed such innovations as the Wisconsin Mound System, which is essentially an onsite single-pass, landscaped sand filter constructed above grade.) In 1974, the 69 occupied buildings of the town were served by individual septic tank systems, 80% of which were thought to be failing, either by discharging above ground or leaking into a drain system leading directly to a creek. The state's Department of Natural Resources ordered Westboro to clean up. The community formed "Sanitary District No. 1 of the Town of Westboro," and hired an engineering firm to draw up a facilities plan for a central treatment plant. It would have cost \$5,500 per building. Furthermore, the town ended up ranked 372/395 on the priority list for EPA construction grant funding. The Small Scale Waste Management Project stepped in with its own proposal. For most of the town, *repaired* individual septic tanks would settle solids, and STEP pumps would transport the effluent in small-diameter pipes to one of two alternating community leaching fields. Houses not connected would be provided with new individual septic systems, but they would be owned and operated by the sanitary district. Estimated cost, \$3,900 per building, or a savings of 30%. The Westboro system has now been in operation for approximately two decades.

Statewide initiatives

More generally, Wisconsin has been at the forefront of onsite management initiatives, which are regulated by the statewide Bureau of Building Water Systems, and administered at the county level. Two classes of installers, Plumbers and Restricted Sewer Plumbers are certified at the state level. In 1994 the percolation test was eliminated, to be replaced by a site-specific soil, drainage, and morphological evaluation performed by a Certified Soil Tester. Presently, Wisconsin is in the process of a systematic overhaul of its onsite regulations. The code in development will establish performance criteria for system output, new procedures for the design, installation, and maintenance of systems, and outreach/training programs. It will also promote research and development, the use of alternative systems, and the recycling of wastewater components.

Maintenance and monitoring responsibilities will lie with the system owner, as they do now. Even under the present code, in most counties, regular pumping schedules are fixed at the time a system is permitted. County staff remind owners of the need to pump by sending them a postcard to be filled out by a private pumper and returned. (If the card is not returned, warning letters and citations follow, but the experience has been that those who require dunning require repeated dunning.) Key to the new scheme will be a computer database that tracks the individual systems' status, and generates reporting and compliance documents. It will operate similarly to Wisconsin's automobile registration system, which can be accessed by the automobile owner through a toll-free line that accepts information and payments. Pumpers and maintainers will be able to report online, and the system will prompt owners about upcoming inspection and pumping requirements that will vary with the particular installation.

Wisconsin also has a statewide grant program, called the Wisconsin Fund, for failed system upgrades. Depending on a homeowner's income eligibility and other qualifications, it will pay for up to 60% of the price of upgrading or replacement.

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Nova Scotia, Canada

The noncontiguous district

A law passed in 1982 allows Nova Scotia towns and municipalities to create Wastewater Management Districts. The idea is to provide uniform "flush and forget" services to building owners, regardless of the mix of technologies and regardless of who owns the systems. All property owners in the district are obliged to participate in the funding, paying an annual charge that covers capital recovery as well as operation and maintenance costs. Boundaries of the district need not coincide with the existing town boundaries, and would typically be smaller.

In fact, the district may be "noncontiguous," consisting of individual properties or groups of properties that require special consideration for environmental or historical reasons. The administrative institution is either a sewer or public works committee of the municipal council. It is vested with all the necessary authorities and duties. It can own or lease land, make contracts, and fix and collect charges. It is held responsible for overall planning; upgrades; and design, construction, inspection, operation and maintenance of all types of systems. Finally, it can enter private property to inspect, repair, or replace malfunctioning systems.

In Port Maitland (population 360), a preliminary study estimated a per household cost of \$6000 to \$10,000 to install a conventional plant. The town opted instead for a mix of individual onsite systems and four cluster systems fed by gravity sewers to central septic tanks, siphon chambers, and contour subsoil trenches. Installation costs were approximately \$2400 per unit. Maintenance, repair, and pumping are provided by private contractors with the District. Annual fees per household were \$65 in 1994. Recent studies have shown that despite seasonally high groundwater, the systems are functioning well.

Guysborough, with a similar population, adopted a plan that includes a small conventional treatment plant for part of the town, an aerated lagoon for another part, and individual onsite systems for a third part. All owners were assessed \$2100 initially, and were charged annual fees of \$125 in 1994.

