SECTION 7.0 ALTERNATIVE 3 (DECENTRALIZED TREATMENT AND CONTINUED USE OF EXISTING WWTFs) ANALYSIS

This Section identifies and describes the analysis of Alternative 3 (Decentralized Discharge). The different methods of analysis are described in Section 4. The analysis will include the following three major categories:

- Environmental Analysis
- Non–Monetary Analysis
- Planning Level Construction Costs

7.1 ENVIRONMENTAL ANALYSIS

This alternative would result in continued reliance on existing wastewater facilities; however, two-thirds of the projected increase in wastewater flow would be directed to decentralized systems for treatment and subsurface land application. Under this alternative, the existing wastewater treatment facilities (WWTFs) would be upgraded to meet the 2025 discharge limits at their existing locations (see Appendix L of the Preliminary Findings Report for a summary of projected 2025 WWTF effluent limits). The majority of new growth would need to be accommodated by on-lot or other types of decentralized systems. In some parts of the project area, new development may not be feasible due to lack of sewers and unsuitable sites for on-lot systems. The following discussion summarizes the trends that would be likely to continue should Alternative 3 be selected.

7.1.1 Land Use and Growth

Land Use Compatibility and Aesthetics. Under this alternative, the existing WWTFs would continue to treat current flows and a portion of projected flows. Upgrades to the existing WWTFs are anticipated to meet existing and future discharge limits (see Section 3.3.1), which would result in relatively minor land use impacts similar to those described for Alternative 1 (No Action). Since this alternative assumes that one-third of the projected increase in wastewater flow would be treated at the existing WWTFs and the remaining two-thirds would be treated by decentralized systems, concerted efforts would need to be made by the municipalities to limit growth of a centralized sewer system (e.g. imposing sewer extension restrictions) and plan for and identify areas that could accommodate decentralized systems. Siting decentralized systems may prove difficult in some study area communities that have limited developable land available, such as Portsmouth. Siting factors that would need to be considered as part of further analysis include land availability, ability of homes to combine discharges, and soil characteristics.

The decentralized systems would require the permanent taking of parcels of land within the WWTF communities. Undeveloped land, including forested and agricultural lands, would be the most likely type of land selected for siting the decentralized systems. Thus, operation of these systems would result in a permanent change in land use. The decentralized system components would primarily be located below grade and the surface revegetated, thus changes to aesthetic character in the vicinity of the systems would be somewhat mitigated.

Land Area Impacted. Table 7-1 summarizes the approximate number of decentralized systems required for each community with a WWTF as well as the associated land area. The information in this table is based on engineering criteria presented in Section 3.3 of this report. For several of the communities, a fairly significant amount of land is anticipated to be required to accommodate the decentralized systems. WWTF communities with significant land area requirements (50 or more acres) include Dover, Exeter, Hampton, Portsmouth, and Rochester.

TABLE 7-1. TOTAL LAND AREA ANTICIPATED FOR DECENTRALIZED SYSTEMS

WWTF Community	Number of Decentralized Systems (10K gpd/system)	Total Land Area (2.5 acres/system)
Dover	20.0	50.0
Durham	6.0	15.0
Epping	7.3	18.3
Exeter	20.0	50.0
Farmington	3.3	8.3
Hampton	26.7	66.8
Milton	0.7	1.8
Newfields	0.3	0.8
Newington	1.3	3.3
Newmarket	8.0	20.0
Pease Development Authority	9.3	23.3
Portsmouth	31.3	78.3
Rochester	39.3	98.3
Rockingham County Facility	2.2	5.5
Rollinsford	1.3	3.3
Seabrook	14.7	36.8

Indirect Growth. This alternative could potentially discourage future growth by limiting the ability of new developments in WWTF communities from tying into existing sewer systems. In order for this to occur, action would be required at the local level to minimize extensions to existing sewer systems and to maximize use of decentralized systems. While the use of decentralized systems would result in the direct loss of parcels (to accommodate the decentralized system and their soil absorption systems (SAS)), this alternative may indirectly protect other undeveloped parcels by limiting the ease in which future growth could occur. In areas where decentralized systems are employed, there would be a finite capacity to the treatment system, which in turn would limit the number of possible future connections to the system. Such an alternative, in conjunction with restrictions on sewer connections or limitations for development of individual on-lot systems, would effectively serve as a temporary form of growth management in communities that contain a number of undeveloped parcels or sensitive resource areas the communities would like to protect.

