

Section 1

Introduction

1.1 Background

This *Wastewater Facilities Plan* presents a 20-year plan for wastewater collection, treatment and disposal for the Town of Stonington. The plan has been prepared in conformance with the Connecticut Department of Environmental Protection (CTDEP) guidelines, and has been partly funded through the State's Clean Water Fund.

The plan has been developed for the Stonington Water Pollution Control Authority (WPCA) as part of a public process. WPCA presented an initial draft of the plan at a public hearing in August 2001. Due to the volume and character of public comment, WPCA provided an extended public comment period, and commissioned a Citizens Review Panel to thoroughly review the draft plan and develop comments and recommendations. After careful consideration of the public comments received on the initial draft, and a complete re-evaluation of the recommendations contained in the initial draft, in fall 2002 WPCA endorsed an alternative to construct a new wastewater treatment facility to replace the three existing plants.

Similarly, a *Facilities Plan Update for the Town of Groton, Connecticut* was prepared by Fuss & O'Neill Inc. in 1996. This included recommendations for collection, treatment and disposal improvements for the Town of Groton system. Given that these neighboring towns were about to make substantial improvements to their respective treatment facilities, the CTDEP suggested that a regional solution including the transfer of all or a portion of Stonington's wastewater flows to the Groton system for treatment and disposal might be advantageous for both communities and should be investigated. As a result, the Stonington WPCA entered into an agreement with CDM, in association with Fuss & O'Neill Inc., to investigate the feasibility of a regional solution. In January 2004, the draft *Groton Analysis* indicated significant capital and operational costs for the regional alternative. After significant discussion, both towns agreed that it was no financial advantage to pursue this option further. A copy of the *Groton Analysis* is included as Appendix F.

WPCA presented its revised draft of the plan, including the recommendation to construct a new wastewater treatment plant to replace the three existing plants, at a public hearing in February 2005. Again, WPCA received a high volume of public comment, most of it against the draft's recommendation to construct a new treatment facility. Subsequent to the hearing, WPCA withdrew the recommendation for a new treatment facility and in the period since the hearing re-evaluated the alternatives. During this period, WPCA was formally notified by the Town of Groton that the regional alternative involving transfer of flow to the Groton system is not a viable option.

In November 2006, WPCA presented its revised draft of the plan at a third Public Hearing. This latest revision, which includes the recommendation to upgrade and maintain operation at its three existing wastewater treatment plants, met with minimal, and generally positive, comments from the public.

1.2 Purpose and Scope

1.2.1 Purpose

The Wastewater Facilities Plan has been prepared to meet the following goals:

- To provide the Stonington WPCA with a cost-effective, comprehensive plan to meet the Town's wastewater needs for the next 20 years.
- To obtain public and regulatory approval of the Plan.
- To position the Town for funding opportunities.

Facilities planning must be performed in order to obtain Grant Assistance from the Connecticut Department of Environmental Protection (CTDEP) for wastewater collection and treatment system improvements. The information contained in this Wastewater Facilities Plan is consistent with state and federal regulations regarding Clean Water funding (i.e., funding provided pursuant to the Clean Water Act and the Connecticut Environmental Protection Act), and the Plan of Study previously approved by CTDEP.

Facilities planning determines wastewater collection and treatment system needs over a 20-year planning period and develops strategies for meeting those needs. The Wastewater Facilities Plan provides the basis for subsequent design and construction, substantiates the need for new or upgraded facilities, examines the cost-effectiveness of a number of feasible alternatives, and demonstrates that the selected alternative is implementable from legal, institutional, financial, and management perspectives.

In addition to a comprehensive evaluation of existing facilities and future system needs within the study area, the Wastewater Facilities Plan also evaluates existing and projected demographic characteristics, and topographic, hydrologic, and institutional features of the study area and assesses their impact on wastewater collection and treatment needs.

1.2.2 Scope

The Wastewater Facilities Plan has been organized as described in the following paragraphs.

