

TOWN OF ORLEANS

COMPREHENSIVE WASTEWATER MANAGEMENT PLAN AND

SINGLE ENVIRONMENTAL IMPACT REPORT

TABLE OF CONTENTS

| SECTION | DESCRIPTION | PAGE |
|----------------|--|-------------|
| ES | EXECUTIVE SUMMARY | ES-1 |
| 1 | INTRODUCTION | 1-1 |
| 2 | EXISTING CONDITIONS..... | 2-1 |
| | 2.1 Land Use and Demographics | 2-1 |
| | 2.2 Environmentally Sensitive Areas | 2-5 |
| | 2.2.1 Watersheds..... | 2-6 |
| | 2.2.2 Freshwater Ponds | 2-6 |
| | 2.2.3 Coastal Embayments | 2-10 |
| | 2.2.4 Protected Areas | 2-11 |
| | 2.3 Soils | 2-16 |
| | 2.4 Groundwater | 2-19 |
| | 2.5 Water Use and Wastewater Flows..... | 2-19 |
| 3 | WASTEWATER MANAGEMENT NEEDS..... | 3-1 |
| | 3.1 Approach | 3-1 |
| | 3.2 Sanitary Needs | 3-2 |
| | 3.2.1 Title 5 Variances | 3-3 |
| | 3.2.2 Intensive Water Use | 3-8 |
| | 3.2.3 Receiving Water Impacts..... | 3-9 |
| | 3.2.4 Combined Indicators of Sanitary Needs..... | 3-12 |
| | 3.3 Water Supply Protection | 3-12 |
| | 3.3.1 Private Wells..... | 3-12 |
| | 3.3.2 Public Wells..... | 3-16 |
| | 3.3.3 Overview of Water Supply Protection Needs..... | 3-18 |
| | 3.4 Surface Water Protection | 3-19 |
| | 3.4.1 Freshwater Ponds | 3-19 |
| | 3.4.2 Estuaries | 3-24 |
| | 3.5 Convenience and Aesthetics..... | 3-29 |
| | 3.6 Economic Growth..... | 3-34 |
| | 3.7 Summary of Current Needs..... | 3-35 |
| 4 | FUTURE CONDITIONS | 4-1 |
| | 4.1 Future Wastewater Quantities | 4-1 |
| | 4.1.1 Definition of Terms..... | 4-1 |

TABLE OF CONTENTS (CONT.)

| SECTION | DESCRIPTION | PAGE |
|---------|---|------|
| | 4.1.2 Theoretical Build-Out..... | 4-2 |
| | 4.1.3 Practical Build-Out..... | 4-3 |
| | 4.1.4 Planning Horizon | 4-4 |
| | 4.2 Population Projections | 4-7 |
| | 4.3 Future Wastewater Needs | 4-9 |
| | 4.4 "No Action" Alternative..... | 4-9 |
| 5 | IDENTIFICATION AND EVALUATION OF WASTEWATER PLAN COMPONENTS..... | 5-1 |
| | 5.1 Wastewater Flows and Loads..... | 5-1 |
| | 5.1.1 Summary of Wastewater Management Needs..... | 5-1 |
| | 5.1.2 Strategies for Reductions of Flows and Loads | 5-3 |
| | 5.2 Wastewater Collection | 5-6 |
| | 5.2.1 Collection System Options | 5-6 |
| | 5.2.2 Criteria for Identifying Properties to be Served..... | 5-7 |
| | 5.3 Wastewater Treatment | 5-8 |
| | 5.3.1 Effluent Limitations and Expected Performance | 5-9 |
| | 5.3.2 Management of Residuals | 5-17 |
| | 5.4 Wastewater Reuse and Disposal..... | 5-19 |
| | 5.4.1 Wastewater Disposal Technology..... | 5-19 |
| | 5.4.2 Wastewater Reuse Opportunities | 5-20 |
| | 5.5 Siting of Wastewater Treatments and Disposal Facilities | 5-22 |
| | 5.5.1 Initial Site Identification and First-Level Screening.... | 5-22 |
| | 5.5.2 Target Effluent Disposal Capacity | 5-22 |
| | 5.5.3 Second-Level Site Screening | 5-23 |
| | 5.5.4 Site-Specific Exploration Needs | 5-27 |
| | 5.5.5 Next Steps..... | 5-28 |
| | 5.6 Non-Traditional Nitrogen Control Measures | 5-28 |
| 6 | FORMULATION OF COMPOSITE WASTEWATER PLANS | 6-1 |
| | 6.1 Initial Plan Formulation | 6-1 |
| | 6.2 Evaluation Criteria..... | 6-4 |
| | 6.3 Overview of Wastewater Plans Recommended for Detailed Evaluation | 6-6 |
| | 6.4 Plan Descriptions..... | 6-9 |
| | 6.5 No Action Plan | 6-11 |
| | 6.6 Importance of Nitrogen Balance..... | 6-11 |
| | 6.7 Extent of Sewer System | 6-12 |
| 7 | EVALUATION OF ALTERNATIVE PLANS | 7-1 |
| | 7.1 Introduction | 7-1 |
| | 7.2 Transfer of Water Among Watersheds | 7-2 |
| | 7.3 Transfer of Nitrogen Among Watersheds..... | 7-7 |
| | 7.4 Extent of Sewer System | 7-8 |
| | 7.5 Need for Land Purchases and Easements | 7-9 |