7.1.2 Air Quality

Similar to Alternative 1 (No Action), continued operation of the WWTFs, after the anticipated upgrades, is generally anticipated to result in minimal impacts to air quality to communities within the study area. Operation of the decentralized systems is similarly not anticipated to result in adverse impacts to air quality. A potential source of emission, if necessary, is anticipated to be small vent structures. These vents may release small concentrations of gasses, such as hydrogen sulfide; however, the concentrations generated by a properly operating system would be minimal and would rapidly disperse. Proximity to receptors should be considered during siting to allow for adequate buffer. Although the dosing pump stations would be sized to contain approximately 24 hours of flow in the event of a power outage, the design in some locations may call for an additional safety factor, i.e. standby generator. Operation of, and thus emission from, a standby generator is expected to be infrequent. Therefore, no significant long-term air quality impacts related to the decentralized systems are anticipated.

7.1.3 Surface Water Flow, Groundwater Recharge, and Water Quality

Surface Water Flow and Groundwater Recharge. For Alternative 3, direct WWTF discharges to the estuary would increase by 2.7%. This increase is expected due to an increase in wastewater generation in the study area discharged to the WWTFs (one-third of the projected wastewater generation).

Indirect discharge from the decentralized systems to the estuary (e.g. groundwater flows from the on-lot decentralized systems) would increase by 5.5%. This increase is expected due to the new decentralized systems discharge (two-thirds of the projected wastewater) which would contribute to the recharge of the groundwater. This new wastewater flow to decentralized systems, and ultimately to the groundwater, is anticipated to be approximately 2 million gallons per day. Finally, new developments not able to connect to existing WWTFs would rely on on-lot disposal, which would contribute to continued recharge of groundwater in localized areas.

The maintenance of stream flow and positive contribution to groundwater would be beneficial for maintaining habitat and preserving water supplies, and for maintaining overall water balance in the watershed.

Water Quality. The following is a summary of the water quality analysis for Alternative 3. This includes changes to the Great Bay salinity and a qualitative Great Bay pollutant loading analysis.

<u>Great Bay Salinity Changes</u>

Similar to Alternative 1 (No Action) the majority of the wastewater generated in the communities with WWTFs will be discharged to the existing WWTF discharge locations. The impact on salinity for the two alternatives is anticipated to be similar. The salinity modeling for Alternative 1 indicated the impact of the WWTF discharge on salinity is anticipated to be 1 ppt or less. See Section 5.1.3 and Appendix C for the discussion of the salinity impacts for Alternative 1.

<u>Pollutant Loading Analysis</u>

Water quality would continue to be affected by WWTF discharges. Under this alternative, the pollutant loading to the Great Bay from WWTFs for BOD, TSS, nitrogen, and phosphorus are all anticipated to decrease due to the new effluent limits projected for this study. This may result in some improvements to the dissolved oxygen (DO) concentrations and potential for eutrophication in the Great Bay. There is anticipated to be a slight increase in toxics discharge to the Great Bay due to increased wastewater generation and incomplete removal during treatment.

It is important to note that while the loading to the Great Bay from the WWTFs will be reduced, other loading inputs to the Great Bay may minimize the improvements of the WWTF loading reductions. These other inputs include non-point sources such as stormwater run-off, atmospheric degradation, and inputs from on-lot systems (e.g. increases in bacterial contribution from malfunctioning or overstressed on-lot systems).

Water quality of local receiving waters may also improve as a result of implementation of decentralized systems, which may pick up flow from failing septic systems that may have been prohibited from connecting to a WWTF. The community systems' discharges to groundwater would not be expected to degrade water quality as long as performance standards, such as type of soil and depth to groundwater are met in the siting and operation of these systems.

7.1.4 Wetland and Terrestrial Resources.

Wetland Resources. General wetland resource area conditions would not be expected to change significantly. Existing wastewater flow would continue to be treated at the WWTFs with discharge to existing receiving waters. Flow from future growth would be split, with one-third going to the central treatment facility, and two-thirds going to small or community systems. The split of flow would be beneficial for maintaining needed hydrology to support wetlands resource areas. On-site disposal systems would provide recharge to groundwater fed wetlands and also contribute to recharging stream flow.

