Town of Orleans

Wastewater Regionalization Study
Orleans-Brewster-Eastham

December 2009

Prepared by:

WRIGHT-PIERCE
Engineering a Better Environment

TOWN OF ORLEANS
WASTEWATER REGIONALIZATION STUDY

ORLEANS--BREWSTER--EASTHAM

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INTRODUCTION

1.1 BACKGROUND

The Town of Orleans has embarked on a multi-year, multi-phase planning process to determine if improved methods of wastewater management are needed, and if so, what those improved methods would entail and what they would cost. This process has been called Comprehensive Wastewater Management Planning and is documented in the report entitled *Orleans Comprehensive Wastewater Management Plan, April 2009 Draft*.

Section 9 of the Orleans draft CWMP provides the rationale for Orleans working with its neighbors to determine if regional wastewater facilities make sense. The Town of Orleans secured a grant from the Cape Cod Water Protection Collaborative (CCWPC), under its "Shared Watersheds, Shared Responsibilities" program, to undertake this regionalization study. The intent is to complete this evaluation while the draft CWMP is undergoing environmental review and then incorporate its findings in the final CWMP in early 2010.

The Town of Eastham is in the process of wastewater management planning and the Town of Brewster is currently securing consulting engineering services for water resources planning. Both towns are now completing assessments of freshwater ponds. Even though Eastham and Brewster are several years behind Orleans in their planning activities, the potential for cost savings through regionalization warrants this evaluation. If sufficient benefits accrue to all towns, Orleans should retain the capability for incorporating wastewater flows from these towns into its project, subject to later confirmation once Eastham and Brewster complete their planning activities.

1.2 STUDY AREA

Orleans and Eastham share the watersheds of the Nauset System, Rock Harbor and Boat Meadow. Both Towns have responsibility for controlling nitrogen to meet the needs as documented in published Massachusetts Estuaries Project (MEP) studies or as projected by MEP staff, which are assumed to lead to nitrogen-based Total Maximum Daily Loads (TMDLs).

Orleans and Brewster (as well as Harwich and Chatham) share the watershed of Pleasant Bay. All four of these towns have responsibility to comply with nitrogen-based TMDLs adopted by EPA in 2007, based on MEP technical reports completed earlier.

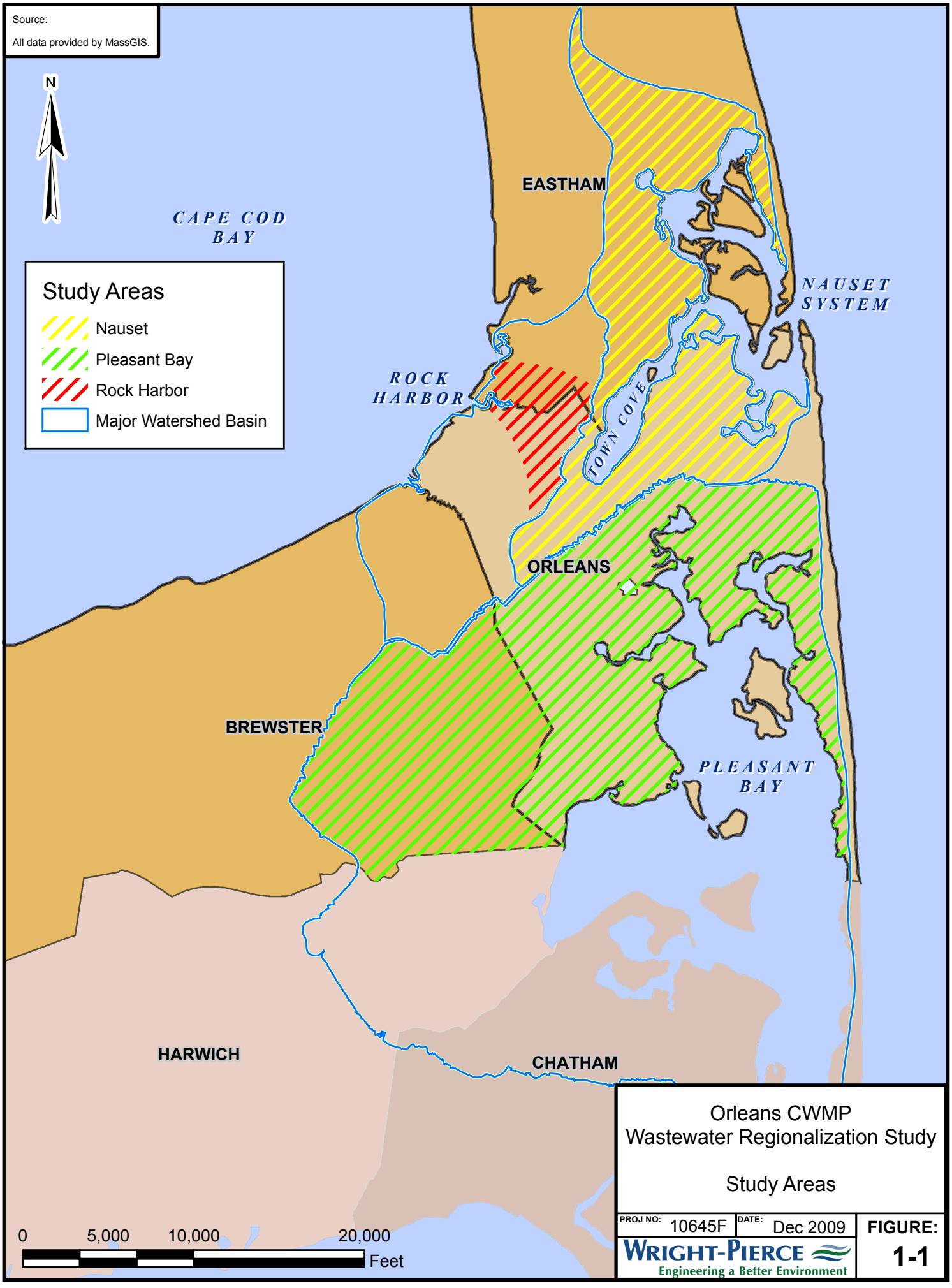
Orleans and Brewster also share the watershed of Namskaket Marsh. The draft MEP technical report for this system indicates that current and projected nitrogen loads in its watershed are well below thresholds, so no nitrogen control needs exist there.

The study area for this project consists of the towns of Orleans, Brewster and Eastham and is depicted on Figure 1-1. Given this sharing of watersheds, it is logical to consider regionalization opportunities.

1.3 PURPOSE OF STUDY

The purpose of this study is to identify and evaluate regionalization alternatives and to determine if they make economic, environmental and political sense. This study will include the following steps:

- Identifying logical options for joint wastewater facilities;
- Estimating wastewater flows in the portions of Eastham and Brewster that are tributary to coastal systems with nitrogen control needs to supplement similar prior estimates for Orleans;
- Identifying prospective sites in Brewster and Eastham where these Towns could address their needs on their own, including possible sewer service areas;


Source:
All data provided by MassGIS.
N
CAPE COD BAY
Study Areas
Nauset
Pleasant Bay
Rock Harbor
Major Watershed Basin
EASTHAM
NAUSET SYSTEM
ROCK HARBOR
TOWN COVE
ORLEANS
BREWSTER
PLEASANT BAY
HARWICH
CHATHAM
0
5,000
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Orleans CWMP
Wastewater Regionalization Study
Study Areas
PROJ NO: 10645F
DATE: Dec 2009
FIGURE: 1-1
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- Estimating costs for both local and regional solutions;
- Developing and applying cost-sharing formulas; and
- Evaluating non-financial issues.

The principal reason for regional cost savings is "economies of scale"; that is, the cost to treat a gallon of wastewater decreases with increasing plant size. As flows increase at a wastewater treatment facility, some costs (such as chemicals or sludge disposal) increase in direct proportion to the flow. Other costs, such as labor, do not increase in proportion to flow. If two or more towns participate in a regional facility, they can share those "fixed costs" and save money over separate individual plants.

Transport costs are the principal factor offsetting these economies of scale. Any town must weigh the cost to build a pipeline to a regional facility against the costs savings attributable to joint treatment. Towns the size of Orleans, Brewster and Eastham are prime candidates to take advantage of economies of scale, provided that transport costs are not excessive.

1.4 REPORT ORGANIZATION

This report consists of six sections. Following this introduction are the following sections:

Section 2:	Estimates of Wastewater Flows
Section 3:	Identification and Description of Regionalization Alternatives
Section 4:	Development and Application of Cost Model
Section 5:	Evaluation of Cost Allocation Methods
Section 6:	Suggested Next Steps

1.5 THREE-TOWN WORKING GROUP

The Towns of Orleans, Brewster and Eastham each provided staff to serve on a "Working Group" for this study. In addition, staff members of DEP, the Cape Cod Commission and the Orleans Brewster Eastham Groundwater Protection District (OBEGWPD) have participated. The Working Group members played an active role in development of wastewater flows,

selection of wastewater disposal sites, and review of the report and its concepts. The working group members are:

George Meservey	Town of Orleans
Jillian Douglass	Town of Brewster
Susan Leven	Town of Brewster
Chris Miller	Town of Brewster
Nancy Ellis Ice	Town of Brewster
Jane Crowley	Town of Eastham
Brian Dudley	DEP
Tom Cambareri	Cape Cod Commission
Jay Burgess	OBEGWPD

The efforts of the Working Group members have significantly benefited this project, and their work is appreciated.

SECTION 2

ESTIMATES OF WASTEWATER FLOW

2.1 INTRODUCTION

In order to evaluate economies of scale, it is necessary to prepare estimates of wastewater flow that would be collected, treated and disposed of. That work has been accomplished for Orleans, and is reported in Sections 2, 3 and 4 of the draft CWMP. Similar, but more generalized flow estimates have been prepared for Eastham and Brewster since actual figures are not yet available. This section of the report summarizes the evaluations used to estimate the wastewater flows now generated in pertinent areas of each town, and the portion of those flows that should be collected for treatment. All wastewater flows have been computed and reported as annual averages for consistency with the Orleans draft CWMP. For each community, an estimate of current wastewater flows was calculated as well as an estimate of future flows at a planning horizon, approximately 20 years from now (2030).