TABLE OF CONTENTS (CONT.)

| SECTION | DESCRIPTION | PAGE |
|---------|--|------|
| | 7.6 Capital Costs | 7-9 |
| | 7.7 Operation and Maintenance Costs..... | 7-13 |
| | 7.8 Net Present Worth Costs | 7-14 |
| | 7.9 Impacts of User Charges and Tax Rate..... | 7-15 |
| | 7.10 Environmental Impacts | 7-15 |
| | 7.11 Energy Consumption | 7-15 |
| | 7.12 Suitability of Treatment Facility Sites | 7-18 |
| | 7.13 Truck Traffic at Tri-Town Site..... | 7-19 |
| | 7.14 Expandability | 7-21 |
| | 7.15 Flexibility for Phasing | 7-22 |
| | 7.16 Potential for Water Reuse | 7-24 |
| | 7.17 Regulatory Acceptability | 7-24 |
| | 7.18 Ease in Implementation | 7-26 |
| | 7.19 Potential for Impacting Town Growth Rate | 7-27 |
| | 7.20 Potential for Siting a Public Works Facility at the Tri-Town Site | 7-28 |
| | 7.21 Overall Public Acceptability | 7-30 |
| | 7.22 Summary of Evaluation | 7-30 |
| 8 | EVALUATION OF ENVIRONMENTAL IMPACTS | 8-1 |
| | 8.1 Introduction | 8-1 |
| | 8.2 Project Description | 8-1 |
| | 8.3 Alternatives to the Project | 8-1 |
| | 8.4 Existing Environment | 8-2 |
| | 8.5 Assessment of Impacts..... | 8-2 |
| | 8.5.1 Surface Water Quality | 8-2 |
| | 8.5.2 Groundwater Quality | 8-3 |
| | 8.5.3 Wetlands | 8-4 |
| | 8.5.4 Floodplains | 8-4 |
| | 8.5.5 Coastal Resources..... | 8-5 |
| | 8.5.6 Open Space and Recreation | 8-5 |
| | 8.5.7 Rare and Endangered Species | 8-6 |
| | 8.5.8 Archaeological and Historic Resources..... | 8-7 |
| | 8.5.9 Traffic | 8-8 |
| | 8.5.10 Air Quality | 8-8 |
| | 8.5.11 Noise | 8-9 |
| | 8.5.12 Erosion Control | 8-9 |
| | 8.5.13 Waste Material | 8-9 |
| | 8.5.14 Existing Vegetation | 8-10 |
| | 8.5.15 Energy | 8-10 |
| | 8.5.16 Generation of Solid Waste | 8-10 |
| | 8.5.17 Public Health..... | 8-10 |
| | 8.5.18 Community Growth and Land Use..... | 8-11 |
| | 8.6 Regulatory Standards and Requirements..... | 8-11 |
| | 8.7 Mitigation Measures | 8-12 |
| | 8.8 The "No Action" Alternative | 8-13 |

