

TABLE OF CONTENTS

SECTION	PAGE NO.
EXECUTIVE SUMMARY	ES-1
1. Introduction	1-1
1.1 Project Study Area.....	1-1
1.2 Past Wastewater Planning In Study Area.....	1-1
1.2.1 Point-O-Woods Sewer System	1-1
1.2.2 Old Colony Beach Club Association and Old Lyme Shores Beach Club Association.....	1-1
1.2.3 Town's 2012 Preliminary Study	1-3
1.2.4 Miami Beach Wastewater Facilities Plan	1-3
1.2.5 Summary	1-3
1.3 Current Regulatory Framework	1-3
1.3.1 Long Island Sound Nitrogen	1-3
1.3.2 Consent Orders	1-3
1.3.3 Local Septic Regulations	1-4
1.4 Project Goals	1-4
1.5 Scope of Work.....	1-4
2. Wastewater Management Needs Analysis.....	2-1
2.1 Project Sub-Areas	2-1
2.2 Criteria Impacting On-Site Systems	2-3
2.3 Summary of Wastewater Management Needs.....	2-4
2.4 High Needs Wastewater Service Area	2-4
3. Current and Future Flow Projections.....	3-1
3.1 Assumptions for Flow Calculations.....	3-1
3.2 Average Annual Flow Projections.....	3-1
3.3 Seasonal Flow Variations	3-5
4. Overview of Local and Regional Alternatives.....	4-1
4.1 Overview	4-1
4.2 Wastewater Management Overview.....	4-1
4.3 Local Alternative	4-1
4.4 Regional Alternative	4-1
5. Collection System Alternatives.....	5-1
5.1 Overview	5-1
5.2 Collection System Terminology	5-1
5.2.1 Gravity Sewer	5-1
5.2.2 Low Pressure Sewer	5-1
5.2.3 Septic Tank Effluent Gravity Sewer	5-3
5.2.4 Septic Tank Effluent Pump Sewer	5-3
5.2.5 Vacuum Sewer	5-4
5.3 Collection System Alternative in High-Needs Sub-Areas	5-4
5.3.1 Gravity Alternative	5-5
5.3.2 Low Pressure Alternative.....	5-5
5.3.3 Septic Tank Effluent Gravity Alternative	5-5
5.3.4 Septic Tank Effluent Pump Alternative	5-5

5.3.5	Vacuum Alternative	5-6
5.4	Common Sewer Infrastructure.....	5-6
5.4.1	Local Alternative Common Sewer	5-6
5.4.2	Regional Alternative Common Sewer	5-6
5.5	Annual O&M Costs.....	5-6
5.6	Regional Alternative Sewer System Configurations	5-6
5.6.1	Downstream Sewers in East Lyme and Waterford	5-7
5.7	Cost Comparison.....	5-17
6.	Treatment Alternatives	6-1
6.1	Introduction.....	6-1
6.2	Overview of Local Treatment Alternatives.....	6-1
6.2.1	Treatment Configurations	6-1
6.2.2	Local WPCF	6-1
6.2.3	Collection System Impacts on Treatment System and Costs	6-3
6.3	Regional Treatment Alternative	6-4
6.4	Cost Comparison.....	6-5
7.	Disposal and Reuse Alternatives	7-1
7.1	Overview of Local Disposal and Reuse Alternatives	7-1
7.2	Local Subsurface Investigations.....	7-1
7.2.1	Test Pitting – Cherrystone	7-4
7.2.2	Soil Borings and Groundwater Wells – Cherrystone and Black Hall.....	7-4
7.2.3	Seasonal High Water Table – Black Hall and Cherrystone	7-5
7.2.4	Aquifer Testing – Black Hall and Cherrystone	7-6
7.2.5	Monitoring Well Survey and Groundwater Flow	7-7
7.2.6	Delineation of Facility	7-7
7.2.7	Groundwater Model – Cherrystone.....	7-8
7.3	Summary of Local Disposal and Reuse Alternatives.....	7-9
7.3.1	Sub-Surface Disposal at the Cherrystone Site	7-9
7.3.2	Reuse at the Black Hall Site	7-10
7.3.3	Sub-Surface Disposal at Black Hall Site	7-11
7.4	Local Disposal & Reuse Costs	7-11
7.5	Anticipated Permits and Requests of CT-DEEP	7-14
7.5.1	Ground Water Discharge Permitting.....	7-14
7.5.2	Wastewater Reuse Permitting.....	7-14
7.5.3	Requests of CT-DEEP.....	7-16
8.	Comparison of Alternatives and RecommEndations.....	8-1
8.1	Introduction.....	8-1
8.2	Comparison of Alternatives	8-1
8.2.1	Capital Costs	8-1
8.2.2	Annual Operation & Maintenance Costs.....	8-1
8.2.3	Total Annual Costs and Financing Options	8-2
8.2.4	Other Considerations.....	8-3
8.3	Recommended Plan.....	8-4
8.3.1	Proposed Alternative	8-4
8.3.2	Coordination with Other Beach Communities.....	8-4
8.3.3	Implementation Plan.....	8-4