Executive Summary

The Executive Summary provides an overview of the findings, conclusions, and recommendations of the Wastewater Facilities Plan. Detailed analysis and discussion of these topics are contained in the body of the report. The Executive Summary is provided for those readers requiring a cursory knowledge of the facilities plan's

contents and provides a concise reference, presenting a condensed version of the major ideas contained in the body of the report.

Section 1 Introduction

Section 1 of the Wastewater Facilities Plan introduces the project. Project goals and approaches are described, and the framework for the technical sections to follow is presented.

Section 2 Wastewater Disposal Needs

Section 2 presents the evaluation of wastewater disposal needs within the Town. The first part of the evaluation involves identification of those areas in Town that are in need of solutions to wastewater disposal problems, because of failing on-lot systems and poor local conditions, such as soil type or high groundwater. The second part of Section 2 includes an evaluation of alternatives to address these problems in the identified areas, and includes recommended solutions.

Section 3 Projected Flows and Loads

Section 3 presents the development of design flow and load projections for use in the Wastewater Facilities Plan. The section documents the sources of information used, the projection methodology, and the results. Flow and load projections include the following sources of wastewater: domestic (from residents), institutional, commercial, industrial, and infiltration and inflow of extraneous wastewater.

Section 4 Wastewater Collection Systems

Section 4 presents an evaluation of Stonington's existing wastewater collection systems, including the interceptor sewers, pump stations, and forcemains. The section documents the results of an inspection of the existing facilities, and a capacity analysis of each major segment of the system.

Section 5 Water Pollution Control Facilities Evaluation

Section 5 presents an evaluation of Stonington's three existing water pollution control facilities (the Mystic, Borough and Pawcatuck WPCFs). Each WPCF is described in detail, and the current operating criteria are summarized. The capacity of each WPCF is determined for varying treatment requirements, and mass balances are developed for each of the WPCFs.

Section 6 Water Quality Analyses

Section 6 presents an evaluation of receiving water issues associated with the discharge of treated wastewater effluent to Stonington Harbor and the Pawcatuck River. The section documents the fieldwork conducted to develop the analysis, and the conclusions. The Mystic River is not evaluated in the Plan because this receiving water was previously evaluated by CTDEP.

Section 7 Alternatives Evaluation

Section 7 presents the evaluation of alternatives available to Stonington for the treatment and disposal of wastewater. The section presents the methodology used in the evaluation, a discussion of wastewater process alternatives, a siting analysis for

those options requiring a new treatment plant site, identification of “finalist” alternatives, and a comparison of the finalist alternatives based on economic and non-economic criteria. This section includes a recommended alternative, based on the evaluation.

Section 8 Recommended Plan

Section 8 contains a summary of the recommendations from the previous sections, and presents an implementation plan, including schedule, describing how these recommendations can be developed over the 20-year duration of the Plan.

Section 9 Environmental Assessment

Section 9 presents a review of the environmental impacts associated with implementing the recommended plan. In addition, the Plan’s conformity with Connecticut’s Conservation and Development Plan is verified and documented.

Section 10 Financial Considerations

Section 10 presents and evaluation of the financial impacts of the recommended plan, and describes alternative mechanisms for funding the recommendations. Grants and low-interest loans from Connecticut are included in the evaluation, as well as phasing opportunities to reduce the impact on the residents of Stonington.

Section 11 Public Participation

Section 11 presents a description of the public participation aspect of the facilities plan development process. The public participation efforts completed throughout the course of the plan development are recorded, and the public’s comments, as received at the public meetings, hearings and throughout the process, are documented and addressed.

1.3 Planning Area

The Town of Stonington is located in the southeast-most corner of Connecticut. The Town is bordered by Westerly, Rhode Island to the east, Groton to the west, and North Stonington to the north, and its southern border consists entirely of shoreline. The Wastewater Facilities Plan study area is solely the Town of Stonington, with two additional, minor contributors, both in North Stonington. In the past, the Town of Stonington has reserved a capacity of 200,000 gallons per day of wastewater from North Stonington in its Pawcatuck collection and treatment systems; however, as a result of evaluating the impacts of holding this reserve and the Stonington public’s comments regarding these impacts, this 200,000 gallon per day flow is no longer included in WPCA’s planning.