TABLE OF CONTENTS (CONT.)

| SECTION | DESCRIPTION | PAGE |
|---------|---|-------|
| 9 | POTENTIAL FOR REGIONALIZATION | 9-1 |
| | 9.1 Introduction..... | 9-1 |
| | 9.2 Regionalization Options..... | 9-1 |
| | 9.3 Evaluation of Options | 9-3 |
| 10 | POTENTIAL FOR WATER REUSE..... | 10-1 |
| | 10.1 Introduction..... | 10-1 |
| | 10.2 Reuse Options | 10-1 |
| | 10.3 Level of Treatment..... | 10-5 |
| | 10.4 Cost Estimates | 10-6 |
| | 10.5 Regulatory Issues..... | 10-6 |
| | 10.6 Other Non-Cost Factors | 10-7 |
| 11 | RECOMMENDED PLAN..... | 11-1 |
| | 11.1 Introduction..... | 11-1 |
| | 11.2 Development of Recommended Plan..... | 11-1 |
| | 11.2.1 Activities of the WMSC..... | 11-1 |
| | 11.2.2 Public Consultation Process | 11-2 |
| | 11.2.3 Plan Selection..... | 11-3 |
| | 11.2.4 Review by Outside Entities..... | 11-4 |
| | 11.3 Overview of Recommended Plan | 11-4 |
| | 11.4 Structural Elements of Recommended Plan | 11-6 |
| | 11.4.1 Wastewater Collection System..... | 11-6 |
| | 11.4.2 Wastewater Treatment System..... | 11-8 |
| | 11.4.3 System for Effluent Disposal and Reuse..... | 11-9 |
| | 11.4.4 Facilities for Septage Handling | 11-12 |
| | 11.4.5 Facilities of Sludge Handling | 11-12 |
| | 11.4.6 Local Wastewater Management Systems..... | 11-13 |
| | 11.4.7 Alternate Layouts for Tri-Town Site..... | 11-14 |
| | 11.5 Non-Structural Elements of Recommended Plan..... | 11-14 |
| | 11.5.1 Fertilizer Control Program | 11-15 |
| | 11.5.2 Stormwater Management | 11-16 |
| | 11.5.3 Water Conservation Program | 11-16 |
| | 11.5.4 Flow and Load Reduction Initiatives | 11-16 |
| | 11.5.5 Enhancement of Embayments Flushing Rates..... | 11-17 |
| | 11.5.6 Land Use Controls..... | 11-18 |
| | 11.5.7 Implementation of Non-Structural Program..... | 11-20 |
| | 11.6 Adaptive Management Plan | 11-20 |
| | 11.7 Groundwater and Surface Water Monitoring Plan | 11-22 |
| | 11.8 TMDL Compliance Plan | 11-24 |
| | 11.9 Phasing of Facilities Construction | 11-28 |
| | 11.10 Regionalization | 11-33 |
| | 11.11 Soil and Groundwater Studies at Tri-Town Site | 11-34 |
| | 11.11.1 Studies Conducted to Date | 11-34 |
| | 11.11.2 Future Testing Program | 11-35 |

TABLE OF CONTENTS (CONT.)

