Chapter 9

Identification and Evaluation of Alternative Management Plans

CHAPTER 9

IDENTIFICATION AND EVALUATION OF ALTERNATIVE MANAGEMENT PLANS

9.1 DEVELOPMENT OF ALTERNATIVE MANAGEMENT PLANS

A. **Introduction.** This Chapter summarizes the various means of addressing nitrogen in the Areas of Concern (AOCs) and identifies the various technologies (as discussed in Chapters 5, 6, 7, and 8) being evaluated for use in Chatham to achieve the TMDLs. It has been well-established that there is a pressing need to remove a large percentage of wastewater nitrogen from the Town's coastal embayments. The goal of the CWMP is to provide a recommended plan to address the wastewater needs of the Town.

As discussed previously in this Report, the following areas (sub-watersheds) were identified as AOCs.

<u>Stage Harbor</u>

- Oyster Pond
- Oyster River
- Stage Harbor
- Mitchell River
- Mill Pond
- Little Mill Pond

<u>Sulphur Springs</u>

- Sulphur Springs
- Bucks Creek
- Cockle Cove Creek

<u>Taylors Pond</u>

- Taylors Pond
- Mill Creek

<u>Pleasant Bay</u>

- Crows Pond
- Ryder's Cove
- Frost Fish Creek
- Bassing Harbor
- Lower Muddy Creek
- Upper Muddy Creek

Site Specific Areas (located within the above identified AOCs)

- Eliphamets Lane
- Toms Neck
- Enterprise Drive Industrial Area
- Commerce Park Industrial Area

The purpose of this section is to summarize the findings of four alternatives evaluated for addressing the Town's wastewater needs within the AOCs and Town-wide:

1. The No Action Alternative.
2. The "Combination Alternative" to address the TMDLs.
3. The "Sewer Alternative" to address the TMDLs (Phase 1 Implementation).
4. The "Town-wide Sewer Alternative" (Phase 1 and 2 Implementation).

The focus of Alternatives 2, 3 and 4 is the collection and treatment of wastewater. In addition to controlling wastewater nitrogen, there are other ways the Town can actively manage nitrogen. Most of these are discussed in Chapter 8 and deal with public education, fertilizer management, stormwater management, improved embayment flushing, and zoning and growth controls.

B. **Muddy Creek Restoration for Nitrogen Reduction.** In 2006, MEP evaluated a scenario which examined the possible restoration of Muddy Creek into a partial freshwater system. The goal of this evaluation was to determine the amount of nitrogen uptake the restored freshwater system would provide and how that would impact the identified septic/wastewater loads that need to be removed.

As discussed in Chapter 4, 75 to 100 percent of the septic/wastewater loads contributed within the Muddy Creek watersheds need to be removed. MEP modeled two scenarios, one where 30 percent of the watershed, atmospheric and benthic nitrogen are reduced, and one where 30 percent of the watershed and atmospheric nitrogen are reduced and the benthic nitrogen flux is zeroed. The scenarios were intended to represent a transitional period following any restoration action and stable freshwater flow, respectively. As a result of this evaluation, the MEP findings indicated that removal rates for septic and wastewater loads could be reduced by one third if Muddy Creek were restored in this way.

As discussed in Chapter 1, the Towns of Chatham and Harwich, in cooperation with the Pleasant Bay Alliance, are actively evaluating issues around this restoration, outside of the CWMP process. Because the CWMP will be developed in an adaptive management style (monitoring of embayments, combined with implementation of the recommended plan), the Town of Chatham may be able to reduce the extent of sewering in the Muddy Creek watershed(s) if the restoration results are realized.

C. **Summary of Technology Evaluations.** Chapters 5 through 7 discuss the various centralized, decentralized, and treated water recharge systems that could be used in Chatham.

1. **Centralized Technologies.** The following technologies were identified for further consideration:

Wastewater Treatment

- Oxidation Ditches
- Effluent denitrification/polishing filters

Disinfection

- Sand infiltration beds

Residuals Management

- Thickening
- Dewatering
- Disposal at regional facility

Wastewater Collection:

- Gravity sewers and pumping stations
- Pressure sewers with grinder pumps

As discussed in Chapters 2 and 5, a preliminary design was prepared as part of this process. During the development of the preliminary design, specific technologies were selected and are the recommended technologies for any Alternative that involves the upgrade of the existing WWTF, as described later in this Chapter.

D. **Purpose and Overview of Preliminary Design.** The preliminary design was prepared to illustrate how a town-wide wastewater collection, treatment, and recharge system should be planned and designed for the Town's build-out condition and for consideration as an option for the CWMP. It was developed in a flexible manner to accommodate the possibility that the entire Town may never become sewered in the future, or to allow that expansion to take place over several phases as might be recommended as part of a CWMP.

1. **Wastewater Collection System.** The wastewater collection preliminary design was developed to define the individual wastewater drainage areas (sewersheds) in Chatham based on the Town's desire to maximize the use of gravity collection systems and to minimize capital and operation and maintenance (O&M) costs. A sewershed is a representation of the area of land or group of properties that would contribute flow to a wastewater collection pumping station. The area extent of a sewershed is typically a function of topography and the availability of road layout for sewer installation. Sewersheds developed as part of the preliminary design were linked together to efficiently convey the wastewater to the Chatham WWTF while trying to allow for the greatest amount of flexibility in implementation. This flexibility is critical for development of the CWMP alternatives, allowing various orders of implementation (priority) and combinations. This also provides the Town flexibility in implementation depending on the Town's priorities and funding opportunities. The preliminary Town-wide sewer layout is shown on Figure 9-1. Figure 9-1 shows the potential layout of 80 sewershed areas each supported by their own pumping station and the 15 sewersheds which are proposed to be connected through sewer extensions to the existing collection system. There is no significance to the number assigned to each area; it is only provided as a unique identifier.

As discussed in Chapter 5, and as part of the preliminary design, it was determined that the most feasible collection system would be a combination of gravity and pressure sewers with grinder pumps.

2. **Wastewater Treatment System.** Operation and control considerations weighed heavily in the decision making process of selecting a technology to be considered for any upgrade to the Chatham WWTF. Both Sequencing Batch Reactors (SBRs) and oxidation ditch type technologies offer various benefits. SBRs provide smaller tanks and eliminate the need for clarifiers. However, oxidation ditch processes have greater process flow flexibility (important in a seasonal community) and more traditional control structure. Both can and are often run through a Supervisory Control and Data Acquisition (SCADA) type system.

Some of the goals/preferences identified by the Town and the WWTF staff included:

- Minimizing pumping within the system (SBRs are often fed from an equalization tank that requires pumps).