1.4 Existing Water Pollution Control Facilities

Stonington currently owns and is responsible for three separate wastewater collection systems and water pollution control facilities (WPCFs). The existing system was the result of the last Town-wide facilities plan for Stonington, which was prepared in 1967.

1.4.1 Mystic WPCF

Prior to construction of the Mystic WPCF, local residences and businesses were serviced by on-site septic systems, and it was known that many of these systems were not operating correctly due to soil conditions. In 1970, the Town of Stonington was granted approval to construct the Mystic WPCF as a 0.88-mgd conventional, secondary-treatment plant, utilizing the activated sludge process, and chlorination for disinfection. Construction of the plant was completed in 1972, and the plant was placed into operation.

In 1987, flows to the Mystic plant began to exceed 90 percent of its design capacity. In January 1988 CTDEP issued an Order which required Stonington to: 1) evaluate the capacity of the Mystic WPCF; 2) prepare 20-year flow projections for the service area; and 3) institute a sewer connection moratorium on the plant's service area.

In 1993 and 1994, WPCA completed a study for improving the operation and performance of the Mystic WPCF. The planned approach included a short-term upgrade program comprised of either operational or minor equipment or structural changes that would immediately improve treatment at the Mystic WPCF. The study also included recommendations for longer-term improvements, key among them being construction of a new double-barrel forcemain between the Mystic and Borough WPCFs, to allow a portion of the Mystic flow to be diverted to the Borough WPCF for treatment. This, together with other improvements at both the Mystic and Borough WPCFs, allowed for removal of the new connection moratorium in the Mystic WPCF service area. The plant upgrade and forcemain construction work was completed in 1999.

The Mystic WPCF was designed to treat an average flow of 0.80 million gallons per day (mgd), and a peak flow of 2.35 mgd. It appears that the permitted average flow of 0.88 mgd, rather than 0.80 mgd, resulted from a clerical error when the permit was originally issued.

The Mystic WPCF employs the following treatment processes:

- Influent comminution (or bypass coarse screening)
- Influent raw sewage pumping
- Primary clarification, with waste activated sludge (WAS) co-settling
- Activated sludge biological treatment
- Disinfection with sodium hypochlorite
- Primary underflow (sludge) de-gritting
- Diversion pumping of de-gritted primary clarifier underflow (to Borough WPCF)

- Odor control
- Digesters (abandoned)

1.4.2 Borough WPCF

Construction of the Borough WPCF was completed in 1975, and the plant was placed into operation.

The Borough WPCF was designed to treat an average flow of 0.66 million gallons per day (mgd). The plant discharges to Stonington Harbor.

The Borough WPCF currently employs the following treatment processes:

- Influent comminution (or bypass coarse screening)
- Influent raw sewage pumping
- Primary clarification, with waste activated sludge (WAS) co-settling
- Activated sludge biological treatment
- Disinfection with sodium hypochlorite
- Sludge thickening and thickened sludge storage
- Odor control

As described earlier, in 1993 and 1994, a study was completed for improving the operation and performance of the Mystic WPCF. A key recommendation from the study was construction of a new double-barrel forcemain between the Mystic and Borough plants, to allow a portion of the Mystic flow to be diverted to the Borough WPCF for treatment. Implementation of this diversion required that upgrade work be conducted at the Borough WPCF. The work at the Borough WPCF included installation of a fine-bubble aeration system, retrofit of the plant's existing digesters into new primary clarifiers, and conversion of one of the plant's existing primary clarifiers into a secondary clarifier. The diversion from the Mystic WPCF began in September 1999.

1.4.3 Pawcatuck WPCF

Construction on the Pawcatuck WPCF was completed in 1978, and the plant was placed into operation. The Pawcatuck WPCF utilizes the same unit processes as the other two plants, but is comprised of a different layout because of the available space.

The Pawcatuck WPCF was designed to treat an average flow of 1.3 million gallons per day (mgd). The plant discharges to the Pawcatuck River. The plant is currently treating flows well below its original design capacity. The Pawcatuck WPCF receives all of its influent flow from a discharge forcemain from the nearby Pump Station No.