Terrestrial Resources. Continued function of the wetlands resource areas would also be expected to provide valuable habitat for some terrestrial wildlife that benefit from water sources and riparian vegetation. While the decentralized treatment systems would result in alteration of surface vegetation available for terrestrial resources, as discussed above in the land use section, the systems would provide some habitat for small mammals or bird life. It is not expected that community systems would necessarily be fenced in any manner, thus wildlife access would likely not be restricted.

7.1.5 Aquatic Resources. It is not expected that there would be any significant effects to aquatic resources as stream flows would be increased by a modest amount and water quality would be improved to the extent the WWTFs must meet more stringent discharge limits. In addition, proper planning and siting of community systems may provide for more reliable on-site disposal than individual on-lot systems which may currently be contributing to localized high bacterial concentrations in receiving waters.

7.1.6 Rare and Endangered Species. It is not expected that there would be any significant effects on rare and endangered species. It is expected that siting of community systems can be done without directly or indirectly displacing any protected species. Maintaining both stream flow and groundwater levels would help to maintain habitat for protected species. In addition, improvements in water quality as a result of imposition of more stringent surface water discharge limits would also help to enhance habitat of rare and endangered species.

7.2 NON-MONETARY TECHNICAL ANALYSIS

The non-monetary analysis is divided into the following sub-categories:

- Complexity
- Public Testimony
- Implementation

7.2.1 Complexity

The complexity of this alternative has been evaluated as it relates to treatment, conveyance, and disposal. The following is a summary of those evaluations.

As described in Section 3.3, there are two components to this alternative: 1) the WWTF improvements and 2) the inclusion of a number of standardized decentralized systems. These components will be discussed separately.

WWTF Component. In this alternative, the anticipated treatment required at the WWTFs is more sophisticated than the existing WWTF treatment in order to accommodate the new treatment limits that would be required for the existing discharge locations. As a whole, the treatment component of this alternative is not considered to be particularly complex.

In this alternative, there is no conveyance component as the existing surface water discharge locations will be used.

The complexity of the disposal component of this alternative is not complex. In this alternative, the existing WWTF outfalls will be used.

Decentralized System Component. This alternative has the added complexity of community on-lot disposal systems. While each individual system may not be complicated, the large number of systems under this alternative makes the disposal portion relatively complicated. As noted in Section 3.3, approximately 200 community on-lot systems are anticipated. These systems will require siting, construction, maintenance, and periodic inspection. These 200 systems will also produce septage that will require periodic removal and disposal.

7.2.2 Public Testimony

This alternative was selected for analysis in this study as a direct result of the amount of public testimony that was given in support of examining a decentralized alternative. The majority of the public comments that were received related to this alternative were in the following categories:

- Concerns related to the benefit of decentralized treatment avoiding inter-basin transfer and the "throwing away" of the wastewater effluent that originated from a groundwater source, and that local/small scale disposal should be examined.

- Concerns of removing as much of the pollutant load from the surface receiving waters by reducing the amount of future flows that would be treated at WWTFs.

- Concern that development of a regional sewer system or the continued growth or tie-ins to the existing 17 sewer systems would result in a rapid and uncontrolled expansion of population and development within the study area.

7.2.3 Implementation

The implementation of the WWTF component of this alternative would be relatively simple. However, it is anticipated that it will be difficult to implement the decentralized system component. Implementation of the decentralized systems component of this alternative would require stricter zoning and sewer tie-in regulations at the local level. These regulations would need to require developers of new residential and commercial units to use decentralized systems in lieu of the existing sewers.

The costs of these decentralized systems would likely be passed on to the buyers. This would probably result in higher costs for the buyers and the potential to reduce the demand for these new units. This reduced demand may in turn limit the amount of growth (population and tax revenue) that a municipality might see over the long run with these regulations.