- Simpler operation (less reliance on timing sequences to maximize fill, settle, and decant cycles). Oxidation ditch type processes are considered more "traditional" systems where processes are not combined in one tank, but are performed in several distinct tanks. These processes are "flow-through" processes using gravity to advance the flow to the next component.

Although the use of either SBRs and oxidation ditch type processes will achieve the performance requirements necessary and have similar requirements for preliminary treatment, effluent filtration and disinfection to meet current MassDEP guidelines for recharge within a Zone II, town preference towards a technology less dependant on automated cycles and with greater process flexibility, lead to the selection of an oxidation ditch type process for further evaluation.

During the preliminary design, additional evaluations were made to compare Orbal® to Carrousel® for the selection of an oxidation ditch type process. Again, both systems were similar as to the need for a secondary anoxic zone and reaeration, or denitrification filter, (in addition to those items discussed above); however the Orbal® has greater process flexibility and greater ability to handle the large variations in flow conditions from startup to build-out. The Orbal® also allows for expansion through the addition of outer rings instead of additional treatment trains. The Orbal® also provides biological phosphorus removal.

The proposed wastewater treatment system (with Orbal®) is illustrated in Figure 9-2 and is designed to treat the Town's wastewater to an effluent total nitrogen concentration of 3 milligrams per liter (mg/L). It was designed to be expanded through phased implementation, to treat all the wastewater generated by the properties in town for the build-out condition, as well as the inflow and infiltration (I/I) that could be collected by sewers as they age and as may occur during extended wet and high groundwater periods as identified in Chapter 2 of this Report. It is also designed to be flexible and treat the relatively low wintertime startup conditions as well as the high build-out summertime conditions.

The improvements to the treatment plant are comprised of the following individual treatment processes:

a. Influent screening and grit removal (headworks).

b. Biological treatment for nitrogen removal, initial phosphorus removal, and treatment of oxygen demand and pathogens.

c. Additional phosphorus treatment (if needed) through ferric or alum addition.

d. Effluent filtration/denitrification to remove nitrogen and fine suspended solids in the effluent, in addition to nitrogen and phosphorus contained in the solids.

e. Ultraviolet disinfection prior to recharge at open sand beds.

The preliminary design took into consideration expansion to accommodate sewering the entire town and provisions/space requirements for additional treatment processes that would be needed to treat the effluent to concentrations less than 3 mg/L, if it is needed in the future, and to provide additional phosphorus removal.

The workhorse of the treatment system is the biological treatment process that is configured as a series of concentric rings. The construction of three rings is recommended for the implementation of Phase 1 to treat an average-annual future flow of 1.3 million gallons per day (mgd). This configuration will allow the Town to reduce the treatment volume (take one ring out of service) during times of low flow to save costs and meet treatment requirements. A fourth ring would be added as part of a Phase 2 implementation if the collection system does expand Town-wide to a potential future/build-out condition of 1.9 mgd on an average-annual basis. The process also has the flexibility of taking various aeration components and process rings off line for repair and maintenance.

3. **Treated Water Recharge Facilities.** The treated water recharge facilities were laid out during preliminary design and are comprised of a series of 12 sand infiltration beds (as shown in Figure 9-3), designed to meet the MassDEP design infiltration rate of 5 gpd/sf.

As discussed in Chapter 6, significant testing and groundwater modeling was completed to determine an appropriate design infiltration rate. Hydraulic load testing and detailed groundwater modeling indicated that a design loading of 30 gpd/sf was appropriate and has a significant safety factor. (This design rate is six times greater than the design rate typically required by MassDEP for projects where detailed testing and modeling are not completed.) As a

result, a maximum of 200,000 square feet of bed area would be needed in the event that sewers are extended to the whole Town. This sizing allows a 100 percent redundancy of beds to allow half of the beds to be "resting" at the design (maximum month) condition. This area could be met with the implementation of beds 1, 2, 3, 7 and the majority of beds 5 and 8 as illustrated in Figure 9-4.

E. **Development of Preliminary Design Sewer Costs.** Costs for centralized collection, and treatment and recharge were developed on a Town-wide basis, with estimates broken down by sewershed and WWTF phase for comparison to decentralized facilities. The overall cost estimate for a Town-wide collection system is summarized in Table 9-1. This table provides a summary of the major components expected for a Town-wide collection system based on the preliminary design. Estimated quantities are provided with unit prices for these components. Costs were developed as part of the preliminary design based on year 2006 dollars, however, the bottom line total provided on this Table has been adjusted to 2007 dollars using an ENR Index.

Collection system costs, as shown in Table 9-1, include costs associated with providing and installing the grinder pumps. The Town will likely procure the grinder pumps and provide them at cost to the property owner. However, it will likely be the property owner's responsibility for grinder pump installation and connection to the collection system. Therefore, the Estimated Project Cost shown on Table 9-1 will be reduced by this amount, but the difference would ultimately be the responsibility of the property owner. Connection costs (from the house to the stub at the property line) for properties connected by gravity are not included in Table 9-1 and would be borne by the property owner. Costs shown in Table 9-1 include only the stub from the sewer main to the property line. These costs were then used as the basis for the development of collection system costs by sewershed (included in Table 9-2) and the sewershed costs are used as the basis of the development of alternative plans.

1. **Collection System Cost Estimating Methodology.** In general, unit costs are developed to estimate construction costs for items such as sewer piping, manholes, pump stations, excavation, dewatering, backfill, mobilization, surface restoration, and other costs. Unit costs are developed based on a combination of the following:

- Schedule of values from recent pipeline construction jobs (water main, gravity sewer, force main and low pressure sewer) in Falmouth, Plymouth and other areas in the Northeast.
- Past engineering experience for similar projects.
- Direct quotes from equipment manufacturers for selected items and other material costs.
- All costs reflect a May 2007 Engineering News-Record Cost Index of 7942.

2. **Unit Cost Items (sewers).** The following is a list of unit cost items that has been included in developing the cost estimate, and a general guide used to identify the basis of these costs:

General Items:

a. *Record Drawings & Construction Photographs* – an allowance for the contractor to accurately photograph the site before, during and after construction for documentation as well as submitting accurate record drawings of installed materials to the Town for their records.

b. *Erosion Control* - allowance for the contractor to install erosion control to ensure any storm related run-off will not enter wetlands or other environmentally sensitive areas.

c. *Final Clean Up & Site Restoration* – allowance for the contractor to return any areas disturbed during construction to the pre-existing condition, including re-seeding grassed areas, dust control and other landscaped items that need to be replaced.

d. *Test Pits* – an allowance for to the contractor to excavate and explore subsurface conditions, typically to identify utility locations and soil conditions. This item is based on excavation per cubic yard and is a function of the linear footage of gravity sewer installed. This was based on several local pipe line construction jobs and the average exploratory excavations required to complete construction.

e. *Sewer Testing* – an allowance for a contractor to test the sewer for leaks and pressure in force main and low pressure applications. A cost of two dollars per linear foot has been used for the total linear footage of gravity, force main, and low pressure lines.

