SECTION 11

RECOMMENDED PLAN

11.1 INTRODUCTION

The previous ten sections of this report describe:

- the documentation of wastewater management needs;
- the identification and evaluation of available solutions for those needs; and
- the detailed evaluation of three distinct wastewater and nutrient management plans.

All of that evaluation and planning leads up to the identification of a single comprehensive plan which is described in this chapter.

11.2 DEVELOPMENT OF RECOMMENDED PLAN

11.2.1 Activities of the WMSC

The WMSC has met regularly during the development of the CWMP, generally twice per month. At those meetings, the Committee has reviewed numerous technical letters from its consultant, made interim decisions as the planning has progressed, and methodically narrowed its search for the best wastewater management plan.

Section 7 of this report summarizes the three wastewater plans that the Committee has evaluated in detail. Those plans all address the Total Daily Nitrogen Loads (TMDLs) that are in place or expected to be adopted to reduce watershed nitrogen loads under the federal Clean Water Act. Those plans are:

- **Plan 1:** Decentralized wastewater treatment at four sites and effluent disposal at eleven sites:
- **Plan 2:** Centralized treatment and disposal at the site of the existing Tri-Town Septage Treatment Facility; and

- **Plan 3:** Centralized treatment and disposal at sites in South Orleans and/or Brewster with summer spray irrigation of Brewster golf courses.

During the period of May to August 2008, those three plans were analyzed with respect to a number of cost, environmental and technical factors, and were the subject of significant public review.

11.2.2 Public Consultation Process

The entire wastewater planning process has benefited from an aggressive program of public consultation, led by both the WMSC and the Citizens Advisory Committee (CAC). That effort is summarized in Appendix C. Public consultation has taken many forms, including:

- Regular meetings of the WMSC that are televised and open to the public;
- Well-attended public meetings on each of three interim reports, at which the public raised many thoughtful concerns and insightful points;
- Periodic WMSC progress reports to the Board of Selectmen, which are televised; and
- A series of weekly workshops held Tuesdays evenings from July 7 to August 19, 2008. Six of the workshops were focused on individual neighborhoods in Orleans, and the last was open to the entire town. A total of 414 people attended.

The workshops included a series of posters describing the project, an overview by members of the WMSC and CAC, and the opportunity for the public to make comments verbally and in writing through a survey form. The posters were available for review at any time that Town Hall was open, and "walk-ins" could complete the same survey form available at the workshops.

The WMSC compiled a listing of all pertinent questions and comments raised at the workshops and tabulated the survey results. Questionnaires were received from 41% of the 414 attendees. Appendix C contains a summary of the survey results. The principal findings are as follows:

- Plan 2 was the most favorable plan to 70% of the respondents, with its lower cost the most often-cited supporting factor.
- Plan 1 was the least favored plan to 73% of the respondents. The most commonly cited drawbacks were the high cost and the need to acquire many private parcels of land.
- The effluent reuse aspect of Plan 3 was cited as a desirable feature, but offset by the uncertainties associated with dealing with a neighboring town which has yet to start its wastewater planning process.
- Many people suggested that town-wide sewers should be part of the selected plan, based on the concern that future more stringent environmental regulations may eventually force the Town in that direction, and the perceived fairness of providing comparable service to all residents.

11.2.3 Plan Selection

Based on its intensive deliberation over the three plans, the overall outreach program, and the specific broad-based input from the citizens attending the workshops, the WMSC voted to proceed with a program centered on Plan 2, supplemented with a number of features from Plans 1 and 3. Those supplemental features include the use of selected local treatment systems to allow early nitrogen control in headwaters embayments of Pleasant Bay (where the greatest need exists for nitrogen control), effluent reuse to allow recycling of the water and nutrients, and planning for town-wide sewers. Plan 2, with these supplemental features, is termed the "Recommended Plan".

11.3 OVERVIEW OF RECOMMENDED PLAN

From the outset of the CWMP process, the WMSC has recognized that a wastewater plan for Orleans must address a number of important issues:

- It must primarily address the significant problem of nitrogen overloading of coastal waters, as well as phosphorus loading threats to freshwater ponds.

- While traditional wastewater collection, treatment and disposal must form the central core of a wastewater plan, every effort should be made to reduce costs by maximizing the benefits of non-structural and non-traditional nutrient management techniques including such programs as control of lawn fertilization, stormwater management, and land use regulations.
- The nitrogen control needs estimated by the Massachusetts Estuaries Project, and implemented as TMDLs by DEP, are still in progress. The TMDLs are based on one likely nitrogen control scenario involving nitrogen load reductions across one or more sub-watersheds. Others scenarios may be possible and desirable.
- The estuarine environment is ever-changing, as evidenced by the April 2007 breach in North Beach.
- The DEP is undertaking a review of the technical basis for the nitrogen control requirements that will include a process for the Town to obtain the underlying models to investigate other control scenarios.
- The magnitude of the costs of nitrogen control dictate that both structural and non-structural steps be implemented in segments over time.
- Regionalization may be beneficial in terms of reducing project costs, and Orleans neighbors are not as far along as Orleans in the wastewater planning process.

Based on these realities, the Orleans WMSC has embraced the concept of "adaptive management". This approach to environmental protection recognizes the need to proceed with nutrient control programs at the same time that the full nature and extent of problem are being better determined. "Mid course corrections" are used to adjust the plan to reflect information that becomes available in the future. Accordingly, the Orleans CWMP has the following components:

1. Structural elements that will be constructed in segments within an overall plan;

2. Non-structural elements that will be implemented in a way that first documents their effectiveness and then allows their full application with predictable results and regulatory support, with the overall goal of reducing the cost of the structural elements;
3. Monitoring of surface waters to document the decline of water-column nutrient concentrations and the restoration of key habitats; and
4. Periodic re-assessment of progress toward cleaner waters and healthier habitats that leads to the refinement of the structural and non-structural elements.

The structural and non-nonstructural components of the Recommended Plan are discussed in the immediately following separate sections of this chapter. Monitoring and periodic reassessment are discussed in Section 11.6 entitled "TMDL Compliance Plan", where steps are outlined for the Town to make appropriate "mid-course corrections".

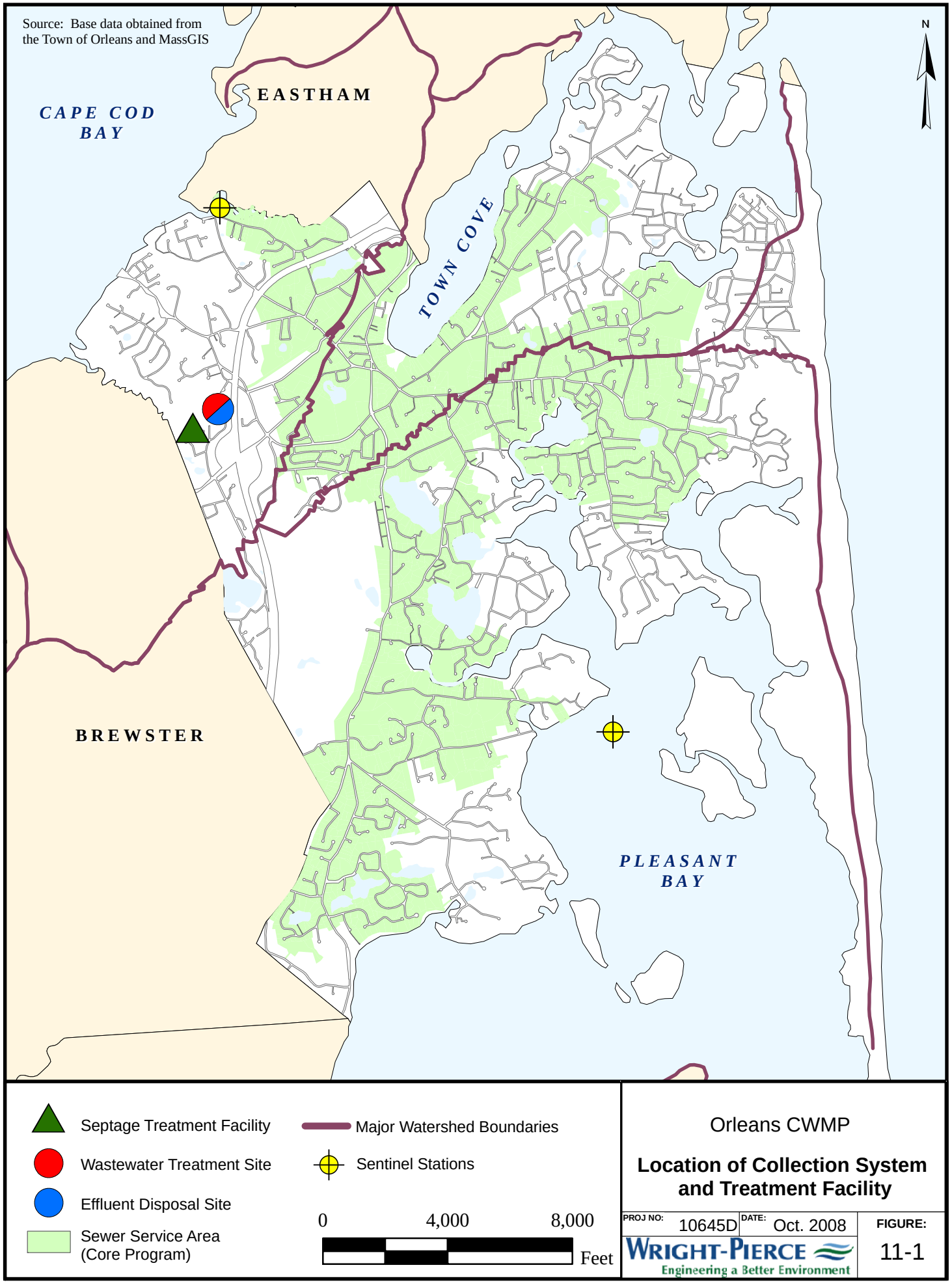
11.4 STRUCTURAL ELEMENTS OF RECOMMENDED PLAN

The structural aspects of the Recommended Plan include facilities for wastewater collection, wastewater treatment, effluent disposal and reuse, septage handling, and sludge disposal.