LIST OF TABLES

TABLE	PAGE NO.
Table 2-1: Project Study Area and Needs Ranking	2-4
Table 2-2: High-Needs Wastewater Service Area	2-6
Table 3-1: Summary of Gravity Wastewater Service Flows.....	3-3
Table 3-2: Summary of LPS Wastewater Service Flows	3-4
Table 5-1: Capital Costs for Gravity Sewer Alternative.....	5-8
Table 5-2: Capital Costs for Low Pressure Sewer Alternative	5-9
Table 5-3: Capital Costs for STEG Sewer Alternative	5-10
Table 5-4: Capital Costs for STEP Sewer Alternative.....	5-11
Table 5-5: Capital Costs for Common Sewer for Local Alternative.....	5-12
Table 5-6: Capital Costs for Common Sewer for Regional Alternative	5-13
Table 5-7: Annual O&M Costs for All Collection System Alternatives	5-14
Table 5-8: Downstream Pump Station Capacities (Regional Alternative).....	5-15
Table 5-9: Estimated Downstream Capital Needs (Regional Alternative)	5-16
Table 5-10: Wastewater Service Area Capital Collection Costs	5-17
Table 5-11: Total Capital and Annual Collection Costs	5-17
Table 6-1: Summary of Local Treatment Costs for Different Collection System Options	6-4
Table 6-2: Regional Capital Cost Summary	6-5
Table 6-3: Treatment Cost Summary	6-5
Table 6-4: Annual Treatment Costs.....	6-6
Table 8-1: Capital Cost Summary.....	8-1
Table 8-2: Annual O&M Cost Summary	8-2
Table 8-3: Total Annualized Costs (0% Grant, 4% Loan).....	8-2
Table 8-4: Total Annualized Costs (0% Grant, 2% Loan).....	8-3
Table 8-5: Total Annualized Costs (25% Grant, 2% Loan).....	8-3

APPENDIX B

Table B-1: Summary of Subsurface Exploration
Table B-2: Seasonal High Water Table Calculations Cherrystone
Table B-3: Summary of Hydraulic Conductivity

LIST OF FIGURES

FIGURE	PAGE NO.
Figure 1-1: Project Study Area.....	1-2
Figure 2-1: Project Sub-Areas	2-2
Figure 2-2: Prioritization of Wastewater Management Needs.....	2-5
Figure 2-4: Lot Size Distribution for High-Needs Wastewater Service Area	2-6
Figure 2-3: High-Needs Wastewater Service Area	2-7
Figure 3-1: Flow Projections for Wastewater Service Area.....	3-5
Figure 3-2: Anticipated Annual Flow Variations for Wastewater Service Area	3-6
Figure 4-1: Local Alternative Stick Diagram.....	4-3
Figure 4-2: Regional Alternative Stick Diagram	4-4
Figure 4-3: Summary of Local and Regional Alternatives.....	4-5
Figure 5-1: Gravity Sewer System Overview	5-2
Figure 5-2: Low Pressure Sewer System Overview.....	5-2
Figure 5-3: STEG/STEP Sewer System Overview	5-3
Figure 5-4: Vacuum Sewer System Overview	5-4
Figure 5-5: Common Sewer for Local and Regional Alternative	5-18
Figure 5-6: Common Sewer for East Lyme and Waterford for Regional Alternative.....	5-19
Figure 6-1: Potential Wastewater Treatment Facility Sites for Local Alternative.....	6-2
Figure 7-2: Anticipated Year-Round Flows	7-2
Figure 7-1: Anticipated Disposal and Reuse Flow Needs.....	7-3
Figure 7-3: Year Round Flows vs. Primary Subsurface Disposal	7-9
Figure 7-4: Year Round Flows vs. Primary Subsurface Disposal and Black Hall Reuse	7-10
Figure 7-5: Year – Round Disposal and Reuse	7-11
Figure 8-1: Recommended Plan (Local Alternative)	8-5

APPENDIX B

Figure B-1: Site Plan
Figure B-2: Subsurface – Cherrystone
Figure B-3: Subsurface – Black Hall
Figure B-4: Slug Test Analysis: WC-2
Figure B-5: Groundwater – CherryStone
Figure B-6: Groundwater Black Hall
Figure B-7: SAS Facility - Cherrystone

APPENDICES

- Appendix A: Consent Orders
- Appendix B: Subsurface Investigation (Figures & Tables)
- Appendix C: Subsurface Investigation - Groundwater Data and Boring Logs