Voter approval of those in the district is required; it must be presented to them as a complete plan that has considered sites, boundaries, servicing options, preliminary designs, and cost estimates. However, districts have often been voted down. Only three Nova Scotia towns had adopted such districts by the spring of 1994. Of sixteen others that considered it, decentralized management was actually recommended in fourteen cases. But six had chosen to centralize, and five were still in nebulous discussion. Five others were actively considering OWMD programs. Equity of either service or cost has been an issue in towns considering a mixed approach. Furthermore, central sewerage is often regarded by the public as more desirable and less interfering. Aside from questions of equity, voters have not always perceived that a problem existed, or that a Wastewater Management District was the entity to fix it.

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Cass County, Minnesota

Rural electric cooperatives manage service districts

Cass County is typical of the counties in the "Northern Lake Ecoregion" which have evolved from an economy based on agriculture and timber to an economy where the lakes and associated tourism have become very important. Because much of the development and growth around the lake regions took place in earlier years, there wasn't great attention paid to lot sizes, soil types, or to consideration of water quality. Cass County is now faced with a growing number of nonconforming onsite septic systems around many of its rural lakes. Furthermore, the state Shorelands Management Act, and Minnesota Pollution Control Agency (MPCA) regulations, are setting tighter regulatory wastewater standards which Cass County is obliged to enforce. And many residents are in the unfortunate position of being unable to sell their homes due to the fact that they can not provide a "conforming" septic system on their property. Cass County has been pressed to look for answers.

In 1994, the county developed the concept of the "Environmental Subordinate Service District," whereby a township, as the local unit of government, can effectively provide, finance, and administrate governmental services for subsets of its residents. Establishment of such districts within a town is now authorized under Minnesota Statute 365A. So far, one district has been formed; five are in planning stages. The purpose of these districts is to provide a self-sufficient, effective, and consistent long-term management tool, chiefly for neighborhood alternative (STEP) collection and communal leach fields. This model is innovative, because it stays at the grass roots level where the affected property owners and the township remain involved. Cass County provides technical and support assistance when required, but is not directly involved on a daily basis. The partnering with the townships and the county has allowed resource sharing, improved communication, and thus has opened up prospects for other cooperative ventures such as land-use planning, road improvements, and geographic information systems.

Once a Subordinate Service District is created by petition and vote from the residents needing the specific service, a County/Township agreement is signed. The County then determines the system's design, handles construction oversight, gives final approval for the collection system, commits to yearly inspections, and assures regulatory compliance. The leach fields are located away from lakes, wells, and groundwater supplies. Cass County will allow systems to lie on county-administered land in order to defray residents' costs, or to enable optimal siting.

The township is the legal entity that secures management services needed for the district to function. Other key players are the MPCA's Brainerd Regional Office, providing regulatory and technical assistance, the Association of Cass County Lakes for lake and water quality monitoring and educational support, the Minnesota Association of Townships for their legal counsel, the Mutual Service Insurance Agency for insuring the townships and the district wastewater collection systems, the Tri-County Leech Lake Watershed (district) for their engineering funding, and the Woodland Bank of Remer for working with the township to obtain low interest financing for residents.

However, **another key and major** player is the Rural Utilities Services (formerly the Rural Electrification Association). The piece of the puzzle missing for the districts to actually work was an operations, maintenance, and management program. Therefore, Cass County sought out the local utility, Crow Wing Power and Light (Brainerd, MN), and asked them to consider helping. Crow Wing Power and Light now provides the following services as utility managers: (1) security monitoring; (2) monthly inspections (they also maintain the grounds); (3) through a subcontractor, pumping of individual septic tanks, and any other repair or maintenance required; and (4) record keeping—logs are kept of inspections

and repairs/maintenance. Bills are sent to the residents involved every six months, totalling about \$200 per year per household.

A management maintenance contract is negotiated for the utility's services, thus reducing the need for additional staffing by the town itself. The township remains the legal entity guaranteeing any unpaid charges through its power to levy special district taxes.

Source

This (extracted) text has been supplied by Bridget I. Chard, Resource Consultant, Red River Ox Cart Trail, Rte 1, Box 1187, Pillager, MN 56734; tel. 218-825-0528.