3. There are no influent pumping or preliminary treatment (comminution, screening or grit removal) facilities at the Pawcatuck WPCF site.

The Pawcatuck WPCF currently employs the following treatment processes:

- Primary clarification, with waste activated sludge (WAS) co-settling
- Septage receiving
- Activated-sludge biological treatment
- Disinfection with sodium hypochlorite
- Sludge thickening and thickened sludge storage
- Odor control
- Digesters (abandoned).

1.5 Water Quality Objectives

1.5.1 Legislative/Regulatory Background

The *Federal Water Pollution Control Act Amendments of 1972* and the *1977 Clean Water Act* are the key federal regulations controlling activities which affect surface water. The overall objective of the *Clean Water Act* is “to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters”. Section 106, 205(j), 208 and 303 of the Act provide the basis for state and regional Water Quality Management. Water Quality Management is aimed at achieving the water quality goals contained in the Act through designation of Water Quality Standards, development of wasteload allocations, and initiation of non-point water quality studies.

The Water Quality Management planning process is implemented through a number of State and federal environmental programs. The following components of the *Clean Water Act* are essential to the Water Quality Management and planning process:

1. **Development of Water Quality Standards (WQS) and regulations necessary to enforce them.**

Section 303 of the federal *Clean Water Act* requires states to adopt surface water quality standards and review and modify these standards at least once every three years.

Section 22a-426 of the Connecticut General Statutes further requires the Commissioner of Environmental Protection to adopt standards of water quality for all the State’s waters. These standards are enforceable under a number of state regulations.

Federal law defines water quality-based standards as the identification and assignment of intended uses to be made of the water and establishing the criteria necessary to protect those uses. Federal regulations require that water quality standards should, wherever attainable, provide water quality for the protection and propagation of fish, shellfish and wildlife and for recreation in and on the water. The state's water quality classifications, based upon the adopted WQS, establish designated uses for surface and ground waters in Connecticut. Mystic Harbor, Stonington Harbor, and the Pawcatuck River have been classified SA/SB or SC, meaning the existing water quality is Class SC and the goal is Class SB.

Class SB water quality designated uses include recreation, fish, and wildlife habitat, agricultural and industrial water supply, and other legitimate uses including navigation. It is CTDEP's goal to attain these conditions in the three receiving water bodies such that Class SB Water Quality Standards are met.

2. Formulation of state and area wide Water Quality Management (WQM) Plans, including comprehensive analysis of the actions necessary to meet the WQS.

Water Quality Management Plans are required by the *Clean Water Act* to provide a basis for regulatory control and enforcement of water pollution abatement activities. In Connecticut, WQM Plans for specific river basins and other geographic planning areas generally take on the form of a wasteload allocation. A wasteload allocation acts to translate water quality criteria into wastewater discharge effluent limitations which are incorporated into a National Pollutant Discharge Elimination System (NPDES) permit.

A wasteload allocation, as its name implies, allocates pollutant loadings and concentration limits to the major contributors of wastewater to a waterbody, up to the determined "Total Maximum Daily Loading" (TMDL). The TMDL is the estimated maximum pollutant loading which a waterbody can receive and still achieve in-stream water quality conditions identified in the state's Water Quality Standards.

The major pollutants of concern for a municipal wastewater facility, and accordingly those for which TMDLs are usually determined, are biochemical oxygen demand, nutrients (nitrogen and phosphorous), and solids. Aesthetic quality may also be considered in this determination.

3. Issuance of permits for point and non-point source discharges.

Connecticut is delegated by the Environmental Protection Agency (EPA) to administer the National Pollutant Discharge Elimination System (NPDES) permitting program for wastewater discharges to surface waters in the state. This program is authorized under Section 402(b) of the federal *Clean Water Act* and Section 22a-430 of the Connecticut General Statutes. NPDES permits are

typically issued for a five year period and specify operating restrictions, physical and chemical discharge limitations, and monitoring and reporting requirements.

The Mystic WPCF, Borough WPCF and Pawcatuck WPCF are currently operating under NPDES Permit Nos. CT0100544, CT0101281 and CT0101290, respectively and all are operating under the General Permit for Nitrogen Discharges. A copy of the permits is contained in Appendix D. **Table 1-1** is a summary of the existing permit and anticipated effluent limitations.