Gravity Sewer Items:

a. *Gravity Mains* – a cost to the contractor to excavate, install and backfill the gravity mains including pipe bedding and police detail required for the installation. Gravity pipes with greater than 12 feet of cover have been given a higher unit cost due to larger equipment needed and longer excavation times. Excavations in State roads also have a price adjustment to reflect the additional cost of State-required control density fill in trenches.

b. *Dewatering* – a cost to the contractor to remove water from trench excavations that are below the ground water table. For this project, it has been estimated that dewatering will be needed for 30 percent of all mains over 12 feet deep.

c. *Service Laterals & Lateral Fittings* – a cost to the contractor to install 4-inch service lateral from the main to the property line of the connecting property. It has been estimated that if the gravity main has been installed in the center line of the right-of-way, the lateral will span 14 feet to the property line.

d. *4-Foot Diameter Manholes* – a cost to the contractor to excavate, install, and backfill 4 foot diameter sanitary sewer manholes.

e. *Connection to the Existing System* – a cost to the contactor to connect new pipes to the existing collection system at selected manholes. This cost includes the excavation, connection and backfill of each connection.

f. *By-Pass Pumping for Connections* – a cost to the contractor to by-pass the existing waste water flow during connections at existing manholes.

g. *Miscellaneous Items per Sewershed* – a cost allowance to cover additional material and installation costs for other parts such as chimneys and clean outs that have not been otherwise considered.

h. *Upgrade/Improvements to the Existing Collection System* – It has been identified that three of the existing pump stations will need improvements, two of which, the Stage Harbor and Queen Anne Stations, need complete re-construction. The Chatham Housing Authority Station will also need to be rebuilt, but the existing pumps should be suitable for use. A unit price item has also been considered for upgrades to existing gravity sewer mains and force mains.

An estimate was also included for the re-installation of existing gravity mains and force mains that are either over capacity for the future flows or in poor condition. This number will depend on the extent of equipment that is re-usable from the existing stations.

Force Main Items:

a. *Force Mains* – a cost to the contractor to excavate, install and backfill the force mains including pipe bedding and police detail required for the installation. Excavations in State roads also have a price adjustment to reflect the additional cost of State-required control density fill in trenches. Use of common trenches was accounted for in the estimate for gravity mains/force mains that will be located in the same trench.

b. *Air Release/Flushing Manholes* – a cost to the contractor to install air release manholes at the high points in the force main and flushing manholes in the low points.

Low Pressure Main Items:

a. *Low Pressure Mains* – a cost to the contractor to excavate, install and backfill the low pressure mains including pipe bedding and police detail required for the installation. Low pressure mains are typically smaller diameter PVC pipes ranging

from 2 to 4 inches in diameter. Excavations in State roads also have a price adjustment to reflect the additional cost of State-required control density fill in trenches.

b. *Air Release/Flushing Manholes/End Manholes* – a cost to the contractor to install air release manholes at the high points in the low pressure main and flushing manholes in the low points. End manholes are installed at junction points where two low pressure mains connect.

c. *Connection to Gravity Manhole* – a cost to the contractor to connect the low pressure main to an existing gravity manhole.

d. *Grinder Pumps* – this item includes the material cost of the grinder pump, based on a quote from the manufacturer, as well as installation of the pump and lateral and engineering required for the connection.

Pump Station Items:

a. *Pump Stations* – a complete construction cost to the contractor to excavate, install and backfill the proposed pump stations. For the purpose of this project, pump stations have been divided into three categories: small (less than 125 gpm), medium (between 125 and 300 gpm) and large (300+ gpm). These costs are based on manufacturer's quotes for suction lift stations that include generator and instrumentation, as well as the necessary site work and wet well construction. This cost does not include costs to bring electricity to the pump station site in the event that adequate power is not available, i.e. the installation of utility poles and single and/or three phase power. The Town may opt to equip the smaller stations with generator hook-ups rather than including generators at each station.

Restoration Items:

a. *Trench Base (T-Base)* - a cost for the contractor to install trench sub-base prior to paving. The Town has indicated a 4-inch layer of base to be used for all trenches. The unit for this item is cubic yard and is based on a trench width of 6 feet for gravity

mains less than 12 feet deep, force mains, and low pressure mains. A trench width of 12 feet was used for gravity mains deeper than 12 feet.

b. *Trench Binder and Top Course* - a cost for the contractor to install temporary paving in the trench after T-Base has been laid and compacted. A pavement depth of 2-inch for binder course and 1-inch for top course was used for this project. Trench widths are based on 6 feet for gravity mains less than 12 feet deep, force mains, and low pressure mains. A trench width of 12 feet was considered for gravity mains deeper than 12 feet.

c. *Full Width Overlay* - a cost for the contractor to install full width paving after the temporary paving has had time to settle. A pavement depth of 1.5- inches for the final course was used for this project. The width of the overlay is based on a 27 feet wide paved surface.

d. *Miscellaneous Paving Items* - a cost for the contractor to install other items associated with final paving such as driveway aprons, milling and grinding of temporary paving and other items. The amount for this item is based on three percent of items 1 through 3 of the restoration items.

3. **Percentage Cost Items.** The following is a list of percentage cost items that have been included in the cost estimate, and a general guide used for these costs (note: percentages are based on recent construction projects). Items “a” through “c”: are based on the subtotal of the unit price items. The sum of those three items and the unit price sub total is the estimated construction cost. Items “d” through “g” are percentages based on the estimated construction cost. The sum of those four items and the estimated construction cost is the total project cost.

a. *Mobilization* - a cost for the contractor to mobilize his equipment (excavators, bulldozers, etc.) on site (five percent of capital costs has been used).

b. *Bonds and Insurance* - costs for the contractor to obtain bonds for bidding the project (three percent of capital costs has been used).

c. *General Conditions* - job meetings, submittals, coordination, project schedules, etc. (five percent of the capital costs has been used).

d. *Contingencies* - a general cost for unforeseen conditions, may vary depending on level of detail in the proposed project (25 percent of the estimated construction cost is used at this phase of the design).

e. *Design* – a general cost for the associated design work required for the engineering (10 percent of the estimated construction cost).

f. *Construction Administration and Resident Project Representative* – a general cost for the Engineer's role during construction as well as a full time on-site representative (10 percent of the estimated construction cost).

g. *Fiscal, Legal, and Administrative* – an estimate for costs associated with these services (four percent of the estimated construction cost has been used for this project).