Paradise, California

A town of 28,000 opts long-term onsite management

The town of Paradise is one of the largest unsewered communities in the United States. But residents have opposed the installation of a central system to process the wastewater generated by **both** single-family residences and commercial developments within the town. Instead, in 1992, the Town of Paradise created an Onsite Wastewater Management Zone (OWMZ), by Town Council adoption of an ordinance (No. 219) which established the regulatory provisions for the installation and maintenance of onsite septic systems. The establishment of the OWMZ was the result of engineering studies that suggested that long-term reliance upon septic systems as the primary source of sewage treatment and disposal would require **active** oversight and management.

OWMZ regulations require that permits be obtained to construct, operate, and repair onsite systems. The town will not issue an operating permit until as-built plans have been received, and, for alternative systems, operating and maintenance manuals have been submitted by the system designers. All systems must be periodically evaluated for compliance. Inspections are required whenever the system is pumped, the property is sold, or a complaint is filed. Otherwise, inspections are required at least every seven years except in identified "areas of concern," where schedules are more frequent. A septic system must be operating without failure and the septic tank must be pumped regularly to permit continued use. Septic system evaluators, typically septic tank pumpers (but also registered environmental health specialists and designers), have been trained and certified by the OWMZ to fulfill this function.

Evaluation reports submitted to the OWMZ by these licensed professionals detail the operational efficiency of the septic system. Receipt by the OWMZ of an evaluation report that documents a **failing** septic system results in the property owner being notified by the OWMZ to repair the system at the owner's expense. The owner must demonstrate proof of compliance within thirty days or the operating permit will be withdrawn, and abatement procedures implemented. Ultimately the town may abate and place a lien on the property. Owners may apply to the town for financial assistance in upgrading systems to compliance standards.

The receipt of an evaluation report that documents a **functioning** system results in an Operating Permit which authorizes the continued use of the system for a specified period of time, based upon the age of the system and its observed operational history. For an ISDS, the annual charge is \$14.20, typically itemized on the water bill.

Sources

Text is based on a written description provided by Wesley P. Greenwood, Onsite Sanitary Official, Town of Paradise, supplemented by reference to the town's *Ordinance 219*, and its *Manual for the Onsite Treatment of Wastewater*, dated 1994. Town of Paradise, 5555 Skyway, Paradise, CA 95969; tel. 916-872-6293.

Warwick, Rhode Island

Public grants for nonconformers

Warwick is a venerable city (founded 1642) with a population of 85,000. Parts of it have been sewered since 1965; today about 45% is sewered. The single treatment plant is run by the Warwick Sewer Authority (WSA). As for the remainder of the city, one Warwick planner describes it this way: "We have [many] Levittown-type neighborhoods, built before there were state regulations; the houses have cesspools, that's all." In fact, there are approximately 15,000 ISDSs in the city, of which an estimated 8,000 to 10,000 are cesspools. Warwick is under pressure to do something about the "many Levittown-type neighborhoods." Conventionally, "doing something" means increasing the size of the existing plant and extending new sewer lines. However, sewer lines are usually the last utility to be installed, and also the deepest. Sewer installations can create havoc, and not just with traffic disruption. Water mains have been breached; there was an explosion when a gas line was cut. Upgrading old sewers is expensive and risky. Nevertheless, there's no question that for many areas of the city it needs to be done.

But there are alternatives for some areas. The WSA is utilizing bond monies approved by Warwick voters to extend public financing to private property in order to rehabilitate failing individual systems. The "On-Site Rehabilitation Program" (OSRP) was developed to address the equity issue for Warwick homeowners who did not have access to public sewers, but were paying their share of the sewer bond debt through city property taxes. The regulations governing the OSRP were enacted pursuant to the authority granted in Rhode Island Public Laws of 1983, Chapter 124. Participants must both own and occupy the residential dwelling. If public sewers are available to the property, the homeowner can not opt for OSRP relief. An upgrade or replacement takes place in three steps: application, design, and construction, each requiring specific approval. The process begins with the seeking of bids from private contractors. Upon completion of the upgrade, the WSA will underwrite a grant to the homeowner for up to \$1600. An optional loan, not to exceed \$2400, is also available to further offset the cost of the new system. Participants pledge to pump their system every three years, although this is not monitored or enforced.