Table 1-1			
Anticipated WPCF Effluent Quality Requirements			
Condition	Mystic WPCF	Borough WPCF	Pawcatuck WPCF
BOD₅ (mg/L)	30 (avg. monthly) 50 (max. daily)	25 (avg. monthly) 45 (max. daily)	25 (avg. monthly) 45 (max. daily)
TSS (mg/L)	30 (avg. monthly) 50 (max. daily)	30 (avg. monthly) 50 (max. daily)	30 (avg. monthly) 50 (max. daily)
TN (mg/L)¹	8.1 mg/L (2006) 5.1 mg/L (2014) 4.5 mg/L (2025)	10.9 mg/L (2006) 6.6 mg/L (2014) 5.6 mg/L (2025)	8.5 mg/L (2006) 4.2 mg/L (2014) 3.1 mg/L (2025)
pH range	6 to 9	6 to 9	6 to 9
Fecal Coliform (per 100 ml)	200 (30-day mean) 400 (7-day mean)	200 (30-day mean) 400 (7-day mean)	200 (30-day mean) 400 (7-day mean)
Total residual chlorine (TRC) (mg/L)²	0.2 (minimum) 1.5 (maximum)	0.2 (minimum) 1.5 (maximum)	0.2 (minimum) 1.5 (maximum)
<p>¹ TN concentrations are based on <i>the General Permit for Nitrogen Discharges</i> allowable WLA (lbs/day) and the projected annual average flow in the indicated year. TN WLAs may be traded among the Stonington WPCFs; it is possible that a WPCF can discharge at a higher effluent TN concentration, but an increase in effluent wasteload will have to be made up by an equal decrease in discharge quantity at another WPCF. TN WLAs 2006 and 2014 are based on the General Permit. It is assumed that the WLA for 2025 is the same as for 2014. More stringent treatment would be needed (in terms of concentration) because of the projected flow increases over time.</p> <p>² Existing effluent TRC limits shown. It is anticipated that stricter limits on TRC will be permitted in the future, requiring that dechlorination be provided following chlorine disinfection.</p>			

1.5.2 Required Degree of Wastewater Treatment

Table 1-1 summarizes the anticipated levels of treatment that would be required for each WPCF. These are based on the current permits for the three existing plants, with the added requirement to eventually provide nitrogen removal. By taking advantage of the nitrogen trading program, the level of treatment shown for effluent nitrogen can be delayed and/or reduced.

1.5.3 Nitrogen Removal

CTDEP, together with the New York State Department of Environmental Conservation (NYSDEC) and the EPA, has been investigating water quality problems in Long Island Sound. The study has identified nitrogen as a primary pollutant that is causing low dissolved oxygen (DO) levels in the Sound's bottom waters each summer. Nitrogen fuels the growth of algae, and when the algae eventually dies and decays, dissolved oxygen is consumed. The problem is severe enough that the DO levels in some areas of the Sound fall below 1 or 2 milligrams per liter (mg/L), well below Connecticut's water quality standard of 6 mg/L.

To address the low DO problem, Connecticut has developed a state-wide total maximum daily load (TMDL) analysis for nitrogen. The TMDL specifies the maximum amount of nitrogen that can be discharged to the Sound without significantly impairing the health of the Sound. The dominant source of nitrogen is wastewater treatment plant effluent. To meet the statewide TMDL, CTDEP enacted a *General Permit for Nitrogen Discharges* which assigns each wastewater treatment plant a wasteload allocation (WLA) for nitrogen. These WLAs decline over time through 2014 and require that the facilities eventually be able to provide nitrogen removal to a low discharge concentration, as summarized in Table 1-1.

The state's nitrogen removal program includes a nitrogen-trading aspect that allows treatment plant owners to buy and sell nitrogen credits, depending on their plant's annual performance versus their WLA. This trading program provides some flexibility in upgrading treatment plants, in terms of schedule and effluent criteria, especially for small treatment plants on the eastern end of Long Island Sound (such as Stonington).