11.4.1 Wastewater Collection System

Wastewater will be collected from selected properties in the nitrogen-sensitive watersheds using traditional gravity sewer systems supplemented by sections of low-pressure sewer and grinder pumps where necessary to overcome steep terrain and difficult-to-access properties. Wastewater will be transported by conventional pump stations and force mains.

The physical extent of the collection system will primarily address nitrogen control needs, and will also allow the elimination of septic systems upgradient of most major freshwater ponds. Figure 11-1 shows an initial assessment of those areas of Orleans where septic systems would be eliminated to meet nitrogen and phosphorus control needs. This sewer service area is based on the goal of collecting as much wastewater nitrogen as necessary with the least amount of infrastructure.



Orleans CWMP

Location of Collection System and Treatment Facility

PROJ NO:	DATE:	FIGURE:
10645D	Oct. 2008	11-1

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The design of the collection system will reflect the possible eventual full sewering of Orleans should the Town later decide to take this step. Major trunk lines and pump stations will be designed for later expansion to be handle the larger wastewater flows, without actually investing capital funds at this time.

For convenience, the sewered areas shown in Figure 11-1 will be termed the "core" sewer service area, and the remainder of town will be termed the "extended" area. This distinction between the "Core Program" (intended to address documented needs, mostly nitrogen and phosphorus control) and the "Extended Program" (to enable full town sewering) will be carried forward to all aspects of the Recommended Plan.

The Core Program will serve about 2,800 properties with 390,000 feet of sewer pipe and generate an annual average flow of 640,000 gallons per day. The Extended Program, if needed or desired, would result in 1,140,000 gallons per day from about 5,300 properties served by 630,000 feet of sewer pipe.

11.4.2 Wastewater Treatment System

Collected wastewater will be transported to the site of the Tri-Town Septage Treatment Facility, near the intersection of Route 6 and Route 6A, where it will be treated to a high level that reflects the requirements of the DEP Groundwater Discharge Permit program. That high level of treatment includes the reduction of effluent total nitrogen to less than 10 mg/l and the removal of the vast majority of pathogenic organisms.

The treatment process will include the following steps:

- Screening and grit removal;
- Primary settling to remove suspended solids;
- Biological treatment to remove BOD, suspended solids and nitrogen;
- Secondary settling to remove the bacterial cultures created in the biological process; and
- Disinfection using ultraviolet light.

A control building will be provided to house offices, laboratory, electrical and mechanical spaces, and sludge dewatering equipment.

Figure 11-2 depicts the proposed layout of new wastewater facilities at the Tri-Town site as well as the existing septage facility there. Table 11-1 presents a summary of design data for wastewater collection, treatment and disposal. Appendix D contains more detail on treatment process sizing.

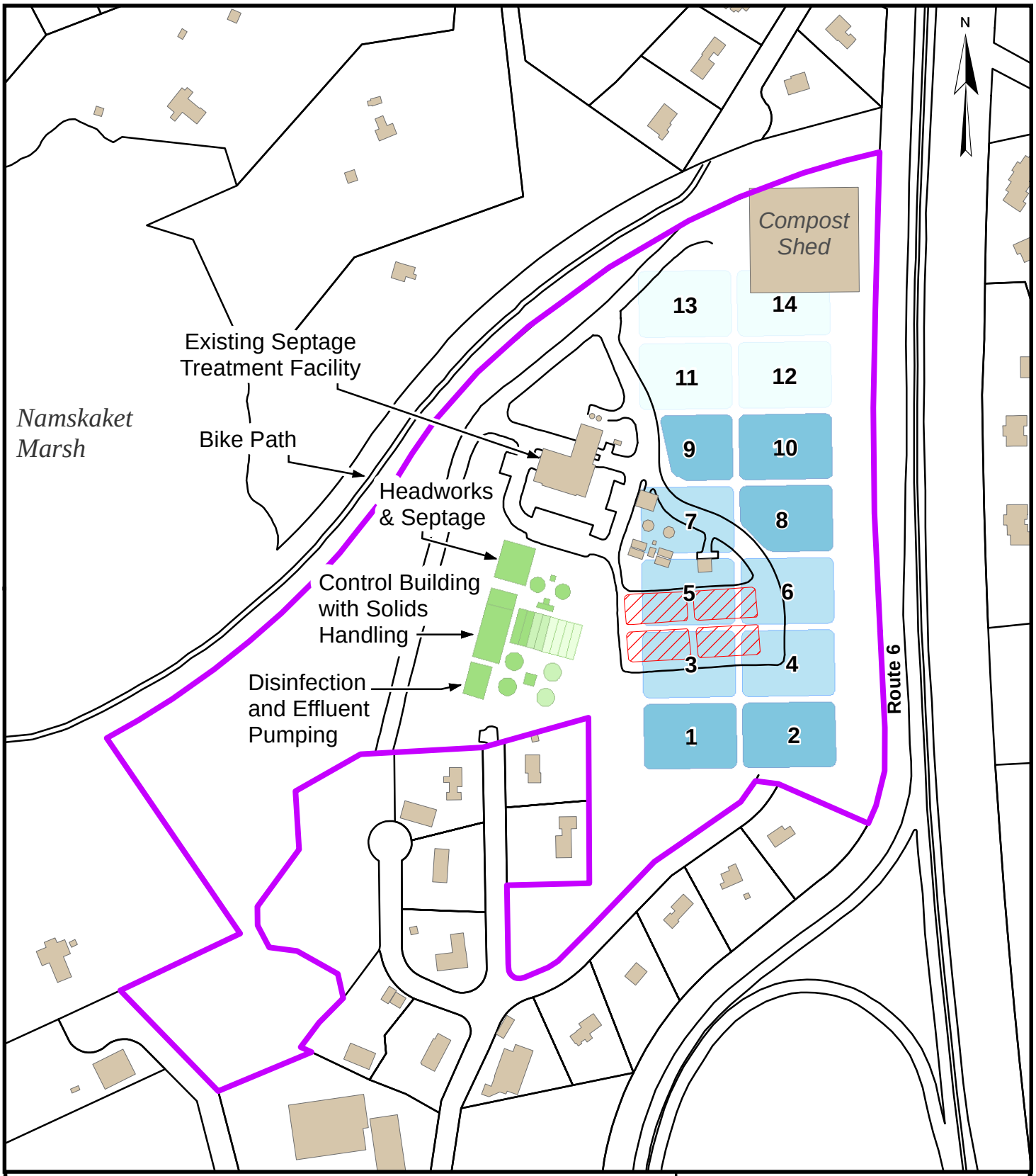
In concert with the Town's intent to implement wastewater solutions in segments, the treatment facilities will be built in phases. The first phase will provide capacity for treating one half of the wastewater to be collected in the Core Program. The site layout will also accommodate both the second half of the Core Program treatment capacity and the full treatment capacity needed for the Extended Program.

11.4.3 System for Effluent Disposal and Reuse

Effluent disposal will be accomplished through rapid infiltration, using a series of open basins located on the easterly and northerly portions of the site. Recharged effluent will mix with native groundwater and will flow away from the site toward Cape Cod Bay. The design of the rapid infiltration basins will be based, in part, on soil and groundwater studies conducted in 2007 and 2008 and summarized later in this chapter.