2.2 DEMOGRAPHIC AND WATER USE STATISTICS

Consistent with standard practice in wastewater planning, water use records were utilized to serve as the basis for estimating wastewater flows. Public water supplies serve the majority of developed properties in Brewster and Orleans. Average water consumption for properties served by public water systems in those two communities has been used to estimate water use for Brewster and Orleans properties served by private wells. For Brewster, the initial analysis was based on 2007 water billing records provided by the Brewster Water Department, and a listing of property type provided by the Brewster Assessing Department to determine seasonality. Supplemental data were provided by Brewster for water use from 2002 to 2007. These data have been linked to a GIS database so that water consumption is geographically tied to specific parcels.

There is no public water system in Eastham, so water consumption data from Brewster and Orleans have been selectively applied to demographic information for Eastham to estimate Eastham's water consumption.

The following methodology was utilized to establish wastewater flows for each community:

1. Develop statistics on water use per property for all properties served by town water, regardless of watershed.

2. Compare those statistics with analogous ones from Orleans.

3. Apply the most appropriate statistics to properties in the applicable watersheds that are not served by town water.

4. Add the estimated water use figures from Step 3 to the actual data for properties that are served by town water.

5. Apply a factor to account for water consumption that does not contribute to wastewater flow.

Table 2-1 presents a summary of the data used in this analysis. The top of Table 2-1 shows the assessors' data on the number of residential properties in each town, distinguishing between seasonal and year-round homes (based on personal property taxes), and presenting subtotals for single-family residences based on the number of bedrooms. These house counts are presented town-wide for all three towns. In addition, Table 2-1 shows the house counts in the areas of Eastham within the Rock Harbor and Town Cove watersheds that are closest to Orleans.

The middle block of data in Table 2-1 shows the percentage distribution of homes by bedroom count for each town. Although there is some variability, the size of homes (as measured by bedroom count) is approximately the same in each town: about 3.1 to 3.2 bedrooms per home on average. Across the entire study area, about 60% of the single-family homes are year-round dwellings, ranging from 57% in Orleans to 65% in Brewster. There is much more variability in the multi-family home distribution, ranging from 25% year-round in Orleans to 81% year-round in Eastham.

TABLE 2-1
SUMMARY OF HOUSING DATA AND RECENT PER-PROPERTY WATER USE

	Orleans			Brewster			Eastham			
							Rock Harbor & Town Cove Only			Total Town-wide
	Year-round	Seasonal	Total	Year-round	Seasonal	Total	Year-round	Seasonal	Total	
A. Number of Homes										
Single-family homes										
2 or fewer BR	469	387	856	643	386	1,029	35	29	64	1,140
3 BR	1,006	712	1,718	2,047	992	3,039	85	55	140	2,640
4 BR	471	347	818	733	409	1,142	43	27	70	1,104
5 BR	109	81	190	93	70	163	6	2	8	142
6 or more BR	15	33	48	18	17	35	2	-	2	42
Total	2,070	1,560	3,360	3,534	1,874	5,408	171	113	284	5,068
Multi-family properties	71	212	283	89	82	171	34	8	42	295
B. Percentage of Homes										
Single-family homes										
2 or fewer BR	23%	25%	24%	18%	21%	19%	20%	26%	23%	22%
3 BR	49%	46%	47%	58%	53%	56%	50%	49%	49%	52%
4 BR	23%	22%	23%	21%	22%	21%	25%	24%	25%	22%
5 BR	5%	5%	5%	3%	4%	3%	4%	2%	3%	3%
6 or more BR	1%	2%	1%	1%	1%	1%	1%	0%	1%	1%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	57%	43%	-	65%	35%	-	60%	40%	-	-
Multi-family properties	25%	75%	100%	52%	48%	100%	81%	19%	100%	-
C. Water Use per Home (gpd)										
Single-family homes										
2 or fewer BR	126	90	109	130	76	109	-	-	-	-
3 BR	163	116	144	173	108	152	-	-	-	-
4 BR	187	152	172	202	131	177	-	-	-	-
5 BR	226	206	218	232	154	198	-	-	-	-
6 or more BR	378	164	231	259	408	339	-	-	-	-
Overall	164	123	147	174	112	152	-	-	-	-
Multi-family properties	360	298	330	196	258	229	-	-	-	-

The last section of data in Table 2-1 summarizes the average water consumption per property served by the public water systems in Brewster and Orleans. The Orleans data represent a four-year average (2002 to 2006) and are the same as presented in Section 2 of the draft CWMP. The Brewster data represent the average water use for 2002 to 2006 as well.

These data indicate that the average residential property served by the public water system in Brewster uses 3.4% more water than the average such home in Orleans. There are two plausible reasons for this difference. First, Brewster has a greater percentage of year-round homes. Second, based on the 2000 US Census, the occupancy of Brewster's year-round homes is slightly higher than in Orleans.

Brewster	2.37 persons per dwelling unit (DU),
Orleans	2.12 persons per DU, and
Eastham	2.27 persons per DU.

2.3 ESTIMATES OF WASTEWATER FLOWS

Brewster

Table 2-2 reports the estimated wastewater flows for the developed properties in Brewster that are located in the Pleasant Bay watershed. First, the wastewater flow was estimated for properties on the public water system, based on actual water usage from the period 2002 to 2006 and an assumed 10% consumptive use (the water used in irrigation, car washing and similar activities). We estimate that these properties now produce an aggregate wastewater flow of about 85,000 gallons per day (gpd). Table 2-2 shows the average wastewater flow for each category of development; for example, the average single family residential property on public water produces 135 gpd of wastewater. Next, the same per-property flows were applied to those developed parcels using private wells, where no public water use information is available. This approach results in an estimated 32,000 gpd from those properties not on the public water system. The overall estimate for the Brewster portion of the Pleasant Bay watershed is about

TABLE 2-2
WASTEWATER FLOW ESTIMATES FOR BREWSTER IN PLEASANT BAY WATERSHED

	Properties on Public Water			Properties not on Public Water			All Properties		
Activity	**Number of Properties**	**Gpd per Property**	**Gpd**	**Number of Properties**	**Gpd per Property**	**Gpd**	**Number of Properties**	**Gpd per Property**	**Gpd**
1. Single-family Residential	502	135	67,770	115	135	15,525	617	135	83,295
2. Multi-family Residential	5	188	940	4	188	752	9	188	1,692
3. Commercial									
Athletics	2	-	-	1	3,380	3,380	-	-	-
Nursing Home *(Note 1)*	1	9,992	9,992	1	1,000	1,000	-	-	-
Other	-	-	-	6	925	5,550	-	-	-
All Commercial	3	3,331	9,992	8	1,241	9,930	11	1,811	19,922
4 Other (State Class 9000)	5	1,224	6,120	91	65	5,915	96	125	12,035
All properties	515	165	84,822	218	147	32,122	733	160	116,944

Notes:

1. *The "nursing home" line item refers to Pleasant Bay Health & Living Center which has a private wastewater treatment plant that discharged 12,000 gpd in 2008.*

117,000 gpd. Approximately 72% of this figure is associated with properties for which water use information is available and 28% from properties where the water use was estimated.

Eastham

Table 2-3 presents the approach that was taken to estimate wastewater flows in Eastham, both town-wide and for the Rock Harbor and Town Cove watersheds. Per-property water use figures were assigned that are intermediate between those calculated for Brewster and Orleans, and a 10% consumptive use factor was applied. This analysis results in wastewater flows of about 52,000 gpd in the Rock Harbor and Town Cove watersheds, and about 830,000 gpd town-wide. (The town-wide estimate was prepared to judge consistency with the town-wide estimates for Orleans that are reported in the draft CWMP; the Orleans town-wide estimate is 779,000 gpd.)

While this study was underway, Stearns & Wheler prepared flow estimates for Eastham as part of a preliminary needs assessment (*Draft Interim Needs Assessment and Alternatives Screening Analysis Report*, *January 2009*). Although different approaches have been used, the Stearns & Wheler flow estimates are quite close to those reported herein. This estimate of 830,000 gpd town-wide compares well with the Stearns & Wheler estimate of 820,000 gpd. For the Town Cove and Rock Harbor watersheds, this estimate of 52,000 gpd also compares well with the Stearns and Wheler estimate of 55,000 gpd. The Stearns & Wheler estimates have been used in the remainder of the report.

2.4 ESTIMATES OF WASTEWATER FLOWS TO BE TREATED

The flow estimates reported in Tables 2-2 and 2-3 represent the wastewater flows across the entire town or the noted watershed. To meet the established or expected TMDLs, a portion of the total wastewater must be collected and treated. Those percentages are as follows for current conditions:

Brewster portion of Pleasant Bay watershed	50% (from the MEP technical report)
Rock Harbor	79% (from the draft MEP report)
Nauset System	55% (estimated by MEP staff)

TABLE 2-3
WASTEWATER FLOW ESTIMATES FOR EASTHAM

Activity	Rock Harbor & Town Cove Watersheds			Town-Wide		
	Number of Properties	Gpd per Property	Gpd	Number of Properties	Gpd per Property	Gpd
1. Single-family Residential						
Year-Round	171	160	27,360			
Seasonal	113	110	12,430			
All Single-family	284	140	39,790	5,068	140	709,520
2. Multi-family Residential						
Year-Round	34	200	6,800			
Seasonal	8	250	2,000			
All Multi-family	42	210	8,800	295	210	61,950
3. Commercial	6	600	3,600	101	600	60,600
All properties	332	157	52,190	5,464	152	832,070

In Tables 2-4 and 2-5, these percentages are applied to the overall wastewater flows to estimate the wastewater flows that must be collected and treated. Table 2-4 summarizes "current" conditions while Table 2-5 presents "future" conditions. For Eastham, a 10% growth in collected wastewater has been used in Table 2-5 as reported by Stearns & Wheler. For Brewster, the Town requested inclusion of a 26% growth factor for its portion of the Pleasant Bay watershed. For TMDL compliance, 50% of current septic nitrogen loads must be removed and 100% of future loads. The requested 26% growth in watershed-wide flow translates to the need to collect 52% of the future wastewater flow. This concept is illustrated graphically below in Figure 2-1.

To illustrate the linkage between the various tables, note that Table 2-2 estimates a flow of about 117,000 gpd from the Pleasant Bay portion of Brewster. Since 50% of that wastewater must be collected and treated, 58,000 gpd is shown in Table 2-4 and 88,000 gpd (52% growth) in Table 2-5. Tables 2-4 and 2-5 report the flow estimates prepared by Stearns & Wheler for Eastham.

Pleasant Bay Health & Living Center is located in Brewster in the Pleasant Bay watershed. In 2007, a private wastewater treatment facility was built there to serve both the original nursing home and the new adjacent development. That treatment facility has operated under a DEP groundwater discharge permit and has produced effluent nitrogen well below the 10 mg/l standard. The 2008 average flow was approximately 12,000 gpd. The nitrogen contribution from that 12,000-gpd facility is accounted for in this evaluation.