Another issue affecting the implementation of the decentralized systems is the ability to find and acquire the land required to site these systems. The areas currently sewered are portions of the municipalities that tend to be denser. Finding and siting community on-lot systems may prove difficult in these areas due to the limited land availability. The limited availability, both in total area as well as in proximity to each other, may result in fewer multiple unit developments that would be constructed in these areas (facilitating the use of a community on-lot system) and therefore make decentralized systems in these areas difficult to implement.

Although this alternative does not require an agreement between municipalities for construction or operation of the WWTF upgrades or the decentralized systems, this alternative does allow the possibility that the multiple communities could join together to share resources, leverage their combined purchasing power (for chemical, supplies, and equipment), and potentially negotiate with the regulators (permit limits, etc.).

7.3 PLANNING LEVEL CONSTRUCTION COSTS

Included herein are estimated planning level costs for Alternative 3. The WWTF planning level costs have been divided into three sub-categories; treatment, conveyance, and disposal. The planning level cost for the decentralized systems have also been included.

The planning level treatment upgrade construction costs for each WWTF are presented in Table 7-2. There are no conveyance and disposal costs associated with the WWTF component of this alternative. In summary, the estimated planning level construction cost for the WWTF component of Alternative 3 is:

- Treatment Costs $ 92,000,000
- Conveyance Costs $ -
- Disposal Costs $ -
- **Total Cost $ 92,000,000**

The planning level construction costs for the decentralized system component of each WWTF community are presented in Table 7-3. In summary, the estimated planning level construction cost for the decentralized system component of Alternative 3 is:

- Decentralized Systems $ 119,500,000
- **Total Cost $ 119,500,000**

It should be noted that the costs associated with the decentralized system component of Alternative 3 can be considered as part of the overall cost of the alternative, or it can be considered separately due to the developer financing the original cost of these systems.

The total estimated planning level construction costs for Alternative 3 for each community are presented in Table 7-4. In summary, the estimated planning level construction costs for Alternative 3 are:

- Treatment Costs $ 92,000,000
- Conveyance Costs $ -
- Disposal Costs $ 119,500,000
- **Total Cost $ 211,500,000**