(A unique complement to the OSRP was added in the fall of 1995. The "Alternative Technology Septic System Pilot Program," funded by the EPA, allowed a small number of interested Warwick homeowners to apply for additional funding beyond the OSRP limits for the installation of "high-tech" systems. A follow-up monitoring and testing program will provide invaluable data on system performance, and on the future viability of utilizing alternative methods for treating onsite waste in Rhode Island.)

The success of the Warwick OSR Program will ultimately depend on the degree of participation which, so far, is small. Nevertheless, the figures are improving. The total number of homeowners assisted with the OSRP during the first ten years (1984-1993) was approximately 300. But with an increased effort focused on public awareness and education, this total had increased during the subsequent 18 months to nearly 500. Such promotion may be essential. A small program in South Kingston (RI) that offered direct tax rebates to upgraders of substandard systems was dropped for lack of participation. Moreover, widespread compliance in such programs may require more than voluntary action.

Rhode Island state law also has provisions for towns to adopt model decentralized wastewater management district legislation. But very few communities have even attempted it. At a recent policy forum on septic system maintenance, it emerged that the enabling legislation might better be focused on resource protection than on wastewater management *per se*, and that if state standards and mandates were in place regarding such protection then the local communities could more easily create (and pass) the sort

of district programs required.

All these efforts have strong support at the state level, which realizes there is a crisis brewing. Says Edward S. Szymanski, Associate Director for Water Quality at RIDEM, "Right now we're on the fence with whether we'll continue with sewers, which are very expensive....We're looking at [alternatives] that perform as well [but are more] cost effective." The entire state is currently revamping its onsite regulations, providing for alternatives, and otherwise reexamining conventional thinking.

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Keuka Lake, New York

A home-rule intermunicipal agreement, eight towns strong

Lake Keuka lies in upper New York State's "Finger Lakes Region." The Keuka watershed supplies water for over 20,000 people; over 10,000 live on the lake's shores, which border 8 municipalities and two counties. Overall, water quality in the lake is good, but occasionally elevated levels of sediment, nutrients, and pathogens have been recorded. Pollution, and its potential impact on health, recreation, property values and the associated tourism industry, led local townspeople to identify watershed management as their leading concern.

This concern was uncovered by a civic group, the Keuka Lake Association; more than 30 years old, it ultimately comprised 1700 members and was able, via its nonprofit Foundation, to acquire \$180,000 in grants and other revenues for study and planning purposes. It went on, in 1991, to establish the Keuka Lake Watershed Project, whose more specific purpose was to promote uniform, coordinated, cooperative watershed management for the region. There were three prongs to its effort: (1) establish details of the current situation; (2) educate the public to the need for action; and (3) foster interinstitutional cooperation.

With regard to the latter, it encouraged the formation of individual Town Watershed Advisory Committees that would provide local participatory forums to address water issues, and at the same time report to the Project's director. An early suggestion of the individual committees was to form a single, oversight committee, consisting of elected officials from the eight municipalities around the lake. This committee came to be called the Keuka Watershed Improvement Cooperative (KWIC). Initially it had no official status.

The stated purpose of the Cooperative was to develop a model watershed law, and then identify who should administer it. In developing the law it specifically excluded facilities of such a size that they were already regulated by the state. When it came to administration, they examined and rejected forming a regulatory commission through the state's enabling procedures, and they examined and rejected county-based ("county-small") watershed districts. Instead, they opted for drawing up an intermunicipal agreement under the state's Home Rule provisions which allow the municipalities to do anything together (by agreement) that they could have done separately. The agreement, itself, was only 8 pages long. It legally formalized the cooperative, providing for a board of directors consisting of the Chief Executive Officer of each municipality, and for a professional watershed management staff. Voters were presented with a package consisting of the agreement, the proposed watershed protection law, and recommended policy and procedures, including those for dispute resolution. After dozens of public meetings the package won by a landslide in every municipality.