The Orleans draft CWMP presents estimates of wastewater flow from the watersheds impacted by Orleans. Here is how those figures change in the various regionalization scenarios, expressed as annual averages at the planning horizon:

Brewster alone	88,000 gpd (Pleasant Bay watershed)
Eastham alone	160,000 gpd (Rock Harbor & Nauset watersheds)
Orleans alone	504,000 gpd (town-wide, core plan)
Orleans and Brewster	592,000 gpd (17% increase over Orleans alone)
Orleans and Eastham	664,000 gpd (32% increase over Orleans alone)
All three towns	752,000 gpd (49% increase over Orleans alone)

FIGURE 2-1
ILLUSTRATION OF CURRENT AND FUTURE NITROGEN LOAD REDUCTIONS

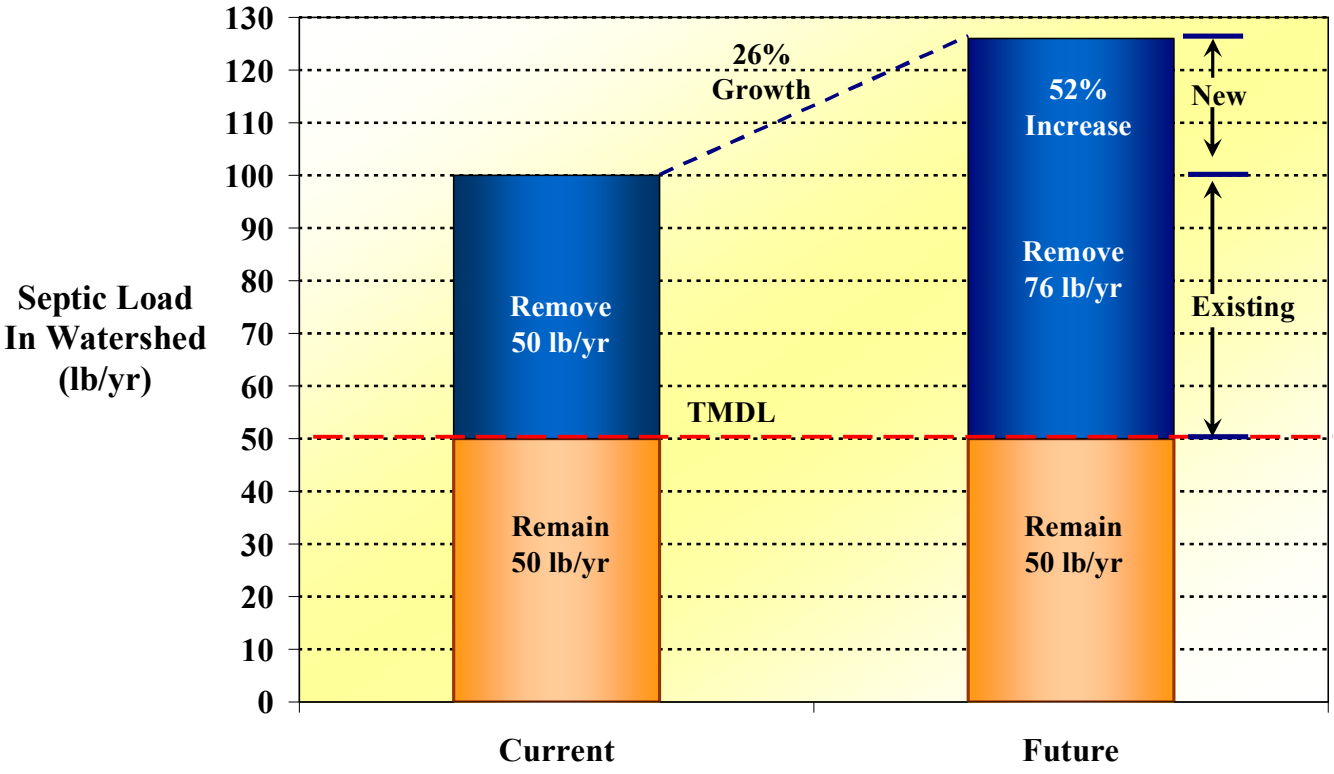

TABLE 2-4
REGIONAL WASTEWATER FLOWS REQUIRING TREATMENT UNDER CURRENT CONDITIONS

Watershed	Wastewater Flows, gpd, originating in:			
	Orleans	Brewster	Eastham	Total
			Note 4	
Pleasant Bay	183,000	58,000	0	241,000
Cape Cod Bay System				
Namskaket	0	0	0	0
Little Namskaket	0	0	0	0
Rock Harbor	51,000	0	10,000	61,000
Subtotal	51,100	0	10,000	61,000
Nauset System				
Town Cove	96,000	0	45,000	141,000
Remainder	41,000	0	85,000	126,000
Subtotal	137,000	0	130,000	267,000
Total--All Watersheds Impacted by Orleans	371,000	58,000	140,000	569,000
		Note 2	*Notes 3 and 4*	
Other Watersheds not Impacted by Orleans	0	Not Available	80,000	Not Available
Town-wide Totals	371,000	Not Available	220,000	Not Available

Notes:

1. *All flows expressed as annual averages, without infiltration/inflow.*
2. *Brewster has flows in watersheds of Herring River and Quivett Creek, where treatment requirements are unknown.*
3. *Eastham has flows in watersheds of Boat Meadow, Herring River and Wellfleet Harbor; the figure shown relates only to freshwater pond watersheds.*
4. *Based on Feb 18, 2009 letter from Stearns & Wheler for tentative sewer service areas in these watersheds.*

The wastewater flows shown in Tables 2-4 and 2-5 represent the volumes of wastewater that would be collected from the various potential service areas. Tables 2-4 and 2-5 will form the basis for cost estimating. Where appropriate for cost estimating, an allowance has been added for infiltration and inflow (I/I), the extraneous surface water and groundwater that inevitably enters the sewer system from leaking pipes and manholes, and from illicit cellar or storm drains. The effluent disposal capacity at the Tri-Town site has been evaluated for the regional flows including appropriate I/I allowances.

Brewster and Eastham Working Group members were each provided an opportunity to review and comment on the wastewater flow estimates. Eastham took no exception to the estimates generated by Wright-Pierce. Brewster provided a number of comments related to existing water use, estimated consumptive use, as well as long-term growth trends. These comments were addressed, are included in the numbers presented in the tables herein, and are utilized in the development of cost estimates in Section 4.

TABLE 2-5
REGIONAL WASTEWATER FLOWS REQUIRING TREATMENT UNDER FUTURE CONDITIONS

Watershed	Wastewater Flows, gpd, originating in			
	Orleans	**Brewster**	**Eastham**	**Total**
			Note 4	
Pleasant Bay	249,000	88,000	0	337,000
Cape Cod Bay System				
Namskaket	0	0	0	0
Little Namskaket	0	0	0	0
Rock Harbor	69,000	0	10,000	79,000
Subtotal	69,000	0	10,000	79,000
Nauset System				
Town Cove	130,000	0	50,000	180,000
Remainder	56,000	0	100,00	156,000
Subtotal	186,000	0	150,000	336,000
Total--All Watersheds Impacted by Orleans	504,000	88,000	160,000	752,000
		Note 2	*Notes 3 and 4*	
Other Watersheds not Impacted by Orleans	0	Not Available	90,000	Not Available
Town-wide Totals	504,000	Not Available	250,000	Not Available

Notes:

1. *All flows expressed as annual averages, without infiltration/inflow.*
2. *Brewster has flows in watersheds of Herring River and Quivett Creek, where treatment requirements are unknown.*
3. *Eastham has flows in watersheds of Boat Meadow, Herring River and Wellfleet Harbor; the figure shown relates only to freshwater pond watersheds.*
4. *Based on Feb 18, 2009 letter from Stearns & Wheler for tentative sewer service areas in these watersheds.*

SECTION 3

IDENTIFICATION AND DESCRIPTION OF ALTERNATIVES

3.1 IDENTIFICATION OF ALTERNATIVES

Eleven regional alternatives were identified for evaluation, as summarized in Table 3-1. Alternatives A-1 through A-4 are "two-town" options involving Orleans and Brewster. Similarly, Alternatives B-1 through B-3, are "two-town" options for cooperation between Orleans and Eastham. The last four options, Alternatives C-1 through C-4, are "three-town" solutions involving Orleans, Brewster and Eastham. These options were selected to determine if the economies of scale afforded by joint treatment exceed the transport costs associated with conveying Brewster and Eastham wastewater to Orleans. Some of the options were selected to determine if Orleans could meet the nitrogen control needs of all three towns by expanding its collection system and treatment facility, so that construction could be avoided in Brewster and Eastham.

Figure 3-1 depicts the alternatives where Eastham and Brewster have their own treatment and disposal (A-1, B-1, C-1**).** Figure 3-2 shows the alternatives where Eastham and Brewster collect wastewater within the respective towns and transport it to the Tri-Town site for treatment and disposal (A-2, B-2, C-2). Figure 3-3 depicts the alternatives where Orleans constructs additional collection and transport-to-treatment facilities in Orleans to offset the nitrogen loadings from Eastham and Brewster (A-3, B-3, C-3). Figure 3-4 shows the alternatives where the Tri-Town site would accept Orleans and Eastham wastewater from the Rock Harbor and Nauset Systems, and where Orleans and Brewster wastewater from the Pleasant Bay Systems would be collected, transported, treated and disposed at a site in the easterly portion of Brewster.