As with the treatment system, the rapid infiltration system will be constructed in segments. Based on currently available soils and groundwater data, the rapid infiltration basins have been sized on a composite loading rate of 7.7 gallons per day per square foot of infiltrative area. Further testing is needed to confirm this rate, but there appears to be capacity at the Tri-Town site for all of the effluent from the Core Program and some of the effluent from the Extended Program. Full town sewering, if needed or desired, will require one or more of the following:

- An additional effluent disposal site (or sites);
- The implementation of innovative vertical disposal systems (wicks) at this site;



Proposed Disposal Basins

- Phase 1
- Phase 4/5
- Extended Plan (Partial)

Proposed Wastewater Treatment Plant

- Phase 1
- Phase 4
- Extended Plan

- Tri-Town Property Line
- Existing Buildings
- Existing Disposal Basins

0 125 250 375 500 Feet

Orleans CWMP

Layout of Proposed Wastewater Treatment and Disposal Facilities at Tri-Town Site

PROJ NO:	DATE:	FIGURE:
10645D	Oct. 2008	11-2

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TABLE 11-1
WASTEWATER SYSTEM DESIGN DATA FOR CORE PROGRAM

Component	Wastewater System Design Data for Core Program	
Wastewater Collection	Properties Served	
	Pleasant Bay watershed	1,680
	Nauset watershed	880
	Rock Harbor watershed	270
	Total	2,830
	Length of Sewers, feet	390,000
	Number of Pump Stations	
	Wetwell/drywell	6
	Submersible	56
	Grinder pumps	78
Wastewater Treatment	Design flow, gallons per day	
	Annual average	640,000
	Maximum month	1,090,000
	Maximum 2-day	1,440,000
	Major Treatment Process	Biological Nitrogen Removal
	Effluent quality	
	BOD/TSS, mg/l	30
	Total nitrogen, mg/l	10
	Fecal coliform, col/100ml	200
Effluent Disposal	Method	Rapid Infiltration
	Loading rate, gal/day/square foot	7.7
	Number of basins	
	Total	10
	In use	8
Septage Handling	Participating Towns	
	Tri-Town District	Orleans, Brewster and Eastham
	Others	Based on market
	Design flows, gallons per day	
	Annual average	31,000
	Maximum month	50,000
Sludge Handling	Major Treatment Processes:	Decanting, Dewatering
	Disposal:	Contract Handling Off Site

- The implementation of an effluent reuse program.

Opportunities for effluent reuse are discussed in Section 10.

11.4.4 Facilities for Septage Handling

Septage disposal will be a continuing need in Orleans unless full town sewering is accomplished. While it is possible for the septage disposal function to be accomplished by the Tri-Town District, it will be more cost effective for the Town of Orleans to build a modern septage receiving station as part of the new wastewater facilities. Those facilities could be sized either for the Town of Orleans alone, for the three towns of the District (Orleans, Brewster and Eastham) or to also include other nearby towns. The septage that is received at the site will be pretreated to remove grit and coarse solids, stored and equalized, and then blended with the incoming wastewater for joint treatment.

11.4.5 Facilities of Sludge Handling

The solids that remain after wastewater and septage treatment will be decanted and dewatered, and trucked off-Cape for suitable reuse or disposal. The Town of Orleans should rely on private haulers for transport of dewatered sludge, and for the grit and screenings removed in the facility's headworks and in the septage receiving station. Wastewater solids will increase as the sewer system expands, offsetting the parallel reduction in Orleans septage solids.

11.4.6 Local Wastewater Management Systems

While the majority of nutrient removal will occur at new wastewater facilities at the Tri-Town site, the WMSC has chosen to incorporate several local "cluster systems" to provide more focused and rapid removal of nitrogen and phosphorus in certain areas.

Three small-scale systems will be built to provide interim nitrogen removal in the watersheds of Pah Wah Pond, Lonnies Pond and Arey's Pond. These coastal ponds, termed "headwaters"

embayments in Pleasant Bay, have some of the highest nitrogen control requirements. Each of these cluster systems will be sized to handle about 9,000 to 10,000 gallons of wastewater per day and provide nitrogen removal to about 15 mg/l. This nitrogen removal will allow faster estuary protection than traditional sewering which will not reach these areas until later phases of the Core Program. Once the centralized wastewater system reaches these areas, the cluster treatment and disposal systems will be abandoned, and the collection systems will be incorporated into the centralized system. Cluster systems were considered for Meetinghouse Pond, where complete removal of nitrogen is required by the TMDLs, but this sub-watershed can be served in the early phases of the central sewer system. One or more additional cluster systems will be considered upon release of the MEP report on the Nauset system, including one near Mill Pond.

By eliminating septic systems upgradient of freshwater ponds as part of the overall nitrogen control program, the phosphorus that enters the groundwater can be eliminated, providing some protection to these ponds for phosphorus enrichment. Investment in public infrastructure accomplishes two purposes in these situations. The municipal sewer system will not pass near Bakers Pond, however, so the Recommended Plan includes a cluster septic system to serve 15 developed upgradient properties. The purpose of this cluster system is to transport wastewater downgradient of the pond; phosphorus "removal" is actually "relocation" in this case because the cluster system will not include treatment processes that remove phosphorus from the wastewater.

The cost to design and construct the structural elements of the Core Program are presented in Section 11.11.

11.5 NON-STRUCTURAL ELEMENTS OF RECOMMENDED PLAN

The nitrogen control needs estimated in the MEP technical reports and set forth as TMDLs by DEP equal or exceed 50% for all nitrogen-sensitive embayments impacted by Orleans. These nitrogen removal percentages are high enough to require municipal sewering. Such structural solutions are expensive and should be supplemented by the non-structural elements discussed below. While these non-structural elements cannot alone solve the nitrogen problem, and most

are not recognized by DEP as fully proven techniques, they can serve as cost-effective supplements to the structural plan. They may allow cost reductions by making later phases of sewer expansion unnecessary. These non-structural elements are discussed in detail in Section 5 and Appendix B.

11.5.1 Fertilizer Control Program

For the Orleans-impacted estuaries studied by the Massachusetts Estuaries Project, about 7% to 10% of the watershed nitrogen load is associated with leaching of fertilizers applied to individual lawns and gardens, town parks and golf courses. If that fertilizer leaching could be avoided, then Orleans would need to eliminate fewer septic systems through its structural program. Fertilizer runoff is also a significant factor in the degradation of freshwater ponds.

The control of fertilizer nutrients will require a multi-pronged approach involving public education, policies on Town park and ball field fertilization, enhancement of subdivision regulations related to allowable lawn area and vegetation type, more controls on private lawn-care companies, and perhaps limitations on the amount or type of fertilizers that can be purchased locally. This multi-faceted program should be developed and implemented as soon as practical, so that its effectiveness can be demonstrated before the later phases of the structural program are initiated. A regional approach is likely to be required. This program must address the identified challenges of fertilizer control, including the import of fertilizer from outside the region, the widespread love of green lawns, the economic burden on certain businesses and the difficulty documenting actual application practices.

11.5.2 Stormwater Management

For the Orleans-impacted estuaries studied by the Massachusetts Estuaries Project, about 8% to 10% of the watershed nitrogen load is associated with stormwater disposal. The Town must improve its stormwater management practices and techniques to comply with its permit under the National Pollutant Discharge Elimination System (NPDES). (It holds a Small MS4 General

Permit under that program.) If these improvements can be implemented in the next few years, and the nitrogen removal effectiveness can be documented, then later phases of the structural program can be scaled back accordingly. Stormwater disposal is a significant contributor of phosphorus to freshwater ponds, and town actions on this front will improve pond water quality as well. The Orleans Board of Selectmen has already identified stormwater management as a high priority task and regular investments on infrastructure have already begun.

11.5.3 Water Conservation Program

Water conservation is a desirable goal because it reduces the Town's impact on groundwater supplies and indirectly saves energy. While water conservation does not reduce the nitrogen load in wastewater, it will reduce wastewater flows and decrease the costs of certain flow-dependent aspects of the structural program. Most important is the impact on effluent disposal facilities. Water conservation will reduce the cost of rapid infiltration, and can help forestall the need for a second effluent disposal location if the Town elects to provide town-wide sewers. The water conservation efforts of the Water Department should serve as the basis for this program and the Town should build on its recent successes. In light of the benefits to the wastewater system, the overall cost savings should be apportioned to both water and wastewater functions, to reflect the loss in Water Department revenues that water conservation can cause.

11.5.4 Flow and Load Reduction Initiative

In addition to water conservation, the Town should adopt a formal program to promote a reduction in wastewater flows and nitrogen loads.

The Board of Health now strictly enforces the Title 5 requirement to provide larger septic tanks and more leaching capacity for homes with garbage grinders. That program should be extended to include a Town ban on garbage grinders in all homes and a public education program should be initiated to emphasize the benefits to both sewered and unsewered properties. The reduction in nitrogen concentration in the wastewater reaching the new treatment facilities may allow later

phases to be somewhat smaller than otherwise. Reducing nitrogen loads from unsewered homes in nitrogen-sensitive watersheds will forestall the need for sewer extensions. As with all these non-structural elements, it will be crucial to set forth a methodology for confirming the nitrogen load reductions that actually occur.

Composting and urine-diverting toilets separate a high-nitrogen waste stream from the rest of the domestic wastewater. If a low-cost reuse or disposal method can be found for the separated urine or compost, then cost savings will accrue to the overall program. Such disposal methods are not now readily available, so the trade-off is between the costs of the municipal wastewater collection system and the cost of trucking the urine or compost to the wastewater treatment plant. To help establish the cost-effectiveness and public acceptability of composting and urine-diverting toilets, the Town should set up a pilot program of about 10 homes that would voluntarily installed these systems and allow their wastewater to be sampled and their costs to be formally documented. If that test program could be successfully completed in the early years of the project then its application to specific neighborhoods could lessen the cost of the structural program.

11.5.5 Enhancement of Embayment Flushing Rates

In certain embayments impacted by Orleans, the Massachusetts Estuaries Project has identified the opportunity to reduce the extent of necessary sewering by altering the hydrodynamics of the natural system. By increasing the flushing rate, the assimilative capacity of the embayment can be increased. In cases where the downstream water body is less nitrogen sensitive, this may be a low-cost measure with manageable side effects.