Regulations govern permitting, design standards, inspection and enforcement. A program for all sites in "Zone One," the land within 200 feet of lake, calls for their inspection at least once every five years. Failures are cited and required upgrades stipulated. Aerobic and other alternative systems must be inspected annually, at which time the owner must show evidence of an extant maintenance contract. Specifications for the design, construction, and siting of replacement systems are also tighter than the state's, and approval may require the use of advanced or "Best Available Technology." Enforcement provisions define violations, and specify timetables for compliance and fines. The individual municipalities issue notices of violations and citations to appear in town or village court. The Cooperative coordinates its activities with state and county health agencies, maintains a database and GIS system to track environmental variables and the performance of new technologies, continues with ongoing studies, and retains a Technical Review Committee to help with policy and regulatory

modifications. Staff include a full time watershed manager, employed by KWIC, and part time inspectors, employed by the towns.

KWIC is financed by septic system permit fees, grants as available, and funds from each member municipality's annual budget. The annual KWIC budget forecasts permit fees, considers grant funds immediately available, and distributes the balance of funds needed evenly among the towns and villages.

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Stinson Beach, California

Another classic, enforceable by shutting off town water

Stinson Beach is a small town in Marin County, located about 20 miles north of San Francisco. Part of the beach is a park that can draw 10,000 visitors on a weekend. The town *generally* answers to Marin County government. At present there are about 700 onsite systems in Stinson Beach. It is another early participant in the onsite management concept.

In 1961 a county survey concluded that surface and groundwaters were being polluted by many of the town's often antiquated onsite systems. In response, the county created the Stinson Beach County Water District, whose task would be solve the problem. The water district is governed by a five-member, elected Board of Directors who make policy and perform water quality planning. Between 1961 and 1973, nine separate studies and proposals for central treatment were rejected by voters. In 1973 the San Francisco Regional Water Quality Control Board (SFRWQCB) intervened, putting Stinson Beach on notice. All onsite systems would be eliminated by 1977, and a building moratorium would go into effect forthwith. Even so, a *tenth* central sewer proposal was rejected. Voters were not only alarmed by costs, but were unconvinced that alternatives had been sufficiently considered. An eleventh study, specifically undertaken to examine alternatives, concluded that onsite remediation was both the most cost effective and environmentally benign.

Concurrence was sought from both the regional board and the state legislature, which enacted special legislation (consistent with California Water Code provisions) in 1978 empowering the Stinson Beach County Water District to establish the Stinson Beach Onsite Wastewater Management Program. The program would answer directly to the SFRWQCB, rather than to Marin County. The program would govern the permitting, construction, inspection, repair, and maintenance of old and, later, new systems. Rules and regulations were approved by the regional board on a trial basis, and were later made permanent. The program went into effect with the passage of a series of town ordinances. Rules and regulations (and ordinances) have evolved as problems were encountered, there being few precedents to go on.

Ownership of the systems, and ultimately the responsibility for repairing or upgrading them, rest with the building owner. But program staff perform inspections out of which come permits to operate, or instead a citation that lists violations and provides a timetable for remediation. (Initially a house-to-house survey was used to identify the most critical failures or substandard systems from which came *interim* permits to operate.) As in the case of George-town, the permit to operate is conditional on authorizing the district to enter property for purposes of inspection and, if need be, repair. Conventional systems are inspected every two years, alternative systems (now stipulated for some areas) every quarter. The permit may carry conditions, or varying periods of validity. The regulations provide penalties for noncompliance of up to a \$500 fine or 60 days imprisonment, each day considered another count. The district also has the power to effect its own repairs and put a lien on the property until repaid. And it has access to low-interest state loan funds for low-income households. However, it has rarely had to take strong measures because the district is also empowered to cut off the water supply of a noncomplier, something it has had to do occasionally. During the initial period, about half the existing systems were found to require repair or replacement.

Five staffers approve plans, and inspect and handle compliance. The budget is met partly out of tax revenues and partly by a \$53 per household semiannual fee. Special inspections or inspections for compliance are also charged for.

Problems encountered at Stinson Beach mostly had to do with delays as bugs were worked out and sudden demands were put on staff as well as private engineers and installers. One completely unanticipated problem: Access ports, required of system owners, were leading to a serious mosquito problem; redesign of the ports resulted. Then, in 1992, the RWQCB imposed a moratorium on new systems pending reevaluation of the program, revised (and tighter) technical, approval and tracking procedures, and the development of a more adequate staffing and fee structure. New ordinances were passed in 1994, and the program is back on track. Not without some growth pains, this 17-year old program is regarded as both successful and adaptable to other locales.