| SECTION | DESCRIPTION | PAGE |
|---------|---|-------|
| | 11.11.3 Long-Term Monitoring Plan | 11-35 |
| | 11.11.4 Potential Disposal Capacity Under Extended and Regional Plans..... | 11-36 |
| | 11.11.5 Fate of Effluent Discharged at the Tri-Town site..... | 11-36 |
| 11.12 | Implementation Steps..... | 11-38 |
| | 11.12.1 Establishment of a Managing Entity | 11-38 |
| | 11.12.2 Land Acquisition | 11-38 |
| | 11.12.3 Regulations, Bylaws and Policies | 11-39 |
| | 11.12.4 Permitting..... | 11-41 |
| | 11.12.5 Coordination with OBEGWPD on Septage Management and Land Requirements..... | 11-42 |
| | 11.12.6 Coordination with Brewster and Eastham on Wastewater Regionalization | 11-43 |
| | 11.12.7 Freshwater Pond Monitoring and Evaluation | 11-44 |
| | 11.12.8 Energy Conservation/Generation and Green Design | 11-44 |
| | 11.12.9 Water Service to Properties Near Wastewater Disposal Locations | 11-45 |
| | 11.12.10 Scope of Preliminary Design..... | 11-46 |
| | 11.12.11 Implementation Schedule..... | 11-47 |
| 11.13 | Financial Plan | 11-48 |
| | 11.13.1 Current Estimates of Cost | 11-48 |
| | 11.13.2 Capital Costs | 11-50 |
| | 11.13.3 Operation and Maintenance Costs | 11-51 |
| | 11.13.4 Application for SRF Loans | 11-52 |
| | 11.13.5 Potential for Grants..... | 11-53 |
| | 11.13.6 Financing Policy with Respect to Betterments and Taxes | 11-54 |
| | 11.13.7 Costs to Typical Users and Non-Users | 11-55 |
| 12 | MITIGATION MEASURES AND MEPA DRAFT SECTION 61 FINDINGS | 12-1 |
| | 12.1 Regulatory Standards and Requirements..... | 12-1 |
| | 12.2 Mitigation Measures | 12-2 |

LIST OF TABLES

| TABLE | DESCRIPTION | PAGE |
|-------|--|------|
| 1-1 | LIST OF COMMONLY USED ACRONYMS AND ABBREVIATIONS | 1-4 |
| 2-1 | SUMMARY OF LAND USE AND DEMOGRAPHIC DATA | 2-2 |
| 2-2 | CURRENT WASTEWATER FLOWS PER LOT..... | 2-22 |
| 2-3 | ANNUAL AVERAGE WASTEWATER QUANTITIES BY WATERSHED CURRENT CONDITIONS..... | 2-25 |

LIST OF TABLES (CONT.)