TABLE 3-1
LISTING OF REGIONALIZATION OPTIONS

Option No.	Description	
A. Two-Town Options---Orleans and Brewster		
A-1	Each Town acts on its own	
	Orleans	Builds the plan recommended in the draft CWMP
	Brewster	Builds a satellite plant for its portion of Pleasant Bay
A-2	Collection of Brewster wastewater in Pleasant Bay watershed and transport to the Orleans collection system for treatment at the Tri-Town site	
A-3	Increased collection of Orleans wastewater in Pleasant Bay watershed with transport to Tri-Town site for treatment; no facilities in Brewster	
A-4	Collection of Brewster wastewater in Pleasant Bay watershed and transport to South Orleans site for treatment with Orleans wastewater from Pleasant Bay watershed	
B. Two-Town Options---Orleans and Eastham		
B-1	Each Town acts on its own	
	Orleans	Builds the plan recommended in the draft CWMP
	Eastham	Builds a satellite plant for its portion of Rock Harbor and Nauset watersheds
B-2	Collection of Eastham wastewater in Rock Harbor and Nauset watersheds and transport to the Orleans collection system for treatment at the Tri-Town site	
B-3	Increased collection of Orleans wastewater in the Rock Harbor and Nauset watersheds with transport to Tri-Town site for treatment; no facilities in Eastham	
C. Three-Town Options---Orleans, Brewster and Eastham		
C-1	Each Town acts on its own	
	Orleans	Builds the plan recommended in the draft CWMP
	Brewster	Builds a satellite plant for its portion of Pleasant Bay
	Eastham	Builds a satellite plant for its portion of Rock Harbor and Nauset watersheds.
C-2	Collection of Eastham and Brewster wastewater in Rock Harbor, Nauset and Pleasant Bay watersheds and transport to the Orleans collection system for treatment at the Tri-Town site	
C-3	Increased collection of Orleans wastewater in the Rock Harbor, Nauset and Pleasant Bay watersheds with transport to Tri-Town site for treatment; no facilities in Brewster or Eastham	
C-4	Collection of Brewster and Orleans wastewater in Pleasant Bay watershed and transport to Brewster site for treatment and disposal.	
	Collection of Eastham and Orleans wastewater in Rock Harbor and Nauset watersheds and transport to the Tri-Town site treatment and disposal	

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Eastham
Wastewater Facility

EASTHAM

CAPE COD
BAY

Orleans
Wastewater Facility

TOWN COVE

BREWSTER

Brewster
Wastewater Facility

PLEASANT
BAY

Sewer Service Areas

- Brewster
- Eastham
- Orleans
- Unsewered Parcels

Wastewater Facilities

- Brewster
- Eastham
- Orleans

Major Watershed Boundary

Source:

Sewer Service Areas developed by Wright-Pierce.
Watershed data from MA DEP.
All parcel data provided by their respective towns.

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N

Orleans CWMP
Sewer Service Areas for Alternatives

A-1 Brewster and Orleans Develop Separate Facilities

B-1 Eastham and Orleans Develop Separate Facilities

C-1 All Three Towns Develop Separate Facilities

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FIGURE:
3-1

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EASTHAM

CAPE COD BAY

TOWN COVE

Shared 2-town or 3-town Wastewater Facility

BREWSTER

PLEASANT BAY

Sewer Service Areas

- Brewster
- Eastham
- Orleans
- Unsewered Parcels

Wastewater Facilities

- Combination of: Brewster, Eastham and/or Orleans wastewater
- Major Watershed Boundary

Source:

Sewer Service Areas developed by Wright-Pierce.
Watershed data from MA DEP.
All parcel data provided by their respective towns.

0 4,000 8,000 Feet

N

Orleans CWMP
Sewer Service Areas for Alternatives

- A-2 Brewster and Orleans collect wastewater with treatment at Tri-Town
- B-2 Eastham and Orleans collect wastewater with treatment at Tri-Town
- C-2 All three towns collect wastewater with treatment at Tri-Town

PROJ NO:	DATE:	FIGURE:
10645F	Dec 2009	3-2

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EASTHAM

CAPE COD BAY

Shared Wastewater Facility

TOWN COVE

BREWSTER

PLEASANT BAY

Sewer Service Areas

- Sewer service area in Orleans to offset Nitrogen removal in Brewster
- Sewer service area in Orleans to offset Nitrogen removal in Eastham
- Orleans service area - Core Plan
- Unsewered Parcels

Wastewater Facilities

- Orleans wastewater including offset of either Brewster, Eastham, or both.
- Major Watershed Boundary

Source:

Sewer Service Areas developed by Wright-Pierce.
Watershed data from MA DEP.
All parcel data provided by their respective towns.

0 4,000 8,000 Feet

N

Orleans CWMP
Sewer Service Areas for Alternatives

- A-3 Orleans Expands Collection System to Offset Brewster Nitrogen Load
- B-3 Orleans Expands Collection System to Offset Eastham Nitrogen Load
- C-3 Orleans Expands Collection System to Offset Brewster and Eastham Nitrogen Load

PROJ NO: 10645F | DATE: Dec 2009 | FIGURE: 3-3

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Engineering a Better Environment

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EASTHAM

CAPE COD BAY

TOWN COVE

Shared 2-town Wastewater Facility

BREWSTER

Shared 2-town Wastewater Facility

PLEASANT BAY

Sewer Service Areas

- Brewster
- Eastham
- Orleans
- Unsewered Parcels

Wastewater Facilities

- Serves Brewster and Orleans in the Pleasant Bay watershed
- Serves Eastham and Orleans in Rock Harbor and Nauset watersheds
- Major Watershed Basins

Source:

Sewer Service Areas developed by Wright-Pierce.
Watershed data from MA DEP.
All parcel data provided by their respective towns.

0 4,000 8,000 Feet

N

Orleans CWMP
Sewer Service Areas for Alternative C-4

Collect Brewster and Orleans wastewater in Pleasant Bay with treatment in Brewster. Collect Eastham and Orleans wastewater in Rock Harbor and Nauset with treatment at Tri-Town.

PROJ NO: 10645F | DATE: Dec 2009 | FIGURE: 3-4

WRIGHT-PIERCE
Engineering a Better Environment

3.2 DESCRIPTION OF ALTERNATIVES

All eleven of the alternatives include wastewater treatment and disposal facilities at the Tri-Town site in Orleans. These facilities are the same as, or are expanded versions of, the Orleans Recommended Plan as described in Section 11 of the Draft CWMP. In order to make fair comparisons, some of the alternatives also include smaller treatment and disposal facilities in Brewster, Eastham or both. The wastewater flows summarized in Section 2 were used to size the various treatment and disposal facilities. For all of the alternatives considered, septage from unsewered properties in all three towns would continue to go to the Tri-Town site.

Alternative A-1

This option was formulated to serve as the baseline for the other Brewster-Orleans alternatives. Orleans would provide for its own wastewater management needs at the Tri-Town site, and Brewster would build its own wastewater facilities to serve its Pleasant Bay needs. The only regional aspect of this plan would be the use of the Tri-Town facility for disposal of sludge from the Brewster facility.

Alternative A-2

For this option, Brewster would build sewers to eliminate enough septic systems to comply with the Pleasant Bay TMDL. The collected wastewater would be piped to the nearest point in the Orleans sewer system, which would convey it to the Tri-Town site, where an expanded facility would treat and dispose of the combined Orleans-Brewster wastewater flow.

Alternative A-3

This option is similar to Alternative A-2, in that an expanded Tri-Town facility would treat and dispose of the combined Brewster-Orleans flow. Instead of a sewer system in Brewster, however, more sewers would be built in the Orleans part of the Pleasant Bay watershed to remove the same septic nitrogen load as would be removed in Brewster in Alternative A-2. The

collection system cost would be borne by Brewster. This option may have a lower cost to transport wastewater to the treatment plant site than would Alternative A-2; and would avoid the need for Brewster to build any new facilities.

Alternative A-4

In the evaluation of alternatives for Orleans (see Section 7 of the Orleans Draft CWMP), one option involved a treatment and disposal facility in South Orleans, that could also serve Brewster. Alternative A-4 of this regionalization evaluation is based in part on that concept. Orleans would build two wastewater facilities; one at the Tri-Town site to serve the northern part of Orleans (and perhaps some of Eastham), and one in South Orleans to serve the southerly part of Orleans and some of Brewster. Sewers would be built in Brewster to fulfill its TMDL responsibility with respect to Pleasant Bay, and a pipeline would connect those Brewster sewers to the South Orleans facility. While this option was called the "South Orleans Plan" in the CWMP, the second treatment facility could also be located in the easterly portion of Brewster.

Alternative B-1

This option was formulated to serve as the baseline for the other Eastham-Orleans alternatives. Orleans would provide for its own wastewater management needs at the Tri-Town site, and Eastham would build its own wastewater facilities to serve its nitrogen control needs in the Nauset and Rock Harbor watersheds. The only regional aspect of this plan would be the use of the Tri-Town facility for disposal of sludge from the Eastham facility.

Alternative B-2

For this option, Eastham would build sewers to eliminate enough septic systems to comply with the nitrogen control requirements expected for the Nauset and Rock Harbor systems. The collected wastewater would be piped to the nearest point in the Orleans sewer system, which would convey it to the Tri-Town site, where an expanded facility would treat and dispose of the combined Orleans-Eastham wastewater flow.

Alternative B-3

This option is similar to Alternative B-2, in that an expanded Tri-Town facility would treat and dispose of the combined Eastham-Orleans flow. Instead of a sewer system in Eastham, however, more sewers would be built in the Orleans parts of the Nauset and Rock Harbor watersheds to remove the same septic nitrogen load as would be removed in Eastham in Alternative B-2. The collection system costs would be borne by Eastham. This option may have a lower cost to transport wastewater to the treatment plant site than would Alternative B-2, and it would avoid construction of facilities in Eastham.

Alternative C-1

This alternative is a combination of Alternatives A-1 and B-1. Each town would provide for its own wastewater needs without reliance on each other, expect for the receipt of sludge at Tri-Town.

Alternative C-2

This option is a combination of Alternatives A-2 and B-2. Both Brewster and Eastham would build sewer systems that would be connected to the closest part of the Orleans collection system, and the Tri-Town facility would provide wastewater treatment and disposal for all three towns.

Alternative C-3

An expanded sewer system in Orleans would eliminate enough septic systems in the Pleasant Bay, Nauset and Rock Harbor watersheds to permit this alternative to meet the expected nitrogen control needs for all three watersheds, without construction in Brewster and Eastham.

Alternative C-4

This option is a combination of Alternatives A-4 and B-2. The Tri-Town facility would treat and dispose of wastewater collected in Eastham and in the northerly areas of Orleans. The South Orleans facility would treat and dispose of wastewater collected in Brewster and in the southerly parts of Orleans.

3.3 ESTIMATED SEWER SERVICE AREAS

In order to evaluate the costs of wastewater transport in regional alternatives, it is necessary to make assumptions as to where wastewater would be collected in Brewster and Eastham. The shaded areas in Figures 3-1 through 3-4 represent the neighborhoods where public sewers would be constructed to allow the elimination of existing septic systems, as the primary way to achieve TMDL compliance.