The benefits of this approach appear to be sufficient for it to be investigated in detail. That investigation would include a confirmation of the flushing rate changes, a detailed analysis of all costs (including dredge spoil disposal), and a frank assessment of the permitting hurdles. DEP has indicated a reluctance to allow a town any credit for this technique, in that it may entail periodic destruction of some or all of the habitat that the nitrogen control program is intended to

benefit. Further, there may be significant regulatory prohibitions related to new dredging projects in Areas of Critical Environmental Concern. In light of the fact that Rock Harbor and the inlets to Areys, Lonnies and Pah Wah Ponds have been historically dredged, these embayments should receive the first priority in the investigation. Studies should consider dredging both as a short-term measure (while structural elements of the Core Program are being implemented) and as a routine part of an on-going nonstructural plan.

11.5.6 Land Use Controls

Unsewered development in nitrogen-sensitive watersheds is the fundamental driving force behind the nitrogen loading problem. The costs of solving that problem can be reduced if the growth rate over the 20-year planning period is reduced below the 22% increase that has been the basis of planning to date. Further, an important funding mechanism now in place is only available for wastewater plans that are "growth neutral"; that is, plans that allow no more growth than would have occurred anyway under wastewater and zoning rules in place at the time of CWMP approval by DEP.

Two important land use controls should be pursued by the Town. The first is a regulation or bylaw that restricts development on sewered properties to that level that is allowed under Title 5 and current zoning.

The second measure is an accelerated program of acquisition of open space in nitrogen-sensitive watersheds. When one considers the full cost of extending the sewer system to capture future nitrogen loads, it may be cost effective to apply those funds to land acquisition. In some cases, it may be prudent to acquire land so that the nitrogen load from future development can be avoided, as well as to avoid other non-nitrogen impacts such as traffic.

The Orleans Board of Health has formulated a nutrient loading regulation that is intended to slow the rate of growth of nitrogen loads in unsewered areas and offset the growth that has already occurred since the start of the CWMP process and will occur prior to the first phase of the

wastewater facilities. Of the 22% growth factor included in the planning process to date, the nutrient loading regulation would offset about 2 to 5 percentage points. It should be adopted as soon as possible, and seriously considered as a continuing tool for managing nitrogen control even after the wastewater facilities are constructed.

Other land use tools are available to slow the growth of wastewater flow (the important issue in sewered areas) and the nitrogen load from septic systems (the operative factor in unsewered areas). Such measures should be held in abeyance until trends in growth can be better discerned.

With all these non-structural elements, it will be crucial to set forth a methodology for confirming the nitrogen load reductions that actually occur so that regulatory approval can be obtained for reductions in the structural program. Capital costs for evaluating non-structural elements of the Core Plan are presented in Section 11.11.

11.6 TMDL COMPLIANCE PLAN

For many U.S. communities, compliance with surface water quality standards is demonstrated by measuring the flow and contaminant concentrations in the discharge from a single municipal wastewater treatment plant, and comparing the results with a single discharge permit. The situation is much more complex on Cape Cod, where the nitrogen loads from a series of activities must be considered and compared with the TMDLs. The regulatory framework for demonstrating compliance is just evolving. DEP has made it clear that the ultimate compliance point is the restoration of habitat (eelgrass or bottom fauna), and that a town is not in compliance with the federal Clean Water Act until watershed nitrogen loads have been reduced to the point where that habitat is restored. The difficult regulatory issue is the travel time of nitrogen in the groundwater and the uncertainties associated with estimating how a reduction in watershed load will impact water-column nitrogen concentrations and how that reduction will lead to habitat restoration. Complicating the issue is the fact that the watersheds of most impacted embayments span multiple towns which may be proceeding with nitrogen control on different schedules and at different paces.

It is understood from discussions with DEP staff that achievement of the nitrogen load reductions implicit in the TMDLs is the only substantive mechanism for compliance over the short term. The threshold nitrogen loads that comprise the TMDLs are the only practical measure of progress, even though long-term monitoring may show that somewhat higher or somewhat lower nitrogen loads may lead to habitat restoration. (Elsewhere in this report, the nitrogen load reductions resulting from the Core Program have been shown to be consistent with published or expected TMDLs, and the added load from effluent disposal at the Tri-Town site has been shown not to exceed thresholds in the Namskaket and Little Namskaket systems.)

It is recommended that the Town of Orleans address this regulatory uncertainty through the phased implementation of a DEP-approved CWMP that includes multiple checkpoints and opportunities for "mid course corrections" based on a number of factors. The Town should be protected against enforcement action by state and federal entities under the Clean Water Act (including consent orders and fines) if:

1. DEP approves the CWMP;
2. The Town proceeds with the phased program outlined in the CWMP;
3. The Town complies with the groundwater discharge permit for the wastewater treatment facility;
4. The Town reports to DEP regularly on the information it will collect to document its progress implementing the plan, including monitoring of embayment water quality and habitat condition; and
5. The full implementation of the Core Program, or logical variations of it, results in whatever improved water quality is necessary to restore critical habitat.

To insure that the Town and DEP agree that the CWMP is being properly implemented, it is recommended that the Town submit an annual report to DEP that documents the following:

- The status of all of its activities called for in the CWMP;

- Spreadsheet-based estimates of the watershed nitrogen loads for all nitrogen-sensitive embayments;
- The results of the water quality monitoring program conducted during the year;
- The results of habitat assessments (may not be done every year);
- Documentation of the capital expenditures expected over the following 5 years, from the Town's Capital Improvement Plan;
- Progress made on non-structural elements of the CWMP; and
- Proposed changes in implementation (such as acceleration or delay of upcoming segments of the plan).

Since water use records form the basis for septic nitrogen loads, the Town should update the analysis reported in the Needs Assessment every five years and include the results in the next annual report to DEP. Similarly, the build-out projections should be updated every five years.

Any significant change from the program contained in the approved CWMP would be submitted to DEP as a formal CWMP amendment after appropriate citizen input and Town Meeting actions. The approved CWMP and approved amendments will document the Town's adaptive management approach.

11.7 PHASING OF FACILITIES CONSTRUCTION

It is recommended that the Town implement the structural and non-structural aspects of this wastewater plan as part of a phased program. The Core Program, aimed at nitrogen and phosphorus control, should be implemented in six steps. Upon completion of the Core Program, and if conditions warrant, an additional four phases could be implemented to effect the Extended Program of town-wide sewers.

The reasons for phased implementation of Orleans' wastewater plan include:

- The very high cost of building all needed facilities over a short time period.
- The potential benefit of adjusting Orleans' program to accommodate wastewater from neighboring towns whose planning is several years behind Orleans' program;

- Uncertainties in the degree and rate of habitat restoration associated with reductions in watershed nitrogen loads.
- Differing degrees of urgency with respect to declining water quality in various sub-embayments;
- Uncertainties in forecasting the location and rate of town growth;
- The need to synchronize watershed load reductions with other towns sharing a given watershed;
- The need to avoid wholesale disruption of large areas of town during sewer construction; and
- The benefits of demonstrating at full scale the potential capabilities of the Tri-Town soils to accept wastewater at higher rates than currently predicted.

It also should be recognized that phasing has some disadvantages, including:

- The added cost and complexity of segmented construction;
- The risk of missing out on favorable financing that will not be available after 2019.
- The risk that the public bidding process will yield different manufacturers of key treatment equipment from one phase to the next.

While these disadvantages should be considered, they are of less importance than the issues discussed above.

Table 11-2 summarizes a possible phasing plan. It shows the six phases, the structural elements that should be included in each phase, and the activities that should be completed prior to the start of each phase. Phase 1 is the most intensive of the six phases, and includes the construction of one half of the needed capacity for wastewater treatment and disposal, and all of the septage handling capabilities. The remainder of the treatment and disposal capacity would be built in Phases 4 and 5. All of the phases include sewer construction, as the wastewater collection system is gradually expanded to reduce watershed nutrient loads consistent with the available

TABLE 11-2

PRELIMINARY PHASING PLAN FOR CORE PROGRAM

Phase	Construction Elements, % of Core Program	Actions and Decisions to be Considered Before Start of Next Phase
		Completion and validation of MEP studies
		Acceptance of TMDL Compliance Plan by DEP
		Resolution of real estate issues with Tri-Town District
		Preliminary design of all facilities
		Final design of Phase 1 facilities
1	50% Treatment	
	50% Disposal	
	20% Collection	
	100% Septage	
	100% Land	
		Final design of Phase 2 facilities
		Viability of flushing enhancements
2	15% Collection	
	100% Local Systems	
		Final design of Phase 3 facilities
		Viability of flow/load reduction measures
3	15% Collection	
		Final design of Phase 4 facilities
		Results of fertilizer reduction program
		Results of stormwater management program
		Viability of So. Orleans regional facility and commitment from Brewster
		Viability of Nauset regionalization and commitment from Eastham
4	50% Treatment	
	25% Disposal	
	15% Collection	
		Final design of Phase 5 facilities
		Results of full-scale rapid infiltration testing
5	20% Collection	
	25% Disposal	
		Final design of Phase 6 facilities
		Results of all efforts to reduce non-structural program
6	15% Collection	