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Two neighboring Martha's Vineyard towns, Massachusetts

Buying time for alternatives

In what was to be a conclusion to fits and starts over more than twenty years, the Selectmen from the neighboring towns of Tisbury and Oak Bluffs (combined population of about 6000) were poised in July of 1995 to sign a consent decree with the Attorney General's office and the Massachusetts DEP. The decree outlined a schedule to plan, design, construct, and operate a conventional sewage treatment system, enabling the closure of each town's illegal septage lagoon. The estimated cost was about \$25 million. However, the plan would sewer only the downtown areas, leaving the question of failing systems and groundwater nitrogen elsewhere unaddressed. Furthermore, with EPA and state grant money essentially nonexistent, the plan was definitely cost-prohibitive in an area where 80 percent of the wastewater flow is seasonal. But the plan had the support of the Selectmen and "downtown" commercial interests whose desires for development and expansion had been thwarted by the wastewater problem. It had the seeming advantage of cost savings because of the two-town approach. At town meetings the proposed facility was alleged to be high on the list for FHA grant monies, when in actuality only an application had been filed; and the case was made repeatedly that the treatment facility was being forced by the DEP, whereas in reality, the DEP was open to other alternatives. On the strength of such arguments, both town meetings had previously approved warrant articles to build the sewers.

But, like many before it, the deal fell apart. A civic group formed in 1994, the Wastewater Coalition, had long felt that the plan was being railroaded; that it had not addressed the problems of nonsewered areas; may not have even properly identified the problems; and had insufficiently considered environmental and economic impacts of the treatment plant. Furthermore, there wasn't even agreement as to where to site such a facility. The Coalition wanted a closer look at alternatives. And it wanted a more open dialogue with greater public participation. On the latter point, it initially even had difficulty obtaining a look at the consent decree before the signing. After doing so, it was able to press for changes in wording that would enable a *genuine* examination of alternatives. The Coalition, at its own expense, brought in a West Coast consultant familiar with decentralized management (i.e. Engineers, Inc.). And, along with others, it pressed for filing an Environmental Notification Form (ENF) with the Executive Office of Environmental Affairs; the significance of which is the strong provisions in MEPA for early and meaningful public involvement in planning. The ENF response specifically provides for examining all alternatives. Politics shifted, and the two-town approach has, if only for now, suffered a setback. Voters in both towns have now tied approval of wastewater funding to a closer examination of alternatives, and have changed the makeup of their Wastewater Advisory Committees to reflect more open-minded approaches.

Histories like that on Martha's Vineyard occur throughout the state, and there are lessons to learn. The towns have already spent hundreds of thousands of dollars on studies and plans with little more to show than when the first plan was shelved in 1976. Efforts at consensus building, and organized public participation, have been weak. More recently, the consideration of alternatives had been too cursory. Finally, insofar as the state was issuing the orders, stronger state leadership, technical advice, and more clearly defined procedures and options might have avoided some of the false starts. On the Vineyard, the issue is far from over, and the passions still strong. The question is, there and elsewhere, how to keep the discussion moving forward, and how to arrive at a solution that sticks.

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Gloucester, Massachusetts

Exploring new approaches for Massachusetts' cities

Gloucester is a fishing port (population, 30,000) on the rocky coast of Cape Ann, about 40 miles north of Boston. While 40% of the city is sewerred, the particularly troublesome area of North Gloucester is not. Failed septic systems have resulted in the closing of shellfish beds, and since 1979 the city has been under a consent decree to comply by 1999 with state clean water standards. Numerous environmental problems were initially taken to imply that North Gloucester should be required to hook into the city sewer. These included shallow soil depth, a high groundwater table, wetland areas, and numerous private wells.

The hookup was partially underway when the EPA Construction Grants program was terminated in 1985, leaving Gloucester still with a problem, and still under a consent decree. Aware that centralized hookups would now become extremely expensive to homeowners, and also aware that the central sewer provided only primary treatment (albeit waived for the time being), the city began an examination of the many ramifications of decentralized management, and many discussions with the state's Department of Environmental Protection.