These projected sewer service areas were developed using two principal criteria. First, the GIS database for the project was used to identity neighborhoods with relatively dense development, and the highest current water use. This assumption is based on the premise that the most cost-effective solution is to maximize the amount of nitrogen collected per foot of sewer pipe. Since water use is the best estimator of wastewater flow, and the existing land use is largely residential (that is, with comparable nitrogen concentrations) this approach should lead to relatively cost-efficient collection systems. The second criterion is the distance to the proposed Orleans collection system, as detailed in Appendix D of the draft CWMP.

Use of these two criteria should lead to good candidate collection areas. Nonetheless, the densest development is not always near the Orleans border, so some trade-offs are needed. For example, part of the selected service area in Brewster is some distance from the Orleans-Brewster town line because of that area's high development density, and because neighborhoods more proximate to Orleans do not have sufficient septic nitrogen load to address the full TMDL.

3.4 PRINCIPAL ASSUMPTIONS

The development of alternatives and cost estimates for a study of this nature involves numerous assumptions that are required to estimate the physical features of each of the alternatives. The principal assumptions are summarized as follows:

Identified Sites for Wastewater Treatment and Disposal:

- **Orleans:** wastewater treatment and disposal would be located at the Tri-Town site. This location is applicable for all alternatives. If additional effluent disposal capacity is needed beyond that which can be obtained at the Tri-Town site, then this would occur at nearby school athletic fields.
- **Brewster:** wastewater treatment and disposal would be located at a site near the Orleans town line, identified as Site 193 in the draft CWMP. This location is applicable for Alternatives A-1, A-4, C-1 and C-4. This site was assumed to require higher levels of treatment due to its location within a Zone II.
- **Eastham:** wastewater treatment and disposal would be located on a public parcel identified by Stearns & Wheler in its February 18, 2009 letter to Wright-Pierce. This location is applicable for Alternatives B-1 and C-1.

Site Capacity for Treated Effluent Disposal:

- **Orleans:** The Orleans Core Plan does not utilize all of the disposal capacity at the Tri-Town site. All of the Tri-Town capacity is needed to accommodate Orleans' Extended Plan. It has been assumed that space on the Tri-Town site would be reserved for Orleans' Extended Plan, and the regionalization options would bear the cost of alternate sites, if needed.
- **Brewster:** The site in Brewster is assumed to have sufficient space to handle treatment and disposal activities for all applicable alternatives.
- **Eastham:** The identified parcel is assumed to have sufficient space to handle treatment and disposal activities for all applicable alternatives.

Nutrient Considerations:

- **Orleans:** the residual nitrogen in the effluent disposed at the Tri-Town site will not exceed the estimated nitrogen assimilative capacity for Namskaket Creek in any of the applicable alternatives; see Appendix G of the draft CWMP.
- **Interbasin Transfer:** Some of these alternatives involve inter-basin transfer of nitrogen. The collection system associated with all Brewster alternatives reflects the removal of all the collected wastewater from the Pleasant Bay watershed. A somewhat larger collection area would be needed for alternatives involving effluent disposal in the Pleasant Bay watershed. This distinction has not been quantitatively accounted for.
- **Natural Attenuation:** Some of the sewered areas in Brewster are upgradient from freshwater ponds that may provide some natural attenuation of nitrogen. That factor was not explicitly accounted for. Alternative collection areas, downgradient from freshwater ponds, could also be considered.
- **Phosphorus:** Pond protection was not considered in this analysis. Collections systems may be able to satisfy multiple needs by removing phosphorus from watersheds of freshwater ponds and nitrogen from watersheds of sensitive coastal embayments. Hypothetical sewer systems were not extended solely for pond protection purposes.

Infrastructure Sizing:

- Assumptions used in the Orleans draft CWMP have been adapted to estimate the nature and extent of Eastham and Brewster facilities to ensure a consistent comparison. Where possible, these estimates have been adjusted to reflect documented differences among the towns, such as development density in the neighborhood to be served by public sewers.
- This analysis includes estimates of the septic system flows that would be eliminated by municipal sewers, as well as the wastewater flows that would require treatment. The difference between these two figures is the infiltration and inflow (I/I) that the sewer system will receive. (The I/I flow includes groundwater leaking into pipes and manholes, and the illicit connection of roof, cellar or storm drains to the sewer system.) The estimate of I/I flows for the proposed collection system in Orleans has been prorated to the Brewster and Eastham collection systems (based on linear feet of collection pipe in each scenario) to provide some uniformity in this analysis estimates. (Stearns & Wheler included an I/I

allowance in the Eastham flow estimates that is somewhat higher than the estimate carried herein.) A similar prorating approach was used for other elements of the collection system cost, including land required for pump station sites.

MEP Technical Reports:

- MEP Technical Reports and subsequent TMDLs are not yet issued for the Nauset, Quivett Creek, Boat Meadow, and Wellfleet Harbor systems. These documents could impact the extent of sewering required (upward or downward) for some of these regionalization alternatives. This evaluation is based on the placeholder value of 55% nitrogen control in the Nauset watershed, applied to both the Town Cove and Nauset Harbor systems, as provided by MEP staff and as used in the draft CWMP.

Land Acquisition:

- It has been assumed that the sites for treatment and disposal in all three towns are publicly owned and no land costs have been included for those options. Land needs for pump stations have been assumed on a scale appropriate to the specific option.

SECTION 4

DEVELOPMENT AND APPLICATION OF COST MODEL

4.1 DEVELOPMENT OF COST ESTIMATING MODEL

The Towns of Orleans, Brewster and Eastham will each be faced with costs in two categories, regardless of whether they act individually or cooperatively in a regional solution. The first category is "capital cost", the cost to design and build the needed facilities. The second category is "operation and maintenance (O&M) costs" which include the ongoing annual expenses to run the facilities (e.g., labor, electrical energy, fuel, chemicals, biosolids disposal, laboratory testing, equipment maintenance, etc.).

A spreadsheet-based cost estimating model was developed for the preparation of the Orleans CWMP. For consistency with previous efforts, that same cost model was used in the analysis.. The cost model was populated with key technical data on each of the alternatives (linear feet of pipe, number of pump stations, for example), and "unit costs" (such as dollars per foot of pipe, or dollars per pump station) were applied based on an extensive database of publicly-bid wastewater projects across New England. Similar information was used to predict operation and maintenance (O&M) costs for a range of plant sizes.

For each alternative, costs were estimated in the following standard categories:

- wastewater collection,
- transport-to-treatment,
- wastewater treatment,
- transport-to-disposal,
- effluent disposal,
- sludge/septage handling,
- cluster systems, and
- land acquisition.

Once basic construction costs were estimated, allowances were added for:

- Contingencies,
- Engineering and legal expenses,
- Site investigation costs, and
- Land costs.

All costs presented herein are expressed in mid 2008 dollars for consistency with the Orleans draft CWMP. It was assumed that all the facilities would be built at one time. While that is not likely, it does provide the simplest basis for comparison and creates a platform for later phasing analyses.

4.2 COST ESTIMATES FOR EACH ALTERNATIVE

Table 4-1 presents a summary of the capital and O&M cost estimates for the most cost-effective of the major alternatives, presented in mid 2008 dollars. This table shows the costs for individual towns acting along, as well as for multi-town solutions. Table 4-1 also indicates the "present worth" of each alternative. A "present worth analysis" is a standard economic tool that allows the calculation of a single "cost" to represent the combination of capital costs and annual expenses for operation and maintenance. In essence, the present worth represents the amount of money that one would invest to be able to pay the capital costs at the beginning of the project and allow periodic withdrawals to pay the annual O&M expenses over a certain period at a given interest rate. For the purposes of this study, the present worth has been computed assuming a 4% interest rate and a 20-year planning period.

The capital, O&M and present worth costs are also presented in Tables 4-2, 4-3 and 4-4, and represent the "regional costs" for each alternative (i.e., Alternative A-1 represents the sum of costs for Orleans and Brewster, Alternative B-2 includes all costs for Orleans and Eastham, and Alternative C-2 represents the regional costs for Orleans, Brewster and Eastham).

TABLE 4-1

SUMMARY OF FLOWS AND COSTS

	Local Solutions			Multi-Town Solutions		
	Brewster Alone	Eastham Alone	Orleans Alone	Brewster & Orleans	Eastham & Orleans	All 3 Towns
Septic flow eliminated, gpd	88,000	160,000	504,000	592,000	664,000	752,000
Flows treated, gpd						
Annual average	108,000	194,000	644,000	752,000	838,000	945,000
Maximum month	183,000	329,000	1,095,000	1,263,000	1,399,000	1,567,000
Short-term peak	278,000	484,000	1,417,000	1,632,000	1,809,000	2,033,000
Capital Costs, $M, mid-2008 basis						
Collection	14.7	23.4	99.5	115.5	123.0	139.1
Transport to treatment	2.4	3.9	3.0	4.0	3.0	3.0
Treatment	13.0	14.9	29.6	32.6	35.4	40.6
Transport to disposal	0.4	0.4	0.4	0.4	0.4	1.5
Disposal	1.6	2.7	7.4	8.5	9.2	11.8
Land	0.6	0.7	5.5	6.2	6.2	6.9
Other	0.0	0.0	5.5	5.5	5.5	5.5
Total	32.7	46.0	150.9	172.8	182.8	208.4
O&M Costs, $/yr, mid-2008 basis	405,000	581,000	1,159,000	1,278,000	1,382,000	1,603,000
Present Worth, $M, mid-2008 basis	37.7	53.2	165.3	188.7	200.0	228.4
Unit Costs for N Removal, $/lb removed	430	335	330	320	300	300

TABLE 4-2
SUMMARY OF COSTS FOR BREWSTER-ORLEANS OPTIONS

	A-1 Brewster and Orleans Develop Separate Facilities		**A-2** Brewster and Orleans Collect Wastewater with Treatment at Tri-Town		**A-3** Orleans Expands Collection System to Offset Brewster N Load		**A-4** Collect all Pleasant Bay Wastewater and Treat in Brewster; Remaining Orleans Wastewater Treated at Tri-Town
Capital Costs, $M, mid-2008 basis							
Collection	114.2		115.5		119.9		112.4
Transport to treatment	5.1		4.0		3.0		5.4
Treatment, with site invest.	42.7		32.6		32.7		54.1
Transport to disposal	0.9		0.4		0.4		0.9
Disposal, with site invest.	9.0		8.5		8.5		9.4
Septage/Sludge handling	3.3		3.3		3.3		3.3
Clusters--treat/disp, land, site invest	1.9		1.9		1.9		1.9
Land	6.2		6.2		6.2		6.3
Non-structural	0.3		0.3		0.3		0.3
Total	183.5		172.8		176.2		194.1
Operation & Maintenance Costs, $M/yr	1.56		1.28		1.28		1.66
Present Worth							
Capital cost, $M	183.5		172.8		176.2		194.1
PW of O&M, $M	19.5		15.9		16.0		20.7
Total PW, $M	203.0		188.7		192.1		214.8
Equiv. Annual Cost, $M/yr	16.3		15.1		15.4		17.2
Savings with respect to Alternative A-1							
Capital cost, %, $M	--	*5.8%*	10.7	*4.0%*	7.3	*-5.8%*	-10.6
O&M, %, $M/yr	--	*18.3%*	0.29	*18.1%*	0.28	*-6.2%*	-0.10
Total PW, %, $M	--	*7.0%*	14.2	*5.3%*	10.8	-5.8%	-11.8