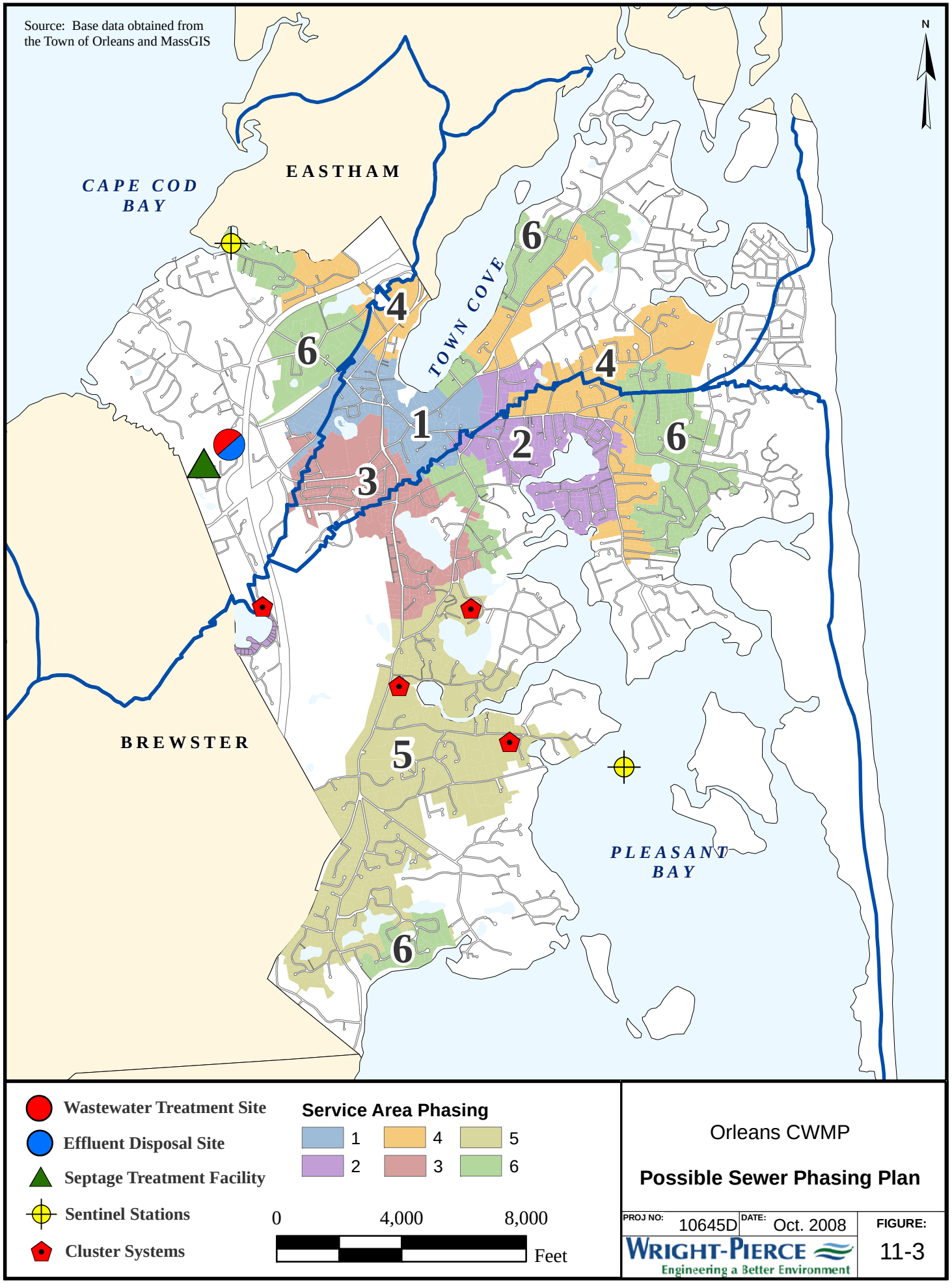
Note: 1) Annual reports to DEP will document results of water quality monitoring and estimates of reductions in watershed nitrogen loads, both of which will be formally assessed prior to the initiation of each phase.
2) Progress by Eastham and Brewster (toward nitrogen removal in watersheds shared by Orleans) should be monitored throughout the Core Program.

capacity for treatment and disposal.

Figure 11-3 depicts the geographic location of the six sewer phases. The first five phases reflect the sometimes competing goals of: a) logical geographic expansion, and b) the desire to reach the most threatened embayments as soon as possible. The inclusion of cluster systems for Lonnies Pond, Arey's Pond and Pah Wah Pond will help to bridge the gap between these competing priorities. The sixth phase will include extensions of the sewer system throughout town to reflect growth over the implementation period.

The possible phasing plan shown in Figure 11-3 would focus first on the downtown area, where the most nitrogen can be collected with the least amount of infrastructure. Phase 2 would start to address nitrogen control needs at Meetinghouse Pond and The River, and continue the extension of the collection system in an easterly direction. Progression from phase to phase is dictated by the geography of Orleans, the need to build a logical core of the sewer system, and the location of the most stressed coastal waters.

Table 11-3 shows how the watershed nitrogen and phosphorus loads will be reduced in each phase of the Core Program. Phase 1 will provide some nitrogen removal in the Rock Harbor, and Town Cove watersheds, while providing enough wastewater flow for effective treatment. Substantial removal of nitrogen will be accomplished by Phase 2 for the Meetinghouse Pond watershed, the one with the highest nitrogen control needs. More than 80% of the required nitrogen removal will occur by Phase 4 for the Nauset system, by Phase 5 for Pleasant Bay and by Phase 6 for Rock Harbor. Four of the six high priority ponds will be served by Phase 4. The inclusion of clusters systems in the Pleasant Bay watershed accelerates the progress toward TMDL compliance by about 10 percentage points in Phases 2, 3 and 4.



Orleans CWMP

Possible Sewer Phasing Plan

PROJ NO:	DATE:	FIGURE:
10645D	Oct. 2008	11-3

WRIGHT-PIERCE
Engineering a Better Environment

Monday, September 22, 2008 2:10:45 PM W:\GIS_Development\Projects\10645B-Orleans\RecommendationPlan\Fig11-3.mxd

TABLE 11-3
NUTRIENT LOAD REDUCTION BY PHASE

	Percentage of Required[a] Nitrogen Removal			
Phase	**Pleasant Bay**	**Nauset System**	**Rock Harbor**	**Ponds [b]**
1	<1	30	34	
2	24[c]	32	34	Bakers*, Reubens
3	31[c]	52	39	Crystal*, Boland's*
4	44[c]	86	49	Ice House*
5	80	86	49	Pilgrim*, Shoal*, Uncle Seths, Twinings
6	100	100	100	Cedar*, Uncle Harveys

Notes: (a) "Required" includes Pleasant Bay TMDLs, Rock Harbor MEP technical report and preliminary Nauset estimates.
(b) * Denotes the first and second priority ponds identified in Table 3-4.
(c) Cluster systems represent about 10 percentage points in Phases 2, 3 and 4.

The reader is cautioned that the sewer phasing depicted in Figure 11-3 is but one of many possible approaches. Other options should be considered during the finalization of the CWMP, based on further technical studies, financial analyses and public input. The Town is encouraged to undertake a healthy debate over the speed with which TMDL compliance will be reached and the prioritization of expenditures by watershed.

Phases 1 and 2 of the Core Program are critical early building blocks of this program and should be implemented as soon as is practical. For initial discussion purposes, it is expected that all six phases of the Core Program will be built over 15 to 20 years, and that the Extended Program will require another 15 to 20 years. Detailed financial planning will be needed to determine if the Town can practically meet those broad preliminary goals.

11.8 REGIONALIZATION

Benefits may accrue to the Town of Orleans if it shares its proposed wastewater facilities with other towns. The two best opportunities are associated with Eastham and Brewster.

The Town of Eastham will be required to remove nitrogen from the Nauset embayment, just as will Orleans. Eastham's options include building its own wastewater facilities and sharing facilities with Orleans. A preliminary estimate of Eastham's nitrogen control needs in that watershed translates to about 80,000 gallons of wastewater per day on an average annual basis. Pending completion of ongoing regionalization studies, Orleans should consider reserving capacity for Eastham's wastewater in the proposed new facilities at the Tri-Town site, based on the expected cost advantages to both towns. Since Eastham has yet to begin formal wastewater planning, its decision-making process may not allow participation in Orleans' first-phase project. It would be prudent however to keep the lines of communication open with Eastham with the possibility of including capacity in a later phase.

Nitrogen loads from the Town of Brewster are estimated to be about 11% of the total nitrogen loads to Pleasant Bay. Those loads exist in the watersheds of sub-embayments that are nitrogen sensitive; consequently some degree of nitrogen control is required. The phased construction of wastewater facilities at the Tri-Town site will allow the Town of Orleans to monitor Brewster's progress with wastewater planning and possibly to participate with Brewster in a Pleasant-Bay focused regional solution, similar to Plan 3, but involving wastewater only from South Orleans. That facility could also include flow from easterly portions of Harwich and northerly neighborhoods of Chatham. The deferral of sewer construction in South Orleans until Phase 5 (see Tables 11-2 and 11-3 and Figure 11-3) is intended to accommodate that decision-making process, based on the expected cost advantages.