In ongoing negotiations for its consent decree, Gloucester is pioneering a new approach to wastewater management in Massachusetts. It is in the process of developing a citywide wastewater plan that avoids construction of additional conventional sewer lines by proposing STEP sewers and/or ensuring that all onsite systems are properly built and maintained. Small community systems and package plants would be administered by the city's Department of Public Works, although their ownership is still under discussion.

Individual systems would still be administered by the Board of Health, albeit in a framework tougher than the state's recently revised (Title 5) regulations. As it presently stands, key provisions relating to individual systems include the following: An initial inspection and pumping will be conducted by either Board of Health personnel or privately-licensed inspectors at the homeowner's option. Inspection will result in either an Operating Permit or an Order to Comply that stipulates upgrade or replacement requirements and a time frame for compliance. Regular inspections will follow, ranging from annual (for food industries) to every seven years (for residences). A BOH computer system now in development will record data from these inspections as well as from septage haulers. There are emergency repair provisions and financial relief (loan) provisions for qualifying homeowners to be funded through a Betterment Bill bond issue. The system is to be financed by license fees from professionals and by inspection fees from homeowners. Contractors and haulers will be licensed annually by the city, which will also conduct training programs. Enforcement will rely on the ultimate power of the BOH to make repairs itself and then invoice, with collection falling to the city and courts.

In areas unsuited for conventional systems, alternative technologies permitted by the DEP will be stipulated. For those, technical advice can be obtained from the DPW as well as the BOH. Such systems must be accompanied by three-year maintenance contracts with either the DPW or a licensed manufacturer/installer. In North Gloucester a National Onsite Demonstration Project is underway to test innovative systems yet to receive general state approval. Not all details of Gloucester's plans are settled, and final approval has yet to be obtained from the DEP, which, however, is being consulted as the plan is developed.

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Barnstable, Cape Cod, Massachusetts

Threading complexities systematically

The Town of Barnstable, like Gloucester, has a little bit of everything when it comes to wastewater management considerations. Its summer population more than doubles from a wintertime base of some 45,000. New development in the past two decades has been explosive. The municipal treatment facility is nearing capacity, especially considering nitrogen effluent limitations stipulated in the discharge permit. Even so, it serves less than half the commercial buildings in the town and less than 10% of the residences. The town is loaded with freshwater and brackish ponds; it is surrounded by over 100 miles of coastline, as well as wetlands, some of which are beginning to experience the effects of eutrophication; its water is drawn from a sole source aquifer under its sandy soils. There have been wells shut down and shellfish bed closures.

But Barnstable bears watching. It has proactive and cooperative Health and Public Works departments. And it is forward-looking. Culminating years of work, its DPW participated in installing a grinder-pump community septic system for a portion of the Red Lily Pond Development in 1988. This was funded through the state's Clean Lakes Program, and required DEP variances, given in this case because the town itself was willing to assume the ongoing burden of inspection and maintenance.

In that same year work was begun on a comprehensive wastewater plan that will address the full spectrum of wastewater treatment, from the central system to the smallest individual onsite remediations. This effort goes far beyond the DEP's original order to address problems at the treatment plant. Barnstable chose to take a townwide approach, anticipating problems ahead in nonsewered areas; and early in the "needs assessment" process negotiated with the DEP to develop a partially decentralized approach. Given Barnstable's location, the plan is also subject to the requirements of the Massachusetts Coastal Zone Management Program, and additionally by the local implementation (Local Comprehensive Plan) of the Cape Cod Commission's Regional Policy Plan.

It will be an extensive, multiyear effort to get through the three phases of planning, facilities design, and construction required of the DEP's State Revolving Fund stipulations. But Barnstable's strategy has been to coordinate; to involve every actor early, including not only the DEP, but the state's CZM office and, at the local level, virtually all commissions and agencies that have any stakes or responsibilities for ground or surface water. And its town staff are able to closely steer the consulting engineer and provide information to the Citizens Advisory Committee.

Midway through the facilities plan, and now examining treatment alternatives, there is still much discussion about where additional sewerage may be required to assure sufficient water quality control, and where it can be avoided. Barnstable is another Massachusetts municipality pioneering the comprehensive wastewater planning approach. Its experience will bear watching.