It should be noted that the engineers estimated cost for the preliminary design does not include costs for the following:

- ***Easements/Land Acquisitions.*** Approximately ten areas are shown in the preliminary layout where pipelines may require easements and/or land acquisitions. The cost of such easements and acquisitions has not been included in the engineers estimated cost due to the uncertainty of the time of acquisition (when the land will be needed), final design of the collection system (final design may re-route pipelines), and instability in the real estate market. In addition, 60 percent of the proposed pumping station locations identified as part of the preliminary design will also require some form of easement or land acquisition. Each site will be reviewed in detail during final design.

- ***Odor Control.*** Costs for odor control at new pump stations (costs for odor control are considered for the upgrade of existing pump stations, see gravity main cost item); force main discharges and other areas have not been included in the preliminary cost

estimate. Costs for odor control will be considered in the final design when specific types are selected.

F. **Development of Preliminary Wastewater Treatment Facility Costs.**

1. **Cost Estimating Methodologies.** The following items were considered during the development of the cost estimate:

<u>In General:</u>

a. Unit costs are developed to estimate construction costs for items such as concrete, excavation, backfill, mobilization, yard piping, process piping, site work, electrical, and other costs. Unit costs are developed based on a combination of the following factors considered as part of the Preliminary Design performed in 2006:

- Schedule of values from recently constructed jobs.
- Past engineering experience for similar projects.
- Various RSMeans 2005 Construction Cost Data Books adjusted for local conditions and the 2006 Engineering News-Record Cost Index (updated as part of the CWMP for 2007).
- Cost for site work, electrical systems, HVAC, plumbing, and other miscellaneous work like painting and miscellaneous metals are applied as percentages of total capital costs.

b. Equipment and associated costs for required equipment are provided by equipment suppliers. Installation costs are estimated when they are not specifically provided by the equipment suppliers.

c. Allowances for fiscal, legal, engineering and contingency costs are estimated at 15 and 20 percent, respectively, and applied to the total construction cost.

d. Costs are referenced to Engineering News-Record (ENR) Cost Index 7942 (May 2007).

The following is a list of items considered when developing the cost estimate and is a general guide used to identify the basis of these costs (note: percentages are based on recent construction projects):

a. ***General Conditions*** (including Mobilization, Bonds and Insurance) - A cost for the contractor to mobilize his equipment (cranes, bulldozers, etc.) on site, to obtain bonds for bidding the project and to attend job meetings, prepare submittals, coordinate, develop project schedules, etc. (eight percent of construction costs has been used for this project based on past experience).

b. ***Site Work*** - Costs for clearing, grading, and seeding the site (four percent of construction costs has been used for this project based on past experience).

c. ***Excavation, Blasting, Backfill, etc.*** - Could be a significant cost and should be determined on a unit (yd^3) basis. Costs are dependent on soil conditions (rock), hauling distance, etc.

d. ***Site Dewatering*** - Could be a significant cost with deep structures, high groundwater tables, proximity to rivers, aquifers, soil conditions, etc.

e. ***Sheet Piling*** - Could be a significant cost with deep excavations, also dependent on soil conditions.

f. ***Yard Piping*** - Piping from one process to another (may be calculated based on length and diameter of pipe or estimated by a percent, typically six to ten percent of construction costs is used for estimating purposes). For preliminary design ten percent was used.

g. ***Process Piping*** - Piping within a process was calculated based on estimated length and diameter of pipe.

h. ***Electrical*** - Electrical costs can be significant and vary depending on the specifics of the project, the more complex the project the higher percent used (typically 10-15 percent of construction costs is used). For this project, major power

distribution, emergency generator costs and SCADA costs are considered separately. For this project we used 10 percent for general electrical. If SCADA had been included in this factor, 15 percent would have been used.

i. ***Heating and Ventilating*** – These are costs for heating and ventilating facilities and they do not include costs for odor control. A two percent factor was used based on a similar sized project.

j. ***Plumbing*** - Costs for plumbing, associated with structures, were estimated to be approximately two percent of the total construction cost.

k. ***Instrumentation*** - This cost is highly dependent on the scope of project, it may be included in the equipment costs or the electrical costs. For this project, a separate SCADA estimate was provided.

l. ***Demolition*** - This cost was included for plant upgrade.

m. ***Equipment Costs*** - Equipment costs should be obtained from a supplier and should include: delivery to site, manufacturer's representative services, and spare parts. Also included in equipment price are:

- Installation - cost for the contractor to install the equipment, cost will vary depending on the complexity of the equipment, typically 15 – 35 percent of equipment cost, could be as high as 50 percent. (Typically 30 percent of the equipment cost is used based on previous experience; however, this percentage may be adjusted for less complicated equipment.)
- Overhead and Profit – contractor's overhead and profit on the equipment, materials and installation were applied as follows: typically ten percent each for overhead and profit for equipment and materials cost, and an overhead of 20 percent and a profit of ten percent of the labor costs were used for estimating purposes.

n. ***Startup and Initial Operation*** - Where applicable.

o. ***Painting*** - Where applicable, a percentage of capital cost will be used to estimate this. Approximately one percent of the project value was used for estimating purposes.

p. ***Special Conditions*** - Any costs that are specific to the site or project that should be included in the project costs.

q. ***Contingencies*** – This is a general cost for items that need revisions or are added during construction. A factor of 20 percent of the construction cost has been used for preliminary design.

r. ***Fiscal, Legal, Administrative, and Engineering*** – These costs are typically 15 percent of the construction cost. The Town has previously appropriated $1.1 million for final design and that value has been carried as part of the development of these costs.

The estimated construction and capital costs are attached and reflect "today's" dollars. They are referenced to an ENR index number as stated above. Bidding climate, world events, natural disasters, materials and fuel costs all impact both short-term and long-term estimates. The cost estimates presented as part of this project are based on the current conditions and the current level of design. Costs will be revised during final design to reflect the estimated midpoint of construction or phasing year, and changes made during the final CWMP and final design.

Table 9-3 summarizes the costs for WWTF improvements for the two WWTF alternatives:

- Alternative 3 is for Phase 1, improvements to provide treatment and collection necessary to meet the nitrogen TMDLs at the future condition.
- Alternative 4 is for Phases 1 and 2, to provide treatment and collection Town-wide.

Table 9-3 includes the costs for the proposed treated water recharge beds (and flow distribution structures) to serve both Phase 1 and Phase 2 as illustrated in Figure 9-4.

G. **Decentralized Technologies.** Evaluations of decentralized technologies are discussed in Chapter 6. The following is a summary of the findings of that evaluation.

Because I/A technologies are regulated by MassDEP, selection of any I/A technology to be used will be made by the individual property owner unless the Town regulations are modified to dictate otherwise. The selection process will depend on the particular application (i.e. for repair, nitrogen removal, variance, etc.) and the current MassDEP status of the technology.