TABLE 4-3
SUMMARY OF COSTS FOR EASTHAM-ORLEANS OPTIONS

	B-1 Eastham and Orleans Develop Separate Facilities		**B-2** Eastham and Orleans Collect Wastewater with Treatment at Tri-Town		**B-3** Orleans Expands Collection System to Offset Eastham N Load
Capital Costs, $M, mid-2008 basis					
Collection	122.8		123.0		128.3
Transport to treatment	6.9		3.0		3.0
Treatment, with site invest.	44.5		35.4		35.5
Transport to disposal	0.9		0.4		0.4
Disposal, with site invest.	10.1		9.2		11.8
Septage/Sludge handling	3.3		3.3		3.3
Clusters--treat/disp, land, site invest	1.9		1.9		1.9
Land	6.2		6.2		6.4
Non-structural	0.3		0.3		0.3
Total	196.9		182.8		191.0
Operation & Maintenance Costs, $M/yr	1.74		1.38		1.39
Present Worth					
Capital cost, $M	196.9		182.8		191.0
PW of O&M, $M	21.7		17.2		17.3
Total PW, $M	218.6		200.0		208.3
Equiv. Annual Cost, $M/yr	17.5		16.0		16.7
Savings with respect to Alternative B-1					
Capital cost, %, $M	--	*7.2%*	14.1	*3.0%*	5.9
O&M, %, $M/yr	--	*20.6%*	0.36	*20.3%*	0.35
Total PW, %, $M	--	*8.5%*	18.6	*4.7%*	10.3

TABLE 4-4
SUMMARY OF COSTS FOR EASTHAM-ORLEANS-BREWSTER OPTIONS

	C-1 All Three Towns Act Independently	C-2 All Three Towns Collect Wastewater with Treatment at Tri-Town		C-3 Orleans Expands Collection System to Offset Brewster and Eastham N Loads		C-4 Collect all Pleasant Bay Wastewater with Treatment in Brewster, and Collect all Rock Harbor and Town Cove Wastewater with Treatment at Tri-Town
Capital Costs, $M, mid-2008 dollars						
Collection	137.5	139.1		148.7		135.4
Transport to treatment	9.3	3.0		3.0		5.4
Treatment, with site invest.	57.5	40.6		43.5		57.4
Transport to disposal	1.3	1.5		1.5		0.9
Disposal, with site invest.	11.7	11.8		11.9		13.9
Septage/Sludge handling	3.3	3.3		3.4		3.3
Clusters--treat/disp, land, site invest	1.9	1.9		1.9		1.9
Land	6.9	6.9		7.0		7.0
Non-structural	0.3	0.3		0.3		0.3
Total	229.7	208.4		221.3		225.4
Operation & Maintenance Costs, $M/yr	2.14	1.60		1.61		1.94
Present Worth						
Capital cost, $M	229.7	208.4		221.3		225.4
PW of O&M, $M	26.7	20.0		20.1		24.1
Total PW, $M	256.4	228.4		241.4		249.5
Equiv. Annual Cost, $M/yr	20.6	18.3		19.4		20.0
Savings with respect to Alternative C-1						
Capital cost, %, $M	--	*9.3%*	21.3	*3.7%*	8.4	*1.9%* 4.4
O&M, %, $M/yr	--	*25.3%*	0.54	*24.9%*	0.53	*9.7%* 0.21
Total PW, %, $M	--	*10.9%*	28.1	*5.9%*	15.1	*2.7%* 6.9

Based on this analysis, there are a number of preliminary conclusions which can be drawn:

1. With respect to Orleans and Brewster, Alternatives A-2 and A-3 are the most cost-effective on a present worth basis. About $10 million in capital costs could be saved in the region by Orleans accepting Brewster wastewater. Annual O&M cost savings would be approximately $280,000. These savings represent about 6% of the capital costs and 18% of the O&M costs for each town acting alone.

2. With respect to Orleans and Eastham, Alternative B-2 and B-3 are the most cost-effective on a present worth basis. That is, a regional solution would save about $14 million in capital and $360,000 per year in O&M costs over each town acting alone. These savings represent about 7% of the capital costs and 21% of the O&M costs for separate facilities in each town.

3. Considering all three towns, Alternatives C-2 and C-3 are the most cost-effective on a present worth basis. A three-town solution, compared to each town acting alone, would save $21 million in capital cost (9% savings) and $540,000 in annual O&M cost (25% savings).

4. The above savings are based on Orleans implementing its Core Plan, as described in the Draft CWMP, which represents 504,000 gpd of septic flow removed and 640,000 gpd of influent wastewater (including I/I). The Town of Orleans must allow for a future Extended Plan, also described in the Draft CWMP, which represents 950,000 gpd of septic flow removed and 1.14 mgd of influent wastewater. The Extended Plan exceeds the anticipated effluent disposal capacity of the Tri-Town site and an off-site disposal location would be required to accommodate the three-town regional alternatives that use only the Tri-Town site. The costs of this second disposal site are included in Alternative C-2 so that Orleans can preserve available capacity for its Extended Plan.

5. While not the least cost solution, Alternative C-4 provides the benefit of preserving effluent disposal space and capacity at the Tri-Town site. Alternative C-4 may warrant additional consideration or modification, especially if Brewster and Harwich express serious interest in regionalization within the Pleasant Bay watershed.

6. Alternatives A-3, B-3 and C-3 were developed as a means to balance the desire of Orleans to maintain provisions for the Extended Plan with the presumed desire of all three towns to address nitrogen removal at the least cost. In this scenario, a three-town solution would save $8.4 million in capital and $530,000 in annual O&M costs when compared to each town acting alone.

7. The current schedule calls for the implementation of Phase 1 of the Orleans Recommended Plan in 2013; implementation of future phases in Orleans and early phases in Brewster and Eastham would be expected to occur no sooner than 2013 to 2015. Given the relatively long period of times before construction bids are received and the uncertainty associated with inflation, it is expected that inflation will increase the cost of these projects by 3% to 7% per year. For Alternative C-2, the least-cost three-town solution, this represents approximately $6 million per year in project cost increases.

8. A review of specific line items in Tables 4-1 through 4-4 shows that the regional options allow significant cost saving for wastewater treatment. The collection costs are generally the same for the single-town and multi-town alternatives, because the same amount of nitrogen must be removed from the watershed in all options. The cost model reflects the differing transport costs, but these are generally much less than the savings associated with joint treatment.

There are many considerations which will go into allocation of these costs and savings, especially in scenarios where facilities in Orleans need to be larger to accommodate regionalization (e.g., Alternatives A-2, B-2, and C-2) or where additional facilities are constructed in Orleans to offset requirements in another town (e.g., Alternatives A-3, B-3, C-3). The allocation of these costs and savings is addressed in Section 5.

4.3 ASSUMPTIONS AND DISCUSSION OF COSTS

A full understanding of these cost estimates and their ramifications requires a discussion of the principal assumptions, which are outlined below:

1. This cost analysis is based on the assumption that nitrogen load reductions mandated by existing or expected TMDLs will be accomplished by eliminating septic systems and the construction of municipal sewer systems. To the extent that any of the Towns is able to reduce nitrogen loads by other means, such as through fertilizer reductions, actual costs will be lower than these estimates. This cost analysis does not address sanitary, convenience, or pond protection needs in Eastham and Brewster, unless those needs are addressed by first addressing the nitrogen control needs.

2. This cost analysis is based on the nitrogen load reductions mandated by existing or expected TMDLs. Modifications to these existing or expected requirements may impact the cost analysis contained herein.

3. The cost impacts to the anticipated sewers and forcemains in the outlying areas of the proposed Orleans system have been implicitly addressed at this time (i.e increased pipe sizes). The actual cost impacts will need to be estimated after regionalization decisions are made.

4. The Town of Harwich has requested to be considered in this regionalization study. A review of watershed mapping shows that the far easterly portions of Harwich are as close, or closer, to the proposed Orleans sewer system than are some of the selected neighborhoods in Brewster. Two options for sewering this area of Harwich are: 1) conveyance to the hypothetical treatment plant in Brewster, and 2) conveyance to the proposed Orleans sewer system. Except for possible limitations on effluent disposal capacity at the Tri-Town site, the conclusions of this study would also apply to these neighborhoods in Harwich; that is, there is money to be saved through regionalization. It

must be recognized, however, that Harwich has at least two other options, including building its own facility in Harwich and regionalization with Chatham. Considering any of the Harwich options is beyond the scope of this study.

5. Some of the properties that have been identified for potential sewering in Brewster are located up-gradient of freshwater ponds that may provide some degree of natural attenuation for septic-impacted groundwater. This analysis has not accounted for that factor. (Indeed, the Brewster Freshwater Ponds Report, issued in September 2009, raises questions about pond water quality.) In reality, a larger sewered area in Brewster might be required to remove sufficient septic nitrogen to meet Brewster's share of the Pleasant Bay TMDL if natural attenuation is occurring. That larger sewer area would result in a higher collection cost than has been estimated here. It is the treatment cost savings that drive the regionalization analysis. If a larger sewered area is needed in Brewster, then the collection costs would be higher for both the "local" and the "regional" treatment options, and the savings through regionalization would not change. Alternatively, a different area of sewers could be identified that is downgradient of these ponds.

6. The collection system selected for Brewster reflects the fact that, in the regional option, the collected nitrogen would be conveyed outside the Pleasant Bay watershed for treatment and disposal, and the small amount of nitrogen remaining after treatment would not impact Pleasant Bay. The collection system leading to the hypothetical treatment facility in Brewster should be larger than in the regional option, because that residual nitrogen remains in the watershed. This factor has not been accounted for in this analysis. If it were quantified, the savings associated with regionalization would be larger than reported here.