| TABLE | DESCRIPTION | PAGE |
|-------|--|-------|
| 3-1 | ENVIRONMENTAL SIGNIFICANCE RATING SYSTEM FOR TITLE 5 VARIANCES..... | 3-4 |
| 3-2 | SUMMARY OF TITLE 5 VARIANCE ANALYSIS..... | 3-6 |
| 3-3 | SUMMARY OF SANITARY NEEDS | 3-13 |
| 3-4 | POND TROPHIC STATUS, IMPAIRED USES AND WASTEWATER MANAGEMENT PRIORITIES | 3-20 |
| 3-5 | WASTEWATER FLOWS UPGRADIENT OF EVALUATED PONDS | 3-23 |
| 3-6 | REQUIRED NITROGEN LOAD REDUCTIONS BY SUB-EMBAYMENTS OF PLEASANT BAY..... | 3-26 |
| 3-7 | REQUIRED NITROGEN LOAD REDUCTIONS BY SUB-EMBAYMENTS OF CAPE COD BAY AND THE NAUSET SYSTEM..... | 3-30 |
| 3-8 | SUMMARY OF NEEDS ASSOCIATED WITH CONVENIENCE AND AESTHETIC FACTORS | 3-32 |
| 3-9 | SUMMARY OF CURRENT NEEDS IN ALL CATEGORIES | 3-37 |
| 4-1 | SUMMARY OF ASSUMPTIONS USED IN BUILD-OUT ANALYSIS..... | 4-5 |
| 4-2 | SUMMARY OF FUTURE NEEDS IN ALL CATEGORIES | 4-10 |
| 4-3 | ANNUAL AVERAGE WASTEWATER QUANTITIES BY WATERSHED AT PLANNING HORIZON | 4-11 |
| 5-1 | SUMMARY OF ALTERNATIVES FOR WASTEWATER MANAGEMENT COMPONENTS | 5-4 |
| 5-2 | EXPECTED EFFLUENT LIMITATIONS | 5-10 |
| 5-3 | EXPECTED EFFLUENT QUALITY..... | 5-12 |
| 5-4 | GENERAL CATEGORIES OF WASTEWATER SYSTEMS | 5-14 |
| 5-5 | INITIAL CAPACITY ESTIMATES FOR IDENTIFIED DISPOSAL SITES | 5-25 |
| 6-1 | INITIAL PLAN IDENTIFICATION | 6-3 |
| 6-2 | EVALUATIVE CRITERIA USED IN RATING WASTEWATER PLANS..... | 6-4 |
| 6-3 | SUMMARY OF WASTEWATER PLAN #1 | 6-14 |
| 6-4 | SUMMARY OF WASTEWATER PLAN #2 | 6-17 |
| 6-5 | SUMMARY OF WASTEWATER PLAN #3 | 6-20 |
| 6-6 | COMPARISON OF WASTEWATER PLANS..... | 6-23 |
| 7-1 | DISPOSITION OF EFFLUENT | 7-4 |
| 7-2 | DISPOSITION OF WASTEWATER NITROGEN..... | 7-8 |
| 7-3 | SUMMARY OF CAPITAL COST ESTIMATES | 7-11 |
| 7-4 | EVALUATION OF ENERGY USAGE..... | 7-16 |
| 7-5 | COMPARISON OF WASTEWATER TREATMENT SITES | 7-20 |
| 7-6 | SUMMARY OF EVALUATIVE CRITERIA..... | 7-31 |
| 11-1 | WASTEWATER SYSTEM DESIGN DATA FOR CORE PROGRAM | 11-11 |
| 11-2 | PRELIMINARY PHASING PLAN FOR CORE PROGRAM | 11-23 |

LIST OF TABLES (CONT.)

| TABLE | DESCRIPTION | PAGE |
|-------|--|-------|
| 11-3 | GROUNDWATER AND SURFACE WATER MONITORING PROGRAM | 11-25 |
| 11-4 | NUTRIENT LOAD REDUCTION BY PHASE | 11-32 |
| 11-5 | SUMMARY OF FLOWS COMPARED WITH APPARENT SURFICIAL CAPACITY OF TRI-TOWN SITE | 11-37 |
| 11-6 | SCHEDULE FOR IMPLEMENTATION | 11-49 |
| 11-7 | PRELIMINARY ESTIMATE OF CAPITAL COSTS FOR CORE PROGRAM | 11-51 |
| 11-8 | PRELIMINARY ESTIMATE OF OPERATION AND MAINTENANCE COSTS FOR CORE PROGRAM | 11-52 |
| 11-9 | EQUIVALENT ANNUAL COSTS FOR TYPICAL RESIDENTS | 11-56 |