A major difficulty with individual I/A systems is the maintenance requirements and costs. Currently, the Town of Chatham, like most towns, is dealing with how to best manage and track their existing I/A systems. Improper maintenance, significant down time due to seasonal use, and owner inexperience all contribute to poor performance and possible system failures. If properly operated and maintained, those systems approved by MassDEP are estimated to achieve moderate effluent quality (approximately 50 percent nitrogen removal) and provide a significant improvement over standard Title 5 septic systems. However, the findings of the recent Barnstable County report on I/A system performance on Cape Cod from 1999 to 2007 showed a high variability in the effluent quality with approximately 60 to 70 percent of systems able to achieve a median total nitrogen value of 19 mg/L or less.

Broad application of these technologies to address the needs of an AOC could severely tax Town resources by requiring increased accounting of systems, inspections, routine operation and maintenance, and monitoring to ensure that the systems are performing properly and achieving the goals associated with large-scale implementation to meet the TMDLs. Depending on the management scheme adopted by the Town, property owners with these systems will be paying for services to permit, install, operate, maintain and monitor the system to ensure proper performance. Even when currently available I/A systems are well operated and maintained they cannot provide the type of nitrogen removal performance needed to address the nitrogen overloads currently occurring in the entire Stage Harbor AOC.

A second drawback is that individual I/A systems do not remove phosphorus which is a concern within the watersheds to freshwater ponds. In addition, as new public-health or environmental-health threats appear in the future (un-degraded pharmaceutical products or “endocrine disruptors”, etc.) the individual systems will be very difficult to upgrade to meet these new threats. These systems would be difficult/costly to upgrade if the nitrogen TMDLs change (become more stringent) in the future versus an upgrade at one centralized location.

I/A technologies have advantages, and based on Board of Health and Planning Department recommendations, and the Town's Nitrogen Loading Regulation, may be required to address specific site conditions and issues (i.e., high groundwater, setback requirements, repair or replacement of existing systems, or limited nitrogen removal in sensitive watersheds). However, each application should be evaluated on a site-by-site basis for those areas not considered for sewers.

Cluster systems were not considered feasible options in most areas of Town (described in Chapter 6) based on lack of available space, costs, implementation considerations, ownership, and operational and maintenance considerations. Additionally, the regional septic system test facility on Cape Cod, the findings of the Barnstable County study, and performance of systems in Chatham and neighboring towns have shown that smaller facilities have struggled to achieve less than 10 mg/L total nitrogen on a consistent basis, as would be necessary to achieve the TMDLs. Therefore, the management and operation of these facilities to consistently achieve 3 mg/L total nitrogen is not realistic. These systems would not provide adequate treatment to meet the TMDLs for the Town's embayments and therefore, as discussed previously, have been ruled out.

Although individual I/A systems have many of the same issues associated with them as the cluster systems, they have less space and ownership constraints than siting several small wastewater treatment facilities. As a result, individual I/A systems are being evaluated in Alternative 2 for use in combination with sewers (the "Combination Alternative") for areas that require a lower percent wastewater nitrogen removal to meet the TMDLs.

It is noted that the technology evaluations completed on a watershed by watershed basis resulted in a recommendation of sewer extensions to meet the TMDLs, with possible extension Town-wide to address other wastewater management needs. During presentations on the watershed evaluations the average performance of common wastewater treatment technologies was discussed. These presentations showed typical average effluent concentrations by technology as follows:

- Standard Title 5 system: 20 to 40 mg/L TN
- Typical Individual I/A system: 15 to 25 mg/L TN
- Community/Cluster: 5 to 15 mg/L TN

- Typical Wastewater Treatment Plant (under Groundwater Discharge Permit): less than 10 mg/L TN
- Proposed upgrade to Chatham WWTF: 3 mg/L TN

The recommendation that upgrade/expansion of the existing wastewater treatment and collection system was the most environmentally sound approach was well received by the CAC and Board of Selectmen. Even with the acceptance of the sewer recommendation; there was a desire to develop a detailed alternative that utilized individual I/A systems to meet the TMDLs to illustrate the cost difference and non-monitoring (performance, uncertainty, operations and maintenance, etc.) factors.

The following sections describe the four main alternative scenarios evaluated as part of this CWMP and FEIR.

9.2 NO ACTION ALTERNATIVE – ALTERNATIVE # 1

This Alternative would limit future wastewater treatment at the Chatham WWTF to 150,000 gpd as directed by the current Administrative Consent Order (ACO) agreed to by the Town of Chatham and MassDEP. The No Action Alternative would mean that the majority of the Town's wastewater generation would continue to be treated using on-site septic systems. The entire Town was declared an "Area of Nitrogen Concern", requiring new development to be regulated by the Town's Nitrogen Loading Regulations developed by the Board of Health. However, existing development will continue to treat wastewater with existing on-site systems, typically not designed for nitrogen removal.

Nitrogen loading assessments performed as part of the MEP have determined that existing and future nitrogen loading into Muddy Creek, the Stage Harbor System, Bassing Harbor System, Taylor Pond/Mill Creek, and Sulphur Springs Watersheds exceed the nitrogen loading thresholds for those embayments. This indicates that continuation of nitrogen loading into these embayments at current levels will further degrade water quality in these embayments.

The impacts of nutrients and pathogens on coastal waters, fresh surface waters, drinking water supplies, and other natural resources are well documented. Without addressing these needs, Chatham will continue to lose natural and economic resources, including declines in the fin-

fishing and shell-fishing industries, loss of property values, continued algal blooms in coastal embayments and ponds, beach closures, and potential declines in tourism as the aesthetic impacts continue to impair the Town's water resources (coastal, fresh, and drinking). For example, Chatham is currently experiencing the loss of naturally occurring oysters in Oyster Pond, increased algal blooms in Oyster Pond and Little Mill Pond (among other embayments), loss of eel grass in the majority of the Town's coastal embayments, impacts to freshwater ponds and the potential for impacts to the Town's drinking water supply and sole source aquifer.

In the No Action Alternative, substandard on-site systems would be identified by means of property transfer inspections or system failures. Upgrading to meet the Title 5 standards and the local Board of Health regulations would not result in significant overall nitrogen removal. Current regulations only address nitrogen loading to coastal embayments from new systems, so the Town's coastal embayments would continue to be impacted by nitrogen discharges within the embayment's watershed from past development.

The Town of Chatham is currently in receipt of the TMDLs for all of its coastal embayment systems. The TMDLs set the daily nutrient load limit for these embayments to improve or preserve their quality. Therefore, failure to address nitrogen loading to the embayments in Chatham under the No Action Alternative would be in violation of the TMDL and subject the Town to enforcement action as stipulated by MassDEP.

In addition, the existing ACO requires completion of the CWMP and implementation of the recommendations of the CWMP. If the Town does not comply with the Consent Order, it could be fined up to $10,000 per day by MassDEP, as stipulated in the ACO.