The Town of Orleans is evaluating these regionalization opportunities under a grant from the Cape Cod Water Protection Collaborative. That study will not be complete until after the publication of the draft CWMP, but its results can be incorporated in the final CWMP.

Regionalization opportunities also exist with respect to septage. The new Orleans wastewater facilities will include capacity for Orleans septage, and can also provide for septage from Eastham, Brewster and other nearby towns. The regional concept has been successful in the Ti-Town District, and an expansion of that relationship to include cooperation on wastewater management may be beneficial to Orleans, Eastham and Brewster.

11.9 SOIL AND GROUNDWATER STUDIES AT TRI-TOWN SITE

11.9.1 Studies Conducted to Date

To determine the suitability of the Tri-Town site for wastewater disposal, studies have been undertaken to characterize the site soils and to model the local and regional groundwater movement. The first evaluation, including a large-scale hydraulic loading test, was completed in February 2008 and is reported in Appendix E. Appendix F includes a report on the second evaluation, which focused on groundwater mounding and regional groundwater flow, and that was completed in June 2008.

These studies were conducted to address four potential limitations on effluent disposal at this location. Those potential limitations, and the results of these studies, are as follows:

Surficial Soil Permeability. The surface soils must be sufficiently permeable to accept the quantities of wastewater that will be applied during the highest periods of the design year. Based on preliminary layouts of the site, a loading rate of more than 6.7 gallons per day per square foot is needed to be able to properly dispose of the effluent quantities expected at the completion of the Core Program. Permeabilities were determined to be somewhat variable across the site, but sufficient to allow a composite loading rate of 7.7 gallons per day per square foot. Therefore the site has capabilities for effluent disposal beyond the Core Program.

Mounding. The application of wastewater effluent will cause the groundwater to rise in a mound under the site. Analytical and numerical modeling shows that the top of the mound will be no closer than 25 feet below the ground surface, well below the 4-foot minimum separation required by DEP.

Local impacts of Mounding. The higher groundwater resulting from effluent application at the site must not cause flooding of the basements of nearby homes, unacceptable reductions in separation of local septic systems from the seasonal high water table, and substantial surface water flow into nearby wetlands. The groundwater modeling shows that the mound dissipates quickly downgradient from the site, and that such impacts will not occur.

Disposition of Effluent-Impacted Groundwater. The wastewater effluent will contain low levels of nitrogen. The regional groundwater flow will carry that nitrogen downgradient to Cape Cod Bay and associated wetlands. Groundwater modeling shows that the new nitrogen loads from effluent disposal will not cause the overall watershed loads to exceed their respective assimilative capacities, as reported in the draft MEP technical reports. The modeling shows that none of the effluent nitrogen will flow to Town Cove or Rock Harbor, two systems that are believed to be already over their nitrogen thresholds.

11.9.2 Future Testing Program

The testing program at the Tri-Town site has been sufficient to confirm its suitability for the quantities of effluent expected from the Core Program, and a bit beyond. During the preliminary design phase of the project, additional soil testing is warranted to determine the site's capabilities in areas not yet tested. Further, once the first phase of effluent disposal facilities is constructed and placed in operation, those initial rapid infiltration basins should be subjected to full-scale testing as the best way to definitely determine long-term capacity. That testing will be very helpful in the design of later phases of the effluent disposal facilities, with possible cost savings.

11.9.3 Long-term Monitoring Plan

Once operation of the new wastewater facilities begins, the groundwater impacts will be measured through a series of monitoring wells within and around the periphery of the site. Those monitoring wells will be used to confirm the mounding analysis reported herein and will form the basis for possible future actions. Monitoring wells downgradient from the site will be used to discern any higher-than-expected water table elevations that might impact cellars or septic systems.

11.10 IMPLEMENTATION STEPS

The recommended wastewater management plan is a complex one, with multiple phases, structural and non-structural components, and significant financial impact on the Town. Many administrative steps must be taken to properly implement the plan and ensure its efficient and effective operation.

11.10.1 Establishment of A Managing Entity

With no existing wastewater facilities and no public works department, the Town of Orleans must create a management entity for this Plan. Significant steps in this direction have been taken through a change in Town charter that will allow the formation of a Board of Water and Sewer Commissioners, incorporating and building on the existing Board of Water Commissioners. The final step in its formation will be a town-wide ballot question in the spring of 2009. Assuming passage, the next important step will be the assignment of existing staff or hiring of an individual to serve as Wastewater Superintendent. That person can have a vital role in the implementation of this plan. Other tasks include developing and implementing a staffing plan (including certified operators and a project manager for construction), making arrangements for office space, deciding on a method of internal financial management (enterprise fund versus special revenue fund) and determining appropriate interfaces with other Town departments and boards.

11.10.2 Land Acquisition

It is generally advisable for a town to identify all of the parcels it must acquire for the project and to acquire them (fee simple interest or easement) at the beginning of the project. Parcel identification should occur as part of preliminary design activities slated to begin in 2009. The extent of sewer construction in private roads should be addressed through a comprehensive easement process.

11.10.3 Regulations, Bylaws and Policies

Existing Town codes should be supplemented with bylaws and regulations that enable the Town to effectively implement the proposed wastewater plan.

The Town should adopt a regulation or bylaw that restricts flow from sewered properties to the maximum flow that the parcel could sustain under Title 5. Such a limitation is necessary to obtain the most favorable funding under the State Revolving Fund, and, for consistency with the overall goal of formulating a "growth neutral" wastewater plan.

One of the most fundamental needs is for a set of Sewer Use Rules and Regulations. These would establish policies and procedures related to new sewer connections, allowable and prohibited discharges, user fees, and many administrative matters. These Rules and Regulations should be drafted by the Water and Sewer Department staff, with assistance from the Town's wastewater consultant, and promulgated during the design phase of the Core Program.

As part of the Sewer Use Rules and Regulations, the Board of Water and Sewer Commissioners should detail the requirements and restrictions related to a "checkerboard" sewer system. These provisions should be in accordance with the 2008 Environmental Bond Bill, or the Town's separate special legislation, or both. The Town must have clear authority to reject an application for sewer service if the connection of that property is not in accordance with the CWMP. The clearest example of this restriction is where the wastewater collection system must pass through watersheds that are not nitrogen sensitive, such as the Namskaket and Little Namskaket systems.

It may also apply when applications are made to connect lightly developed neighborhoods with a relative high cost of service per foot of collecting pipe.

Another important document is the User Charge System. This plan establishes the basis for billing for wastewater services. It should be drafted by the Water and Sewer Department staff, with assistance from the Town's wastewater consultant, and adopted during the design phase of the project.

The Orleans Board of Health has drafted and received public input on a nutrient control regulation that is intended to slow the growth of nitrogen loading in the watersheds of sensitive embayments and to account for some of the growth in nitrogen load that has occurred since the start of the planning process (and that will continue to occur through the completion of Phase 1 facilities). That regulation should be adopted in the near future and its effectiveness and need re-evaluated when Phase 1 facilities come on line.

The Board of Health should adopt a policy that allows the deferral of construction of new septic systems, particularly those that include enhanced treatment systems, for properties to be included in the early phases of sewer construction. Such deferral should be accompanied by the placement in escrow the avoided costs to be later applied toward that property's betterment assessment.

A policy on private wastewater facilities should also be adopted by the Board of Health. That policy should establish guidelines for the use of nitrogen-removing septic systems in the watersheds of nitrogen-sensitive embayments, and town-wide. In general, the Town should not encourage nitrogen-removing systems on individual lots, since the extent of the sewer system has been formulated to allow all unsewered parcels to get by with simple Title 5 systems, and expenditures for individual nitrogen removing systems are a diversion of capital. Exceptions may be needed for near-shore-areas located in the later phases of the Core Program, where the time needed to provide public sewer may be comparable to the design life of the individual

system. Another exception would involve situations where enhanced treatment is needed to address public health issues related to inadequate setbacks or depth to groundwater.

11.10.4 Permitting

There are a number of regulatory programs and permitting requirements that apply to the planning, design and implementation of the Recommended Plan. These include:

- DEP approval of the CWMP.
- DEP Groundwater Discharge Permitting under 310 CMR 5.0. A groundwater discharge permit is required for the new wastewater facilities planned for the Tri-Town site. Depending on the plan for short-term septage management, the existing permit held by the Tri-Town District may need to be extended for two or more years beyond its current 2012 end date.
- Compliance with the federal Clean Water Act through nitrogen-based TMDLs as implement by DEP.
- DEP Reclaimed Water Guidelines will apply to any effluent reuse activities.
- DEP Plan Review is required for the proposed new wastewater treatment facility, once final plans and specifications have been prepared.
- DEP Site Assignment under MGL Chapter 83 Section 6 is required for any publicly-owned wastewater site. The existing site assignment for the Tri-Town site will probably need to be expanded to account for the proposed wastewater facilities
- DEP Sewer Extension Permits will be needed for system expansion after completion of the first phase.
- Compliance with the Massachusetts Wetlands Protection Act and local supplemental bylaws is necessary for all impacts on protected resources.
- The project must be reviewed under the requirements of the Massachusetts Environmental Policy Act (MEPA) which will require both an Environmental Notification Form and an Environmental Impact Report.