7. The site of the hypothetical treatment and disposal facilities in Brewster is located within the Zone II of Brewster water supply wells in an area that Brewster has designated as a Groundwater Protection District. Recent revisions to the DEP groundwater discharge permit regulations impose very stringent effluent limits on Zone II discharges. Not knowing how these new regulations will be applied, or the details of the Brewster Zone II

mapping, it has been assumed that the treatment costs at the Brewster site would be 20% higher than in a non-Zone-II situation. That premium is equivalent to a capital cost of about $2 million, or about 20% of the projected savings through regionalization. This factor is of about the same magnitude as the underestimate described in Item 6 above (i.e., larger service area required to address residual nitrogen remaining in Pleasant Bay in Brewster), and would not change the overall conclusion that a joint facility with Orleans is cost-effective. If Brewster were to locate a disposal site outside a Zone II, then this $2 million premium could be avoided, and the capital cost savings with regionalization would be $2 million less.

8. The recommended Core Plan for Orleans would use about 60% of the available effluent disposal capacity at the Tri-Town site. The three-town regional option would use most of the remaining capacity and leave no room for Orleans' Extended Plan. It has been assumed that ongoing site explorations will show that the site cannot handle the flows from Brewster and Eastham, as well as Orleans' Extended Plan, and that a supplemental disposal site would be needed for the portion of the combined flow. Section 10 of the draft CWMP presents a cost estimate for an effluent reuse option for the Orleans Core Plan (i.e., 504,000 gpd septic flow removed) that involves drip irrigation at ballfields at the elementary and middle schools. The incremental cost increases for that option are $7 million in capital costs and $120,000 per year in operation and maintenance costs, which includes some enhanced treatment. For the purposes of this analysis 75% of the incremental costs have been included for the appropriate three-town options. If the Tri-Town site is shown to be capable of accepting the entire three-town flow, then this incremental cost would not be applicable. It is important to note that this incremental increase may also be applicable to the two-town scenarios, depending on the likelihood of Orleans Extended Plan implementation; however, we have not included that allowance in this analysis.

9. Using Brewster's predicted flows, a sensitivity analysis was performed to see how regionalization cost savings would change if the flow predictions in Section 2 were 20% higher or 20 % lower. That analysis indicates that regionalization capital cost and present

worth savings would be within 4% to 6% of those presented herein; (i.e., the $10.7 million capital cost savings would range from $10.3 million to $11.4 million). This demonstrates that the majority of the costs are related to collection and the majority of the savings result from treatment economies of scale.

SECTION 5

EVALUATION OF COST ALLOCATION METHODS

5.1 INTRODUCTION

Section 4 presents the estimated costs to build and operate regional wastewater facilities, without consideration of how the costs would be allocated to the participating towns. This section of the report presents concepts and methods to allocate the costs associated with regionalization or how to allocate the savings.

5.2 HYPOTHETICAL BASIS FOR ANALYSIS

In order to illustrate the cost sharing concepts, the following hypothetical example is presented, involving two towns. The "Host Town", where the regional wastewater treatment facility would be located, would own and operate the facility. The "Customer Town" would provide its own collection system and piping to transport its wastewater to the collection system of the Host Town. Treatment services would be provided by the Host Town to the Customer Town through an inter-municipal agreement that would establish the basis for sharing of capital and operating costs.

For this discussion, it is assumed that the treatment facilities would be owned and operated by the Host Town. It is also possible that a District could be formed to accomplish the same functions. In the case of Orleans and its neighbors, single-town ownership is believed to be more practical. This assumption is based on the fact that Orleans is several years ahead of Brewster and Eastham in its wastewater planning, and the formation of a district could not occur until those towns "catch up" with Orleans. This would delay Orleans for several years.

The cost sharing concepts are most easily understood with a simple hypothetical cost example. Assume the following for the capital costs of treatment facilities serving each town individually and for one joint plant:

Facility serving only Host Town	$30 million
Facility serving only Customer Town	$15 million
Total of individual facilities	$45 million
Regional facility	$35 million
Savings with regional facility	$10 million

Further assume that, of all the wastewater flow the regional facility would be designed to treat, the Host Town generates 75% and the Customer Town generates 25%.

In this analysis, the key question is: "What is the best way to allocate the $35 million capital cost of a joint treatment facility to the Host and Customer Towns?" Said another way: "How should the two Towns share the $10 million cost savings attributable to regionalization?" This key question is utilized to illustrate the allocation concepts that follow.

5.3 COST ALLOCATION CONCEPTS - CAPITAL COSTS

There are many possible ways to answer the questions identified above. The paragraphs that follow describe some of the common ones.

Option 1. Customer Town Pays Incremental Cost

With this approach, the Customer Town pays all the "extra" capital costs that would be incurred by the Host Town to accommodate the Customer Town's wastewater flow. The Host Town would incur $5 million more capital expense ($35 million for the regional facility less the $30 million it would have paid for its own plant) and that increment would be paid by the Customer Town. In this scenario, all of the regional capital cost savings accrue to the Customer Town, and there is no capital cost advantage to the Host Town. Nevertheless, the Host Town might be willing to consider this option, due to the potential savings in O&M costs through a separate cost-sharing formula.

Option 2. Customer Town Pays What It Would Have Paid for Its Own Facility

In the reverse of the first option, The Customer Town pays the $15 million that it would have paid to deal solely with its own wastewater treatment obligation. The Host Town pays the difference, or $20 million. In this scenario, all of the regional capital cost savings accrue to the Host Town, and there is no capital cost advantage to the Customer Town. As with the first option, the Customer Town might be willing to agree with this approach based on potential O&M cost savings over the life of the project.

Option 3. Regional *Costs* are Allocated Based on Wastewater Flow

Since the Host Town generates 75% of the overall wastewater flow, it would pay that percentage of the capital cost of the regional facility, or $26.25 million. The Customer Town's share would be 25% of the total, or $8.75 million. In this option, the Host Town would realize 38% of the $10 million savings associated with regionalization, and the Customer Town would realize 62% of the savings.

Option 4. Regional *Savings* are Allocated Based on Wastewater Flow

With this approach, the Host Town would realize 75% of the $10 million savings, since it generates 75% of the wastewater flow. Its capital cost share would be $22.5 million ($30 million less 75% of $10 million). The Customer Town would pay $12.5 million ($15 million less 25% of $10 million).

Option 5. The Cost Savings are Split Equally.

This approach is perhaps the simplest. Each Town saves $5 million compared to what it would have spent on its own facility. The Host Town pays $25 million and the Customer Town pays $10 million.

Option 6. The Host Town is Paid a Flat Host Fee

There are a number of hard-to-quantify disadvantages of being the Host Town. These include the potential negative impacts on homes and businesses near the facility, the risk associated with compliance with the discharge permit, the potential liabilities associated with worker and visitor safety, and the impacts on local groundwater quality. In some circumstances, host communities

ask for a flat "host community fee" to account for these issues. For illustrative purposes, assume that this flat fee would be $2 million or about 5% of the capital cost of the joint treatment facility. The addition of the host fee could be coupled with any of the cost allocation approaches listed above. If the hypothetical $2 million host fee were applied to Option 5 (equal sharing of capital cost savings), the Host Town would pay $23 million of the $35 million capital cost ($30 million less 50% of savings, less $2 million), and the Customer Town would pay $12 million ($15 million less 50% of savings, plus $2 million).

Option 7. *Cost* Allocation Equal to Allocation of *Savings*

In this example, the costs to the Host Town for its separate facility represent two-thirds of the sum of the costs for two individual facilities. If the capital costs of the joint facility were split on this two-thirds-one-third basis, The Host Town would pay $23.33 million and the Customer Town would pay $11.67 million. Mathematically, this approach results in the same percentage sharing of **costs** and **savings**: $6.67 million of savings go to the Host Town and $3.33 million in savings go to the Customer Town.

Table 5-1 summarizes the application of these seven options to the hypothetical cost example. Options 1 and 2 bracket the full range of results; the Host Town's share of capital cost would fall between $20 and $30 million. The most likely alternatives fall in a smaller range, $23 to $26 million, or 65% to 75% of the total cost. For the Customer Town, the most likely options fall in the range of 25% to 35% of the total cost, or $9 to 12 million.

5.4 COST ALLOCATION CONCEPTS - O&M COSTS

With respect to O&M costs, there are fewer common options. Most O&M cost-sharing formulas are based on actual wastewater flow, often with a small percentage surcharge on the per-gallon price paid by the Customer Town. Sometimes wastewater strength is also accounted for in either capital or O&M cost sharing, but that approach may not be necessary due to the absence of any significant high-strength waste sources in Orleans or neighboring towns.

TABLE 5-1
SUMMARY OF COST SHARING EXAMPLES

	Option 1 Customer Pays Incremental Costs	**Option 2** Customer Pays Individual Costs	**Option 3** Costs Allocated on Flow Basis	**Option 4** Savings Allocated on Flow Basis	**Option 5** Savings Split Equally	**Option 6** Option 5 Plus Host Fee	**Option 7** Equal % of Costs & Savings
Capital Cost Share, $ million							
Host Town	30.0	20.0	26.25	22.5	25.0	23.0	23.33
Customer Town	5.0	15.0	8.75	12.5	10.0	12.0	11.67
Share of Savings, $ million							
Host Town	0	10.0	3.75	7.5	5.0	7.0	6.67
Customer Town	10.0	0	6.25	2.5	5.0	3.0	3.33
Capital Cost Share, %							
Host Town	85.7%	57.1%	75.0%	64.3%	71.4%	65.7%	66.7%
Customer Town	14.3%	42.9%	25.0%	35.7%	28.6%	34.3%	33.3%
Share of Savings, %							
Host Town	0%	100%	37.5%	75%	50%	70%	66.7%
Customer Town	100%	0%	62.5%	25%	50%	30%	33.3%

5.5 APPLICATION OF COST SHARING FORMULAS

The Working Group reviewed the cost sharing example presented herein, and discussed the advantages and disadvantages of each candidate approach for cost allocation It selected two methods, Option 3 and Option 6, to apply to the cost estimates presented in Section 4. These cost allocation options were selected because they are intuitively simple and they bracket the greatest reasonable range for cost sharing. The most desirable cost-sharing scenario may fall somewhere between the costs presented from applying Option 3 and Option 6. The illustrative costs are presented in Table 5-2, where Cost Allocation Options 3 and 6 are applied to Regionalization Alternatives A-2, B-2, and C-2. Table 5-2 illustrates the costs and savings related only to regional treatment, and do not include collection and disposal costs.