9.3 COMBINATION ALTERNATIVE – ALTERNATIVE # 2

A. **Alternative #2 – General.** The basic underlying premise of Alternative #2 was to maximize the use of I/A systems to meet the TMDLs and to determine if this was cost-effective. However, as discussed previously during presentations to the TAG, CAC, and Board of Selectmen on the use of various technologies, it was determined that the TMDLs could not be met under build-out conditions using I/A systems alone in any watershed.

Advantages of the Combination Alternative:

- Number of sewered parcels is reduced; and
- Home-owners can select the I/A technology that best suits their needs (aesthetics, space, cost) based on the MassDEP approved technologies available.

Disadvantages of the Combination Alternative:

- Inconsistent performance of I/A technologies;
- Requires creation of a management structure to manage I/A system performance locally to ensure compliance with TMDLs;
- Higher present value cost for most watersheds; and
- Homeowners will be responsible for purchasing, installing, operating and maintaining I/A systems (or paying for such services) as required by the Town.

Based on the TMDL requirements stated in Chapter 4, the following AOCs were chosen for evaluation under the Combination Alternative:

- Mitchell River subwatershed – 50 percent wastewater removal.
- Mill Pond subwatershed – 50 percent wastewater removal.
- Sulphur Springs subwatershed – 62 percent wastewater removal.
- Taylors Pond subwatershed – 40 percent wastewater removal.
- Ryder's Cove subwatershed – 75 percent wastewater removal.

Each of these sub-watersheds, as identified by the MEP reports, requires removal of less than, or equal to, 75 percent of the existing wastewater nitrogen load to achieve the TMDL; therefore, the use of I/A systems to treat a portion of the watershed was evaluated.

Two other sub-watersheds, Muddy Creek-Upper and Nickerson Neck, also have wastewater removal percentages less than 75 percent but were not chosen for evaluation. Muddy Creek-Upper provides a unique opportunity to evaluate nitrogen reduction by natural attenuation as discussed previously. MEP modeling has indicated the potential for a 34 percent reduction in the septic load that would need to be addressed if the natural attenuation goal is achieved. If and until the actual reduction is realized it is difficult to undertake alternative comparisons and, therefore, Muddy Creek-Upper was not included. The Nickerson Neck sub-watershed was not

included due to the inherent difficulties of dealing with a watershed complicated by the large, shared Pleasant Bay system.

The remaining AOCs as part of a Combination Alternative would be addressed through sewering:

- Oyster Pond and Oyster Pond River
- Stage Harbor
- Little Mill Pond
- Mill Creek
- Frost Fish Creek
- Eliphamets Lane
- Toms Neck
- Commerce Park and Enterprise Drive

These areas either have 100 percent wastewater nitrogen removal recommendations or other conditions (high groundwater, industrial areas) that would require or benefit from sewering.

Several other areas of Town (Red River watershed, Chatham Harbor watershed, and sections of town not located within the watersheds as shown on Figure 9-1) although not specially targeted for nitrogen removal will be addressed through the centralized treatment alternative and/or the Town's nitrogen loading regulations and, therefore, were not included as part of this analysis. Many of these areas fall within sewersheds that are critical to other AOCs and, therefore, sewering within these areas will aid in the reduction of direct septic system impacts on Nantucket Sound, Pleasant Bay or the Atlantic Ocean.

Use of individual I/A systems in this Alternative is based on an average annual effluent concentration of 19 mg/L total nitrogen from each system, as observed through the Barnstable County data collection efforts and as the MassDEP accepted performance level for I/A technologies.

The analysis compared the total build-out wastewater nitrogen load to the amount that could be removed using I/A systems. Since 100 percent use of I/A systems (at 19 mg/L TN in effluent) will not achieve the TMDL under build-out conditions for a sub-watershed some level of

sewering is required. The evaluation started with 50 percent of the build-out flow addressed with I/A systems and the balance addressed with centralized wastewater collection, treatment, and recharge outside of the watershed. Based on the results of the 50/50 (I/A to sewer) scenario, the proportion of I/As to sewering was adjusted to maximize the use of I/A systems.

As stated above, the reliance on the variable performance exhibited by I/A technologies, as documented by the recent Barnstable County report, to meet a regulated limit (TMDL) is a significant risk when it is anticipated that there will be stipulated penalties for not achieving the TMDLs. Combine this with the complex management structure required to manage and enforce permit limits; the difficulty and expense inherent in the future expansion or upgrade of these systems; and limited data showing I/A technologies ability to achieve removal of other wastewater contaminates that may be regulated in the future, all weighed heavily against the wide-spread use of I/A technologies.

B. **Alternative #2 - Development of Costs.** This Alternative would include upgrade of the existing WWTF to a flow less than 1.3 mgd (average annual flow from the Phase 1 Sewer areas) to address TMDLs in Chatham. It would also include the creation of a management district and installation of one or more types of I/A technologies on individual properties within an AOC watershed.

1. **Cost Basis.** Implementation of individual nitrogen removal systems for each area evaluated for the use of I/A's would require property-owner installation or upgrade of their existing system. The use of individual I/A systems on a large scale would also require the establishment of a decentralized wastewater management district or service area to assist in operations, maintenance and monitoring of these systems. Costs for the development and operation of such a district are difficult to estimate with precision because there is no precedent on Cape Cod of such a system and, therefore, are <u>not</u> included in the costs summarized below. These costs could be developed if there is an interest in proceeding with Alternative #2.

Installation and upgrade of the I/A on-site systems would have a capital cost of approximately $13,000-$25,000 per system based on cost estimates prepared by the Barnstable County Department of Health and Environment as part of a 2007 study for the Town of Eastham, MA. The capital costs have been increased by 25 percent to allow for a construction contingency. These costs are based on the following factors:

- Average of typical I/A technologies equipment costs, engineering and permitting.
- Some cost savings can be obtained if components of the existing Title 5 systems can be reused.
- I/A performance based on achieving 19 mg/L total nitrogen in the system effluent.

The Barnstable County Department of Health and Environment's report entitled "Projected Use of Innovative/Alternative On-Site Sewage Treatment Systems in Eastham, Under Current Regulations and Policies", estimated that the O&M costs are approximately $1,500 per year for systems in Eastham. This was based on approximately $350 for electricity and about $1,200 for inspection and maintenance (performed quarterly). If these systems are to be used as part of a watershed solution to achieve a TMDL it is not unreasonable to expect the monitoring and maintenance requirements will increase in frequency to monthly. Therefore, with the variability of inspection service costs, equipment replacement requirements and electrical usage, it is likely that the O&M costs will range between $1,500 and $3,600 per year. Therefore, an average O&M cost of $2,600 per year per system is estimated. This value generates a total present worth cost (20 years at three percent interest) for each system of approximately $38,000-$50,000. This does not include Town costs associated with creating a management district, or other entity, to manage a large number of I/A systems.