LIST OF FIGURES

| FIGURE | DESCRIPTION | PAGE |
|--------|--|------|
| 1-1 | MAJOR WATERSHEDS | 1-3 |
| 2-1 | ZONING DISTRICTS | 2-3 |
| 2-2 | LAND USE | 2-4 |
| 2-3 | MONTHLY VARIATION IN RESIDENT POPULATION | 2-5 |
| 2-4 | MAJOR GROUNDWATER BASINS | 2-7 |
| 2-5 | FRESHWATER PONDS | 2-8 |
| 2-6 | ACEC'S WETLANDS, AND OPEN SPACES | 2-12 |
| 2-7 | OUTSTANDING RESOURCE WATERS AND SHELLFISH GROWING AREAS | 2-13 |
| 2-8 | FLOOD PLAINS | 2-14 |
| 2-9 | SOIL CONDITIONS | 2-18 |
| 2-10 | PERCHED WATER TABLE | 2-20 |
| 2-11 | CURRENT WASTEWATER FLOW PER LOT | 2-23 |
| 2-12 | CURRENT WASTEWATER FLOWS BY MAJOR WATERSHED | 2-24 |
| 2-13 | SEASONAL VARIABILITY IN WATER USE AND WASTEWATER FLOW | 2-26 |
| 3-1 | TITLE 5 VARIANCES 1995-2005 | 3-7 |
| 3-2 | WATER USE INTENSITY | 3-10 |
| 3-3 | RECEIVING WATER QUALITY | 3-11 |
| 3-4 | LOTS WITH SANITARY NEEDS | 3-14 |
| 3-5 | EXTENT OF PUBLIC WATER SUPPLY LINES | 3-15 |
| 3-6 | DEVELOPED LOTS IN PUBLIC WATER SUPPLY ZONE IIS | 3-17 |
| 3-7 | POND PROTECTION NEEDS | 3-22 |
| 3-8 | CONVENIENCE AND AESTHETIC FACTORS | 3-33 |
| 3-9 | AGGREGATED NEEDS | 3-36 |
| 4-1 | WASTEWATER FLOW PROJECTIONS AT BUILD-OUT | 4-6 |
| 4-2 | DETERMINATION OF WASTEWATER FLOW AT END OF PLANNING HORIZON | 4-8 |

LIST OF FIGURES (CONT.)

| FIGURE | DESCRIPTION | PAGE |
|--------|--|-------|
| 5-1 | GENERIC WASTEWATER MANAGEMENT SYSTEM | 5-2 |
| 5-2 | TRI-TOWN SEPTAGE TREATMENT FACILITY | 5-18 |
| 6-1 | WASTEWATER PLAN LEGEND..... | 6-7 |
| 6-2 | WASTEWATER PLAN #1 | 6-15 |
| 6-3 | WASTEWATER PLAN #1 | 6-16 |
| 6-4 | WASTEWATER PLAN #2 | 6-18 |
| 6-5 | WASTEWATER PLAN #2 | 6-19 |
| 6-6 | WASTEWATER PLAN #3 | 6-21 |
| 6-7 | WASTEWATER PLAN #3 | 6-22 |
| 7-1 | SCHEMATIC REPRESENTATION OF WASTEWATER MANAGEMENT PLANS | 7-3 |
| 10-1 | POSSIBLE RECLAIMED WATER PIPELINE | 10-4 |
| 11-1 | LOCATION OF COLLECTION SYSTEM INFRASTRUCTURE AND TREATMENT FACILITY | 11-7 |
| 11-2 | LAYOUT OF PROPOSED WASTEWATER TREATMENT AND DISPOSAL FACILITIES AT TRI-TOWN SITE..... | 11-10 |
| 11-3 | POSSIBLE SEWER PHASING PLAN | 11-30 |

LIST OF APPENDICES

| APPENDIX | DESCRIPTION |
|----------|--|
| A. | Evaluation of Freshwater Ponds - Bakers Pond, Boland Pond, Cedar Pond, Crystal Lake, Ice House Pond, Pilgrim Lake, Sarah's Pond, and Shoal Pond. |
| B. | Information on Wastewater Management Components |
| C. | Public Consultation |
| D. | Preliminary Sizing Data for Wastewater Treatment and Disposal Elements of Recommended Plan |
| E. | Hydrogeologic Investigations at Site 241 |
| F. | Hydrogeologic Modeling at Site 241, and Supplemental Soil Investigations |
| G. | Executive Summaries of Relevant Technical Reports by the Massachusetts Estuaries Project |
| H. | Habitat Assessment Letter Report |
| I. | Local Cluster Systems |
| J. | Greenhouse Gas Emissions Analysis |
| K. | Regionalization Study |
| L. | Town Regulations and Policies |
| M. | Peer Review of CWMP |
| N. | EOEEA Certificate and Response |