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Cape Cod Tri-Town Groundwater Protection District, Massachusetts

Modest but successful beginnings

Massachusetts *already has* onsite wastewater management entities. As a condition for receiving federal and state grant money to build a joint septage treatment facility (the Tri-Town Plant), three neighboring lower Cape towns were required to establish an onsite inspection and maintenance program. They created the Orleans, Brewster, and Eastham Groundwater Protection District, which required special enabling legislation drawn up in 1988. Implementation then followed in 1989, with the towns signing an intermunicipal agreement. The district operates in partnership with the individual town Boards of Health. Policy and procedure are determined by a three-member Board of Managers, each to represent, directly or by designation, the Chair of the Board of Selectmen of the several towns. The Board of Managers is supported by a Technical Advisory Committee consisting of three members from each town. An Advisory Board had originally drawn up the inspection and maintenance program for approval by the DEP. The newly created district staff, based at the plant (in Orleans), perform inspections as agents of the BOHs, but enforcement responsibilities remain with the individual BOHs. The BOHs also retain responsibility for inspecting upgrades of new systems; legal access to systems derives solely from BOH authority.

For the startup period the goal was to have every system inspected within three years; departments or committees within the individual towns (such as Conservation Commissions and Boards of Health) would identify environmentally sensitive areas to receive attention first. Thereafter, commercial systems would be inspected every year, and household systems every three years. One team of inspectors can inspect 30 units per day if owners have cooperated. The system is given a visual inspection for obvious defects; percentage of solids and a tank profile is determined; and the pH is measured. The owner may be verbally briefed at the time, but in any event receives an educational brochure, a report on the system, and, if necessary, an order to repair, pump, or replace—which comes from the BOHs after they have received an inspection report. The homeowner then chooses a contractor, who performs any required services and reports to the District.

Operational expenses at both the plant and for inspections are met with discharge fees (\$.07/gallon) levied on property owners. The plant also accepts septage not originating in the district, most recently charging \$.07.5/gallon discharge fees. Homeowners, who are provided with 45-day notice, are not charged for inspections, but are required to have the tank cover exposed. This has been a problem both of willingness and ability or knowledge. The cost of inspections to the district is not onerous, averaging about \$25 per system; but the towns' BOH workloads, funded through town budgets, have increased as well.

A computer database has been essential to the Tri-Town effort, which only has an inspection staff of three people to oversee some 15,000 systems. The database tracks the details of the properties, the systems, and their inspection, pumping, and maintenance history. It took more than a year to minimally functionalize the system.

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Much of the information on the structure and requirements of onsite management programs covered in this document is repeated extensively in government and consulting reports, facilities plans, and papers presented at society meetings heavily attended by government and consulting professionals. In consequence, giving original source attributions for ideas or concepts is not typically possible, and thus in-text references have been kept to a minimum. Most of the information has, however, been drawn from the sources that follow. Monographic titles, however long or short the work, are set in ***bold, italic***. Analytic works are set in **bold**, with the parent work set in *italic*. Trailing information concerns the "publisher," which in most cases is a government agency that may or may not be able to provide a document directly, but that should be able to explain how to obtain it. Many of the documents drawn on have been photocopies from various repositories, and sometimes have lacked complete bibliographic information. They are often treated as monographs or manuscripts.

Sources for the case studies are provided *with* the case studies, and are not necessarily repeated here.

Please note that in this listing "EPA" is used as the abbreviation for the U.S. Environmental Protection Agency (Office of Water, Washington, DC 20406). "NSFC" is used as the abbreviation for the National Small Flows Clearinghouse (West Virginia University, P.O. Box 6064, Morgantown, WV 26506-6064). The NSFC is an EPA funded information center. Most EPA documents concerning wastewater, as well as many documents from other sources, are available through the NSFC. (This fact is often noted in the references, but the absence of such a notation should not be construed to mean the document is *not* available from NSFC.) The NSFC also publishes several serials, including a newspaper, entitled ***Small flows***; a newsletter, entitled ***Pipeline***; and a professional journal entitled ***The small flows journal***. Information in this document has been drawn from many issues of those serials in addition to the references listed below. The NSFC is an excellent starting point for anyone researching wastewater management, and can be reached toll free at 800-624-8301.

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