Costs for centralized collection systems, used in combination with I/A systems, were based on the percentage of the watershed serviced by the sewersheds described in Chapter 5, the percent of flow being contributed to the WWTF, and the percent of nitrogen needed to be removed within the watershed by sewering after I/A technologies are installed on a percentage of the watershed's parcels.

2. **Basis for Ryder's Cove Subwatershed.** A nitrogen assessment was performed as part of the Bassing Harbor/Pleasant Bay System as part of the MEP Project. Based on the estimated flows and results of the MEP report, this system could be served by sewers or a combination of sewers and I/A type on-site systems.

- Thirty-two (32) percent of flow addressed using individual nitrogen removal (I/A) systems combined with 68 percent sewering of this watershed.
- Sewered portions are connected to the Chatham WWTF.

3. **Basis for Mitchell River Subwatershed.** A nitrogen assessment was performed for Mitchell River as part of the Stage Harbor System as part of the MEP Project. Based on the estimated flows and results of the MEP report, this system could be served by sewers or a combination of sewers and I/A type onsite systems.

- Fifty-seven (57) percent of flow addressed using individual nitrogen removal (I/A) systems combined with 43 percent sewering of this watershed.
- Sewered portions are connected to the Chatham WWTF.

4. **Basis for Mill Pond Subwatershed.** A nitrogen assessment for Mill Pond was performed as part of the Stage Harbor System as part of the MEP Project. Based on the estimated flows and results of the MEP report, this system could be served by sewers or a combination of sewers and I/A type onsite systems.

The wastewater treatment alternatives identified for this AOC are listed below:

- Sixty-one (61) percent of flow addressed using individual nitrogen removal (I/A) systems combined with 39 percent sewering of this watershed.
- Sewered portions are connected to the Chatham WWTF.

5. **Sulphur Springs.** A nitrogen assessment of Sulphur Springs was performed as part of the Sulphur Springs System as part of the MEP Project. Based on the estimated flows and results of the MEP report, this system could be served by sewers or a combination of sewers and I/A type onsite systems.

The wastewater treatment alternatives identified for this AOC are listed below:

- Thirty-six (36) percent of flow addressed using individual nitrogen removal (I/A) systems combined with 64 percent sewering of this watershed.
- Sewered portions are connected to the Chatham WWTF.

6. **Taylors Pond.** A nitrogen assessment for Taylors Pond was performed as part of the Taylors Pond System as part of the MEP Project. Based on the estimated flows and results of the

MEP report, this system could be served by sewers or a combination of sewers and I/A type onsite systems.

The wastewater treatment alternatives identified for this AOC are listed below:

- Fifty-three (53) percent of flow addressed using individual nitrogen removal (I/A) systems combined with 47 percent sewering of this watershed.
- Sewered portions are connected to the Chatham WWTF.

In summary, the following I/A and sewering percentage mixes were arrived at as meeting the respective TMDLs:

- Mill Pond: 61 percent on I/A and 39 percent on sewer
- Mitchell River: 57 percent on I/A and 43 percent on sewer
- Ryder's Cove: 32 percent on I/A and 68 percent on sewer
- Sulphur Springs: 36 percent on I/A and 64 percent on sewer
- Taylor's Pond 53 percent on I/A and 47 percent on sewer

The costs developed for each Combination Alternative are presented in Table 9-4 and will be compared to the sewer option only later in this section.

The findings of this Alternative analysis, from both monetary and non-monetary factors, indicate that sewering the entire sub-watershed remains the more favorable alternative.

9.4 SEWER ALTERNATIVE TO MEET TMDL – ALTERNATIVE #3

This alternative is based on addressing the TMDL needs of the Town by extending sewers to those areas identified by MEP, the two industrial parks, Toms Neck and Eliphamets Lane. Other major components of this alternative are:

- Implementation of WWTF upgrade/expansion, at the existing WWTF site, to treat approximately 1.3 mgd on an average annual basis to meet TMDL requirements (Phase 1) in Stage Harbor, Pleasant Bay, Sulphur Springs, and Taylor's Pond watershed areas. WWTF Flows are summarized on Table 9-5.

- Expansion of the collection system to those areas identified as needing sewering to meet the TMDLs. Sixty-one (61) of the 94 sewersheds identified would need to be sewered in order to address the TMDL requirements as shown on Figure 9-6.
- Further investigation into the freshwater restoration of the upper reaches of Muddy Creek which could provide a quicker remediation of the nitrogen impacts of this waterbody and to Pleasant Bay as a whole.
- Implementation of the coastal embayment water quality monitoring program for TMDL compliance.
- Continued public education on fertilizer use and management of other controllable sources of nitrogen within the Town.
- Continued application and enforcement of the Town of Chatham Board of Health Nitrogen Loading Regulation in those areas not designated for immediate (next 5 to 10 years) connection to the WWTF as part of addressing the Town's TMDLs.
- Continued implementation of storm water improvements and management.

A. **Process/Equipment Description and Design Criteria for WWTF Upgrade**. The proposed process equipment and facilities are based on the preliminary design developed and discussed previously, as illustrated on Figure 9-4.

The following wastewater treatment processes have been identified throughout the development of the CWMP. The following list is a summary of the core technologies that will make up the new WWTF's major components.

<u>Preliminary Treatment:</u>

- Complete plant pre-engineered system for screening and grit removal.

<u>Secondary Treatment:</u>

- Orbal® process constructed in a modular design to allow future Phase 2 expansion.
- Three secondary clarifiers (two for Phase 1, third for Phase 2).

<u>Filtration:</u>

- Continuous backwash denitrification sand filters.

Disinfection:

- Ultraviolet Disinfection

Treated Water Recharge:

- Two new sand infiltration beds (80,000 sq ft total).

Sludge Processing:

- 1.0 m Belt Filter Press.

Odor Control:

- Activated Carbon.

Support Facilities:

- Return activated sludge and waste activated sludge pumping (centrifugal pumps).
- Plant water (pumps and hydropneumatic tank).
- Sodium hypochlorite for nocardia control – chemical tank and pumps.
- Sodium hydroxide for alkalinity addition – chemical tank and pumps.
- Methanol –for supplemental carbon.

Other considerations as requested by the Town for flexible future site operations:

- Provide space for a physical/chemical total phosphorus removal system, and a possible additional anaerobic zone for total phosphorus removal.
- Provide space for return activated sludge processing for the possible consideration of a Cannibal® sludge minimization process.