- The project must comply with the Cape Cod Commission's Regional Policy Plan and undergo review as a Development of Regional Impact (DRI).
- Review must be conducted under the Massachusetts Natural Heritage and Endangered Species Program, pursuant to the Massachusetts Endangered Species Act.
- Review must be conducted under the program of the Massachusetts Historical Commission.
- All activities must be consistent with the two Areas of Critical Environmental Concern.
- Compliance with the regulations of the Old Kings Highway Regional Historic District is required for above-grade structures located in the District (all areas of Orleans north and west of Route 6A).
- The Town must issue building permits for treatment facilities and pumping stations after compliance with the State Building Code is demonstrated.
- Permits are required from Mass Highway for all construction work in state roads.

Compliance with these programs must be demonstrated at various stages of project development.

11.10.5 Coordination with OBEGWPD on Septage Management and Land Requirements

Septage and grease wastes pumped from properties in Orleans are now disposed of at the Tri-Town Septage Treatment Facility. The buildings, tanks and equipment are owned and operated by the Orleans Brewster Eastham Groundwater Protection District (OBEGWPD). The 26-acre site is owned by the Town of Orleans.

Phase 1 wastewater facilities could be built at the Tri-Town site on land not currently used by the District. This would allow septage handling in District facilities during the construction period. The Phase 1 wastewater facilities should include new modern septage handling facilities, which, once completed, can replace the aging plant and equipment owned by the District. Therefore, the Tri-Town facilities could be abandoned, demolished or partially reused once Phase 1 is complete. The proposed construction by the Town of Orleans on the Tri-Town site would

require an amendment to the existing inter-municipal agreement if construction is to occur before 2015. (Resolution of real estate issues with the Tri-Town District will require a full legal review of the inter-municipal agreement and development of alternatives by the Orleans Board of Selectmen for discussion with its counterparts in Brewster and Eastham.)

New septage handling facilities should be sized for the reduced septage quantities from Orleans. They can also include capacity for septage from Eastham and Brewster, the other members of the District, as well as from other nearby towns. Groundwater modeling and nitrogen mass-balance analyses have demonstrated that a regional septage handling capability will not cause the assimilative capacities of Namskaket and Little Namskaket systems to be exceeded.

To ensure a smooth transition, the Town of Orleans should:

- Make whatever arrangements are needed to build Phase 1 facilities on the land the Town owns at the Tri-Town site that is not currently used by the District.
- Coordinate with Brewster and Eastham Boards of Selectmen on the abandonment, demolition or reuse of District buildings and tanks;
- Support the development of a contingency plan to address potential major equipment repairs and funding limitations; and
- Approach towns in the region to discuss providing dedicated capacity in the new wastewater facility for septage receipt and treatment.

Those discussions should begin in the near future, with a goal of obtaining Eastham and Brewster concurrence with the septage management aspects of the Recommended Plan by late 2008. The contingency plan should be completed in early 2009. Clear access to the site should be obtained by mid 2010.

11.10.6 Coordination with Brewster and Eastham on Wastewater Regionalization

The Town of Orleans has embarked on a wastewater regionalization study, funded by the Cape Cod Water Protection Collaborative, which is expected to show that cost savings can accrue to

both Orleans and its neighbors through shared wastewater facilities. That study will be completed after the issuance of the draft CWMP, but before the final CWMP is completed. Orleans should address the recommendations of that study as soon as they are available and if appropriate, begin discussions with Eastham and Brewster to be able to adjust the phasing program to reflect possible participation by those towns. These discussions should be part of a DEP-mediated assessment of watershed-wide progress toward TMDL compliance.

11.10.7 Pond and Estuary Monitoring

A critical part of the Town's adaptive management approach is the monitoring of water quality in its ponds and sensitive embayments. With respect to the nitrogen-based TMDLs, monitoring is needed to demonstrate eventual compliance. As important, however, is regular monitoring to establish baseline conditions and then to track progress toward the TMDLs that will allow adjustment of the phased program. Monitoring must include water column concentrations of nitrogen and other key parameters, as well as periodic assessments of eelgrass coverage and the number and diversity of bottom organisms.

The Town should work closely with the Pleasant Bay Alliance which is developing a monitoring program for that estuarine system in conjunction with DEP. The Pleasant Bay monitoring program should serve as good basis for similar programs for other embayments impacted by Orleans. Existing pond monitoring programs should be reviewed and adapted as necessary to track improvements related to phosphorus loading. The final CWMP will present a summary of those programs based on progress expected in late 2008 and early 2009.

While wastewater sources of nitrogen dominate the nutrient loading to coastal waters, freshwater ponds receive phosphorus loads from other significant sources such as runoff, waterfowl and benthic recycling. The Town should systematically evaluate all of its major freshwater ponds to determine what other phosphorus controls are needed to supplement the reduction in wastewater loadings effected through the Core Program.

11.10.8 Energy Conservation/Generation and Green Design

Wastewater management facilities use large amounts of energy to run equipment, to heat and ventilate structures and to fuel vehicles. An energy conservation plan should be developed as part of the preliminary design of the structural elements of the Core Program to ensure that all cost-effective energy conservation and generation options are appropriately considered. At that time, the decision should be made on whether or not to pursue LEED certification of the major buildings associated with the wastewater treatment plant. The LEED program (Leadership in Energy and Environmental Design) establishes benchmarks against which building design can be judged, and should be pursued to the extent that the program identifies capital expenditures with reasonable pay-back periods.

The Tri-Town site is being considered as the location for a Town wind turbine. The preliminary design of wastewater facilities should be closely coordinated with the efforts of the Town Renewable Energy/Wind Committee to ensure appropriate synergy.

11.10.9 Water Service to Properties Near Wastewater Disposal Locations

While the design and siting of all new wastewater facilities will be in full accordance with all applicable regulations and codes, it would be prudent for the Town to ensure that public water service is provided to all developed properties located downgradient from all effluent disposal locations.

11.10.10 Implementation Schedule

Some of the many important implementation steps are summarized in Table 11-4, which includes a tentative schedule for action.

Assuming Special Town Meeting endorsement of this draft CWMP in late October 2008, the final CWMP should be prepared over the following eight months, for publication by June 2009. Many important steps should occur during the finalization of the CWMP, including completion of the Regionalization Study, completion and validation of MEP technical studies, and additional

soils testing at the effluent disposal site. The Final CWMP should be submitted to DEP for approval with a target approval date of October 2009.

This CWMP is subject to review by the Executive Office of Environmental Affairs under the Massachusetts Environmental Policy Act (MEPA) and by the Cape Cod Commission as a Development of Regional Impact (DRI). A joint review process has been established, with a goal of completing this review in the fall of 2009.

Table 11-4 also lists the key steps in the preliminary and final design processes, leading up to bidding of Phase 1 construction contracts early in 2012, to allow the start of construction in July of 2012. Once the preliminary design is complete for the sewer system, it should be coordinated with the Town's road maintenance plan and any actions intended to take over private roads that may otherwise be subject to easements.

Important administrative steps are outlined in Table 11-4. These include establishing the Board of Water and Sewer Commissioners in 2009, completing the financing plan and hiring a wastewater superintendent in 2010, adopting Sewer Use Rules and Regulation and a User Charge System in 2013 and dealing with the termination of the Tri-Town District in 2013 to 2015.

11.11 FINANCIAL PLAN

11.11.1 Current Estimates of Cost

As a basis for cost estimating, preliminary sizing has been conducted for the various structural elements of the recommended plan, including the collection system, the central treatment system, the effluent disposal facilities, the local treatment and disposal systems, and the septage handling facilities. This preliminary sizing information has been used to estimate the costs to build and operate the structural facilities.

TABLE 11-4
SCHEDULE FOR IMPLEMENTATION TASKS

CWMP Completion	
Complete Draft CWMP	Late Sep 2008
Submit MEPA Environmental Notification Form (ENF)	Early Oct 2008
Public Hearing on Draft CWMP	Oct 2, 2008
Special Town Meeting to Endorse Draft CWMP	Oct 27, 2008
EOEA Secretary's decision on ENF	Late Nov 2008
Additional soil investigations at Tri-Town site	Nov--Dec 2008
Completion of Regionalization Study	Dec 2008
Modifications to CWMP for MEP Nauset report	Jan 2009
Decisions on phasing	Feb 2009
Completion of DEP review of MEP models	Apr 2009
Confirmatory embayment modeling	Apr--Jun 2009
Complete Final CWMP	Jun 2009
Submit CWMP to MEPA as EIR	Jun 2009
EOEA Secretary's decision on EIR	Sep 2009
DEP approval of Final CWMP	Oct 2009
Design and Construction	
Annual Town Meeting appropriation for preliminary design	May 2009
Begin preliminary design	Jul 2009
Submit application for Groundwater Discharge Permit	Oct 2009
Complete preliminary design	Apr 2010
Conduct land surveys	Mar--May 2010
Annual Town Meeting appropriation for final design and land acquisition	May 2010
Obtain Groundwater Discharge Permit	Jun 2010
Begin final design for Phase 1 facilities	Jul 2010
Complete design for Phase 1 facilities	Sep 2011
Bidding for Phase 1 facilities	Jan--Feb 2012
Annual Town Meeting appropriation for construction of Phase 1 facilities	May 2012
Award construction contracts	Jun 2012
Start construction of Phase 1 facilities	Jul 2012
Complete Phase 1 construction and start-up Phase 1 facilities	Jun 2014
Administrative Items	
Annual Town Meeting approval of "growth neutral" bylaw	May 2009
Voter approval of Board of Water and Sewer Commissioners	May 2009
Complete financing plan	Jan 2010
Complete site assignment	Jul 2010
Hire wastewater facilities superintendent	Jul 2010
Obtain access to Tri-Town land	Oct 2010
Hire staff for wastewater facilities	Jul 2013 to Jun 2014
Adopt Sewer Use Rules and Regulations	Jan 2013
Adopt User Charge system	Jan 2013
Issue Tri-Town termination notice	May 2013
Terminate Tri-Town Intermunicipal Agreement	May 2015
File SRF Project Evaluation Form	Aug 2009
Complete O&M Manual	Jan 2014

11.11.2 Capital Costs

The capital costs of a public infrastructure project include both the costs of construction and the ancillary expenses for land, design, construction oversight, start-up and other essential items needed to create a self-sustaining system. Table 11-6 presents the current preliminary estimate of capital costs. Of the approximate $100 million construction cost, about three quarters is associated with the collection system and the rest with treatment and disposal and with septage handling. When costs for land, contingencies, engineering and legal expenses are included, a total capital cost of approximately $150 million is indicated.