With Cost Allocation Option 3 (costs apportionment based on flow), the greatest benefits accrue Eastham and Brewster. For the two-town regionalization alternatives, Brewster would accrue 81% of the savings (Alternative A-2) and Eastham would accrue 70% of the savings (Alternative B-2). In the three-town alternative (Alternative C-2), Brewster and Eastham together receive 90% of the savings. In general, cost sharing on a flow basis accrues the greatest percentage of the savings to the smaller contributor.

With Cost Allocation Option 6 (equal sharing of savings tempered by payment of a host fee), the greatest benefits accrue to Orleans. For the two-town regionalization alternatives (Alternatives A-2 and B-2), Orleans would accrue about 70% of the savings. Orleans would accrue 54% of the savings in the three-town alternative (Alternative C-2). In general, this cost allocation option provides most of the savings to the host and major flow contributor.

Table 5-2 accomplishes the goal of the Working Group to demonstrate a broad range of cost per town that can serve as a framework for more detailed evaluation and negotiation. While other approaches are possible, this exercise shows that Brewster's share of regional treatment costs could be in the range of $5 million to $10 million, compared to the $13 million it might spend on its own. Eastham's share could be in the range of $8 to $12 million, compared with the $15 million it might spend on its own.

TABLE 5-2

SUMMARY OF TREATMENT CAPITAL COST ALLOCATIONS FOR TWO POSSIBLE APPROACHES

	Alternative A-2		Alternative B-2		Alternative C-2	
Wastewater Flow, gpd						
Orleans	504,000	*(85%)*	504,000	*(76%)*	504,000	*(67%)*
Brewster	88,000	*(15%)*	0		88,000	*(12%)*
Eastham	0		160,000	*(24%)*	160,000	*(21%)*
Total	592,000		664,000		752,000	
Cost Allocation Option 3 - Cost Apportioned on Flow Basis						
Capital Cost, $M						
Orleans	27.7	*(85%)*	26.9	*(76%)*	25.6	*(67%)*
Brewster	4.9	*(15%)*	0		4.6	*(12%)*
Eastham	0		8.5	*(24%)*	8.0	*(21%)*
Total	32.6		35.4		38.2	
Cost savings, $M						
Orleans	1.9	*(19%)*	2.7	*(30%)*	4.0	*(10%)*
Brewster	8.2	*(81%)*	0		8.4	*(22%)*
Eastham	0		6.4	*(70%)*	6.9	*(68%)*
Total	10.1		9.1		19.3	
Cost Allocation Option 6 - Savings Split Equally Plus Host Fee						
Capital Cost, $M						
Orleans	22.6	*(76%)*	23.0	*(78%)*	19.1	*(65%)*
Brewster	10.0	*(77%)*	0		8.6	*(66%)*
Eastham	0		12.4	*(83%)*	10.5	*(70%)*
Total	32.6		35.4		38.2	
Cost savings, $M						
Orleans	7.1	*(70%)*	6.6	*(72%)*	10.5	*(54%)*
Brewster	3.0	*(30%)*	0		4.4	*(23%)*
Eastham	0		2.5	*(28%)*	4.4	*(23%)*
Total	10.1		9.1		19.3	

5.6 UNIT COSTS FOR FUTURE NITROGEN TRADING

While traditional cost sharing is based on wastewater flows (and sometimes wastewater strength), Orleans, Brewster and Eastham should also consider cost allocation based on the amount of nitrogen removed. The over-riding goal of wastewater management in the region is removal of nitrogen from the watersheds of sensitive coastal embayments. One way to evaluate nitrogen removal options is to express their costs on the basis of the dollars spent per pound of nitrogen removed from the watershed. The first step is to combine the capital cost of a project with its expected annual operational costs. This is done by amortizing the capital cost (converting it to an equivalent annual costs based on some interest rate and term), and then adding the annual operating and maintenance costs to the amortized capital cost. The result is the annual amount needed to build and operate the facility, assuming replacement at the original cost at the end of the term. Next, the annual cost is divided by the pounds of nitrogen removed from the target watershed over a year. The result is the overall cost per pound of nitrogen removed. The 11 options evaluated in this report have costs ranging from $300 per pound to $430 per pound. Table 4-1 presents such costs for individual and regional options.

If Brewster were to build its own facilities, under the assumptions used in the analysis, it would pay $430 per pound of nitrogen removed from the Pleasant Bay watershed. Orleans has the ability to offer Brewster a share in a regional wastewater facility at some number higher than the cost of that regional facility ($300 per pound). If Orleans were to extend its sewer system to serve other Orleans properties, and the nitrogen removed is equivalent (in embayment protection terms) to the nitrogen that would have been removed in Brewster, then Orleans could use the dollar-per-pound method for assessing charges to Brewster.

One application of this cost accounting method is in a "cap and trade" approach, as is used in the air pollution industry. Each town in the watershed would be assessed a fee for each pound of nitrogen that enters the watershed above the embayment's threshold. (That is, the nitrogen load would be "capped" at the TMDL threshold.) If the fee that is charged (say $450 per pound) is more than Brewster can negotiate with Orleans (say $325 per pound), than Brewster has an incentive to buy credits from Orleans. In Alternative A-3, Orleans would be "trading" the credits it would generate by removing more nitrogen than Orleans is required to remove.

Considering costs on this basis is a convenient way to combine capital and O&M costs into a single number that also accounts for the effectiveness of the nitrogen removal system. This approach may have applicability in negotiations among the three towns. Any "cap and trade" system would only be possible if some regulatory entity had the legislative authority to set up such a system and to impose fees based on measurable performance.

SECTION 6

SUGGESTED NEXT STEPS

This evaluation of regionalization alternatives demonstrates that there are significant opportunities for meaningful savings, both in capital costs and in annual O&M expenses, that could accrue to Orleans, Eastham and Brewster. That said, regionalization is an inherently difficult process through which to navigate, often due to non-technical and non-financial factors. Some examples of non-technical and non-financial factors related to regionalization include:

- Multi-town public education and outreach is necessary on the source and extent of the nitrogen control problem, the options to address the problem, the location of town boundaries versus watershed boundaries, the importance of making forward progress, and the advantages and disadvantages of acting regionally.
- There may be a lack of public will to act regionally (versus independently) due to the perceived or actual loss of local control for the "customer communities".
- The "host community" may not be willing to act regionally (versus independently) due to the perception of "selling" its resources (such as effluent disposal site capacity) to others or bearing too much of the burden of environmental impacts.
- There is the need to select the proper administrative entity (e.g., municipal structure or quasi-municipal district).
- The completion of complex legal documents and gaining Town Meeting approvals can be challenging tasks.

Based on the foregoing discussion, in conjunction with the numerous financial and technical considerations, one would expect that preliminary commitments on regionalization could take months if not years to obtain. Accordingly, in order to ensure that each community is expending its limited time and financial resources appropriately, an agreed-upon implementation approach and milestone schedule should be developed and followed by each community. A suggested implementation approach includes the following steps:

1. Conduct thorough reviews of the May 2009 and June 2009 drafts of this report by the Working Group, and incorporate pertinent comments into a final report. (This step was accomplished in second half of 2009.)

2. Submit the second draft (June 2009) report to the Boards of Selectmen from Orleans, Brewster and Eastham, and discuss it in a public meeting held jointly by the three Boards. It may also be appropriate for that meeting to include specific discussions related to Orleans building regional septage capacity at its wastewater facility. Topics could include: Tri-Town facility contingency planning and funding; continuation or dissolution of the Tri-Town District; and future septage receiving provisions at the Orleans municipal wastewater treatment facility. (That meeting was held on September 10, 2009.)

3. Solicit and secure a commitment from each of the three Boards (or Town Meetings as appropriate) on wastewater regionalization and septage regionalization. The following simplified choices are suggested:

    a. **Opposed to regionalization** (will not participate in planning, design or construction);
    b. **Committed to regionalization now** (will begin formal negotiations for reserving capacity); or
    c. **Open to regionalization long-term** (may negotiate in the future).

4. Address the following issues with those towns that are "committed to" or "open to" regionalization:

    a. Wastewater volume from each community,
    b. Septage volume from each community,
    c. Participation in capital costs, and
    d. Participation in O&M costs.

5. Finalize this Regionalization Report to address the input from the three Boards, including their choice of level of commitment, if that input can be obtained at this early stage. (This final report has been prepared in December 2009, following a statement by the Eastham Board of Selectmen in support of continuing to discuss regionalization options. No other commitments have been obtained as of this date.)

6. Present the Regionalization Report to the Cape Cod Water Protection Collaborative. (This presentation occurred at the September 9, 2009 meeting of the Collaborative.)

7. Include the final Regionalization Report in the Final Orleans CWMP, with appropriate modifications to the schedule and implementation plan contained in Section 11 of that CWMP.

In that Orleans is the farthest along in wastewater planning of the three communities, the schedule for decision-making on regionalization must be coordinated with the completion of the Orleans CWMP, currently scheduled for early 2010. To the extent that regionalization is elected, the CWMPs for each Town should ultimately include an implementation schedule that reflects the necessary administrative steps. The Orleans CWMP should also report on any confirmatory model runs (conducted through the MEP) which would be necessary to show that the proposed regional plan is TMDL compliant, particularly for options involving sewers in Orleans to offset nitrogen loads in the other towns.

The proposed phased construction of the Orleans wastewater facilities will dictate deadlines for firm commitments from Eastham and Brewster. In Phase 1, one half of the wastewater treatment capacity would be built at the Tri-Town site. The remaining treatment plant capacity would be built in Phase 4, either at Tri-Town or at a site near the Orleans-Brewster town line. Binding commitments related to participation by Eastham and Brewster could be deferred until the start of the Phase 4 design. However, earlier commitments would be beneficial, in that they would allow the design of Phase 1 facilities to accommodate later inclusion of Eastham and Brewster flows. (Such accommodations might include designing pump stations to be readily expanded in the future for regional flows.) During the preliminary design (2010 to 2011), it will be important for Orleans to estimate the added costs to facilitate later inclusion of the other Towns. Orleans would then make an informed decision (with Brewster and Eastham), on whether or not to incur those costs in Phase 1, or to expect a higher cost in Phase 4. Choosing to "commit to regionalization now" would allow Eastham or Brewster to benefit from that advance planning for future participation. Choosing to remain "open to regionalization long-term" would keep either Town's options open for participation in Phase 4, but without the benefits of that advance planning.

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