At the time of the Draft CWMP, disinfection was not being proposed for Alternative #3. The treated water is being recharged to the ground, through sand infiltration basins, which has been reported as very effective at removing viral and bacterial contaminants. The USEPA's *Process Design Manual: Land Treatment of Municipal Wastewater Supplement on Rapid Infiltration and Overland Flow*, states "*There has never been any evidence of any water-related disease problem related to the operation of any land treatment system in the United States*." The USEPA Manual further states: "*Since the RI {rapid infiltration} system itself will remove bacteria and virus effectively, there is no need for wastewater {disinfection} prior to application*." Therefore, disinfection facilities were not being proposed. However, following subsequent discussions and

reviews as described in Chapter 1, UV disinfection will be provided and is included in Alternatives 3 and 4.

Table 9-6 Inventory of Existing and Proposed Facilities and Process Equipment summarizes the equipment that would be included as part of this alternative.

B. **Collection System.** The collection system will be phased over 30 or more years. The first 20 years will involve expansion of the collection system to address those areas in Town identified as AOCs in order to achieve the TMDLs. This will include the extension of sewers within 61 sewersheds shown on Figure 9-6 and Table 9-7. This Table also includes flows for the existing collection system as well as other existing privately owned collection systems. These flows are important to quantify as the Town develops their flow estimates. CBI has been included in this Table as a result of discussions with MassDEP regarding CBI's wastewater treatment system's poor performance, and therefore may be required to be connected to the Town's collection system.

Flows were developed as discussed in Chapter 2 of this report and consider build-out (future conditions). Because this is a planning study the values reported in tables like 9-7, where I/I is considered, represent the potential future flow conditions that could be experienced at the WWTF. Therefore, these values when compared to the average annual flow for any given area may appear large.

I/I can occur under any flow condition and, therefore, it is represented as a constant value that is added to various flow conditions (average annual, maximum month, peak day, peak instantaneous). It is anticipated that following initial start up and through proper regulations these values should be less than reported, however, for planning purposes a design life of the collection system piping should be estimated at greater than 50 years. It is not unreasonable to expect that as the system ages I/I can become a significant component of flow and, therefore, must be accounted for in planning and design.

These I/I values are conservatively based upon the recommendations of the "Design Guide for Wastewater Treatment Works" (commonly referred to as TR-16) as prepared by the New England Interstate Water Pollution Commission, and used by MassDEP and design professionals to plan and design for wastewater infrastructure. Use of proper construction procedures and

oversight during construction can significantly reduce initial and future infiltration, and enforcement of sewer use regulations to eliminate inflow from sump pumps and roof leaders can limit future inflow.

9.5 TOWN-WIDE SEWER - ALTERNATIVE #4 – NEW WWTF TO TREAT 1.9 MGD AVERAGE ANNUAL

Alternative #4 is the expansion of Alternative #3 to treat the wastewater from the entire Town (average annual flow of 1.9 mgd). The evaluation and technology selection are the same as for Alternative #3. Alternative #4 provides some additional sludge handling facilities for future conditions and expansion of the effluent disposal facilities.

Key considerations of Alternative #4 are:

- Two-phased implementation of WWTF expansion. Phase 1 is as described in alternative #3. Phase 2 would expand the facility to 1.9 mgd on an average annual basis and provide capacity to serve the entire Town of Chatham. WWTF Flows are summarized on Table 9-5.
- Expansion of the collection system to areas beyond those sewered in Phase 1, with the possibility of sewering all of the 94 sewersheds identified during preliminary design.
- Continuation of management recommendations identified in Alternative #3.

A. **WWTF Expansion.** The following wastewater treatment processes have been identified throughout the development of the CWMP. The following list is a summary of the core technologies that would be added as part of Phase 2 to those identified as part of Alternative #3:

<u>Preliminary Treatment:</u>

- Complete plant pre-engineered system for screening and grit removal.

<u>Secondary Treatment:</u>

- Orbal® process expansion with 4th ring.
- Third secondary clarifier.

Filtration:

- Continuous backwash denitrification sand filters expanded as required.

Disinfection:

- Additional banks of UV bulbs.

Treated Water Recharge:

- Addition of two new sand infiltration beds (60,000 sq ft total).

Sludge Processing:

- A new 2.0 m Belt Filter Press.

Support Facilities (as needed) to Handle Additional Flows

B. **Collection System.** In Alternative #4 the collection system will be extended to the 33 remaining sewersheds over the ten years following the Phase 1 implementation, resulting in town-wide coverage as shown in Figure 9-1 and Table 9-8. The Figure and Table represent the extent and costs, respectively, of the entire Town-wide implementation of this Alternative (both Phase 1 and Phase 2).

The total length of proposed Town-wide sewer is approximately 106 miles, 88 miles of which are proposed gravity and 18 miles of proposed low pressure, compared to the existing system of approximately 5 miles of gravity mains. The total number of low pressure grinder pumps is estimated at 1,200. This is based on one grinder pump per building/property. There are grinder pump units suitable for multiple buildings; however, these installations can become difficult to manage if buildings are owned by different parties; therefore, this plan is based on one pump per property.

Of the 1,200 grinder pumps proposed, approximately 530 belong to buildings where a gravity main travels by, but the elevation of the building is lower than the gravity main; therefore a pump is needed to convey the wastewater to the higher elevation in the main. The remaining 670 grinder pumps belong to buildings that have low pressure sewers based on review discussions and the cost analysis with the Town.

9.6 SUMMARY

The following alternatives are being carried forward for evaluation as part of the environmental impact analysis in Chapter 10:

- Alternative #1 – No Action Alternative (MEPA requirement)
- Alternative #3 – Sewer to Meet TMDL
- Alternative #4 – Town-wide Sewer

Costs developed for Alternative #2 were compared to the costs of addressing those same watersheds with a centralized collection system as identified in Alternative # 3 to achieve TMDL limits, see Table 9-9. Comparisons were based on Present Worth Value and only considered the sewer and WWTF improvement costs associated with the specific watershed in order to provide an even comparison.

For the five watersheds where a combination of technologies were considered, the total present worth cost of sewering for Ryder's Cove, Sulphur Springs, and Taylor's Pond to achieve TMDLs was less than the present worth value of using a combination of sewers and I/A technologies.

Cost analysis of the Mitchell River and Mill Pond watersheds showed use of individual I/A technologies, when combined with sewer, could be cost effective (on a present worth basis). However, these present worth costs do not include the cost of managing these systems through the Town's existing departments, or the creation of and management through a new department or management district. In addition, the proximity of these areas to the existing collection system and the level of effort and management necessary to verify that the I/A systems consistently achieve permit limits so TMDLs can be achieved, makes this a less attractive alternative to the use of a centralized collection system. Based on this analysis, the lowest cost alternative to be considered for these sub-watersheds is a centralized collection system.

The findings from both a monetary and non-monetary analysis indicate that sewering remains the more favorable alternative, therefore, Alternative #2 will not be considered further.