The costs presented in Table 11-5 are expressed in mid 2008 dollars, and suitable inflationary factors must be considered to project those costs into the future. For simplicity, these estimates do not yet include the added costs of constructing the project in phases. A preliminary estimate of capital costs for Phase 1 is $50 to $60 million. The normal course of project development will include a preliminary design phase and a final design phase, both of which allow the opportunity to update costs estimates based on increasingly more detailed information.

The costs presented in Table 11-5 pertain only to the Core Program. Should the Town later decide that the Extended Program is needed or desired, approximately $96 million would be added to the capital cost.

11.11.3 Operation and Maintenance Costs

Once the structural aspects of the recommended plan are in place, the Town will incur significant on-going costs for operation and maintenance (O&M). Table 11-6 presents a preliminary estimate of those costs, which total approximately $1.4 million per year. Labor, energy and sludge disposal are the most significant items and account for nearly 75 percent of the total. No credit has been included for revenues from septage haulers, nor have the costs of the Extended Program been included.

As with the capital costs, the preliminary and final design work will provide opportunities for updating these preliminary figures.

TABLE 11-5
PRELIMINARY ESTIMATE OF CAPITAL COSTS FOR CORE PROGRAM

Component	Cost, $ million
Collection System	73.2
Central Treatment System	19.3
Effluent Disposal Facilities	5.5
Septage Handling	2.2
Local Treatment/Disposal Systems	1.3
Construction Subtotal:	**101.5**
Site Investigations (soils, archaeology)	0.6
Land	5.2
Evaluation of non-structural elements	0.3
Engineering, Legal and Administrative	15.2
Contingencies	25.4
Total:	**148.2**

Notes: All costs expressed in mid 2008 dollars.
No premium included for phased construction.

11.11.4 Application for SRF Loans

The Town should view the State Revolving Fund (SRF) as a primary financing mechanism for the capital costs of this project. This program typically provides favorable interest rates for eligible costs and a 20-year repayment schedule. Eligible costs include most collection, treatment and disposal facilities, but do not include design costs or land purchase. The Massachusetts DEP administers this program. The Town should submit a Project Evaluation Form in August 2009 to provide DEP with an outline of the project and current cost estimates. DEP applies a series of priority rankings to determine which projects receive funding in given year, and places the selected projects on its Intended Use Plan annually. Factors that contribute

TABLE 11-6
PRELIMINARY ESTIMATE OF
OPERATION AND MAINTENANCE COSTS FOR CORE PROGRAM

Component	Cost, $ per year
Labor	580,000
Chemicals	50,000
Electricity	184,000
Fuel	50,000
Sludge Disposal	204,000
Maintenance	109,000
Equipment Replacement	83,000
Laboratory and Monitoring	40,000
Administrative	40,000
Engineering	30,000
Total:	**1,370,000**

Notes: All costs expressed in mid 2008 dollars.

to higher priority ratings include: the severity of the problem to be corrected by the project, regionalization, and the existence of any state or federal enforcement actions.

The SRF program is currently being revised to include a new more favorable financing mechanism provided under the 2008 Environmental Bond Bill. Orleans should be a prime candidate for that favorable financing for projects which focus on nutrient management. The bill sets forth five criteria:

- The project must have a nutrient management focus
- The applicant must be free from enforcement orders related to nutrient control
- The project must stem from a DEP-approved CWMP
- The CWMP must be consistent with any applicable regional water resources management plans

- The approved plan must be "growth neutral"; that is, it should not allow any more wastewater flow than would have occurred anyway under current zoning and wastewater requirements.

This CWMP is being developed to comply with all of these criteria. The financing under this new program will include the equivalent of zero percent loans, and the term of the loan is 30 years. The legislation that establishes this financing program also extends the maximum allowable term for betterment assessments to 50 years.

11.11.5 Potential for Grants

The most applicable grant program for Orleans is administered through the Rural Development program of the US Department of Agriculture. Grants are available for up to 45% of eligible project costs, based on median family income, but typical state allocations are unlikely to be sufficient to cover any significant portion of the Orleans project cost. Loan funding is also available. Current terms are 3.625% for 30 years.

As the project evolves, other grant funding should be pursued, including demonstration grants for evaluation of some of the non-structural plan components.

11.11.6 Financing Policy with Respect to Betterments and Taxes

The Town must establish a detailed plan that allows these very large capital and operating expenditures to be funded in a way that maintains the Town's sound financial standing. While that plan will evolve during the design phase of the project, certain policies need to be established to allow the public to understand the impacts on individual property owners. Those policies include:

- Recovery of annual operation and maintenance costs from users proportional to their wastewater flow; and

- Balancing betterment assessments and property tax increases to reflect the mix of benefits that accrue only to users and those benefits that accrue to all taxpayers.

On August 27, 2008, the Orleans Board of Selectmen addressed the latter issue, by establishing the goal of equalizing the annual costs paid by users and non-users. Based on preliminary cost information available at that time, the Board set forth a policy of recovering 80% of the project debt service through property taxation (paid by users and non-users) and 20% through betterment assessments (paid only by users).

11.11.7 Costs to Typical Users and Non-Users

Table 11-7 presents current estimates of the equivalent annual costs to typical sewered users and those who continue with private on-site septic systems. The basis for these cost estimates is presented in the notes of the table. Based on the August 27, 2008 Selectmen's policy, recovering 80% of the project costs through the property tax results in a rough equivalency between sewered and unsewered users, for the stated assumptions. While there may be property owners who are faced with different costs than the "typical" owner, this interim policy should eliminate any significant incentive for most residents to either seek or avoid sewer service.

For the owner of a $700,000 home (the 2008 average assessed value), the equivalent annual cost for the Core Program is about $2,600, given the assumptions listed in Table 11-7. For the owner of a $300,000 condominium in the 15% federal tax bracket, the equivalent annual cost would be approximately $2,100, other factors being equal. The equivalent cost would be approximately $3,400 per year for the owner of a $1,500,000 home in the 35% tax bracket.

11.12 ENVIRONMENTAL MITIGATIONS

There are many mitigation measures that will be employed in the implementation of the Recommended Plan that will lessen its environmental impacts. These include:

- Restricting sewer construction work to the period of October to May to avoid periods of high traffic;

- Segmenting sewer work on public streets to avoid protracted closures;
- Designing sewer lines and pump stations to avoid floodplains and to minimize encroachment on the buffers of wetlands and other protected resource areas;
- Consideration of cross-country sewer routes to avoid traffic impacts during construction;
- Restricting work hours on construction sites near residential areas;
- Requiring contractors to implement dust control measures;
- Erosion and siltation controls at all construction sites as part of site-specific stormwater management plans;
- Compliance with all terms of Orders of Conditions for work in wetland buffers;
- Installation of odor and noise control systems on operating equipment and facilities;
- Implementation of policies that restrict potential odor-generating activities to times of the day with the least impact;
- Compliance with applicable standards for construction activities near historic structures;
- Facility siting to avoid habitat of rare and endangered species;
- Facility site design to include vegetated berms and to maximize natural buffers; and
- Selection of wastewater treatment equipment to minimize energy use and maximize nitrogen removal.

TABLE 11-7
EQUIVALENT ANNUAL COSTS FOR TYPICAL RESIDENTS

	Equivalent Annual Cost, $/year	
Cost Item	**Typical Sewered Home**	**Typical Unsewered Home**
Betterment Assessment	623	0
Property Tax Increase	1,231	1,231
Sewer Connection	648	0
Septic System Replacement	0	1,570
Septage Pumping	0	88
User Fee	435	0
Income Tax Reduction	-345	-345
Total:	**2,592**	**2,544**

Basis: 20% of municipal debt service recovered from betterment assessments
80% of municipal debt service recovered from property taxes
$5,000 sewer connection cost financed at 5% over 10 years
$18,000 septic system replacement cost financed at 6% over 20 years
Typical home assessed at $700,000
Increased property tax deductible from federal income tax (28% bracket)
O&M costs of wastewater system recovered from 3,100 equivalent users