Table 7-2. Alternative 3 Estimated WWTF Upgrade Costs

FACILITY	Year 2004 Max Mo. Flow, MGD	Year 2025 Max Mo. Flow, MGD	Economy of Scale $ Factor	Upgrades Anticipated	Incremental Flow Increase, MGD	Carbon Removal Upgrade Anticipated	Carbon removal upgrade @ $7.5/gallon	C only Filtration Upgrade Anticipated	Filtration Upgrade @ $2/gal	Nitrogen Upgrade Anticipated	Influent TN Load , lbs/day	Eff. TN Load (8mg/l), lbs/day	TN removed, lb/day	TN Removal @ $40/lb/day	TP Removal Anticipated	P-Flitration/ Chemical Addition @ $3/gallon	Other Upgrades Anticipated	Cost Assumptions (new flow only unless noted)	Other Upgrades $	Estimated Total Construction Cost
DOVER WWTF	4.57	4.87	0.70	C, TN	0.100	yes new flow	$ 530,000	no	$ -	yes	779.0	311.6	467.37	$ 4,780,000	no	$ -	IP, Pre, Dis	$6/gal	$ 600,000	**$ 5,910,000**
DURHAM WWTF	1.71	1.8	0.80	TN	0.030	no	$ -	no	$ -	yes	290.2	116.1	174.14	$ 2,030,000	no	$ -	IP, Pre, Dis	$6/gal	$ 180,000	**$ 2,210,000**
EPPING WWTF	0.32	0.429	1.00	C, TN, TP	0.036	yes new flow	$ 270,000	no MBR	$ -	yes new flow	6.1	2.4	3.64	$ 50,000	new flow chemical only	$ 110,000	Pre, Mem, Dis	$6.5/gal	$ 240,000	**$ 670,000**
EXETER WWTF	3.6	3.9	0.70	AS, C, TN	0.100	all flow	$ 20,480,000	no	$ -	yes	617.2	246.9	370.30	$ 3,780,000	no	$ -	Pre	$2.5/gal	$ 250,000	**$ 24,510,000**
FARMINGTON WWTF	0.52	0.57	0.90	C, TN, TP	0.017	yes new flow	$ 110,000	no for P only	$ -	yes	89.5	35.8	53.71	$ 710,000	yes	$ 1,450,000	IP, Pre, M	$5/gal + $100K metals study	$ 180,000	**$ 2,450,000**
HAMPTON WWTF	3.3	3.7	0.70	C, TN	0.133	yes new flow	$ 700,000	yes	$ -	yes new flow	22.2	8.9	13.34	$ 140,000	no	$ -	M, Dis, SH	$6/gal + $100K metals study	$ 900,000	**$ 1,740,000**
MILTON WWTF	0.08	0.09	1.00	AS, C, TN, TP	0.003	all flow	$ 680,000	no for P only	$ -	yes	13.9	5.6	8.34	$ 120,000	yes	$ 250,000	NR	na	$ -	**$ 1,050,000**
NEWFIELDS WWTF	0.08	0.084	1.00	AS, C, TN	0.001	all flow	$ 630,000	no	$ -	yes	13.6	5.4	8.14	$ 120,000	no		NR	na	$ -	**$ 750,000**
NEWINGTON WWTF	0.18	0.2	1.00	TN	0.007	no	$ -	no	$ -	yes	31.1	12.5	18.68	$ 270,000	no		NR	na	$ -	**$ 270,000**
NEWMARKET WWTF	1.04	1.16	0.80	AS, C, TN	0.040	all flow	$ 6,960,000	no	$ -	yes	180.1	72.1	108.09	$ 1,260,000	no		IP, Pre, Dis	$6/gal	$ 240,000	**$ 8,460,000**
PEASE DEVELOPMENT AUTHORITY WWTF	0.72	0.86	0.90	NR	0.047	no	$ -	no	$ -	SBR mods only				$ 100,000	no		Dis	$1/gal	$ 50,000	**$ 150,000**
PORTSMOUTH WWTF	8.23	8.7	0.60	AS, C	0.157	all flow	$ 39,150,000	no	$ -	no	na	na	na	$ -	no		Dis, SH	$6/gal	$ 940,000	**$ 40,090,000**
ROCHESTER WWTF	5.51	6.1	0.60	TP	0.197	no	$ -	no for P only	$ -	yes new flow	32.8	13.1	19.68	$ 170,000	yes new flow	$ 350,000	2nd Clarifier	$1.5 M Clarifier	$ 1,500,000	**$ 2,020,000**
ROCKINGHAM COUNTY WWTF	0.085	0.118	1.00	AS, C, TN	0.011	all flow	$ 890,000	yes	$ -	yes	16.0	6.4	9.61	$ 140,000	no		NR	na	$ -	**$ 1,030,000**
ROLLINSFORD WWTF	0.15	0.17	1.00	TP	0.007	no	$ -	no for P only	$ -	no	0.0	0.0	0.00	$ -	yes new flow	$ 20,000	NR	na	$ -	**$ 20,000**
SEABROOK WWTF	1.17	1.39	0.80	NR	0.073	no	$ -	no	$ -	no	na	na	na	$ -	no		Air	$1/gal	$ 70,000	**$ 70,000**
SOMERSWORTH WWTF	1.79	1.9	0.80	C, TN, TP	0.037	yes new flow	$ 220,000	no for P only	$ -	yes new flow	6.1	2.4	3.67	$ 40,000	yes new flow	$ 90,000	Pre	$2.5/gal	$ 90,000	**$ 440,000**
Totals	**33.055**	**36.041**			**0.995333333**		**$ 70,620,000**		**$ -**		**2097.8**	**839.1**	**1258.7**	**$ 13,710,000**		**$ 2,270,000**			**$ 5,240,000**	**$ 91,840,000**

Legend

C = Carbon
TN = Total Nitrogen
TP = Total Phosphorus
AS = Activated Sludge

IP = Influent Pumping
Pre = Preliminary Teatment
Dis = Disinfection
Mem = Membranes

M = Metals
Air = Aeration
SH = Solids Handling
NR = Not Required

Table 7-3. Alternative 3 - Decentralized Systems Planning Level Construction Cost Estimate

Flow Increases, Decentralized Systems Required, and Planning Level Construction Cost Estimates						
WWTF COMMUNITY	Year 2004 Maximum Month. Flow, MGD	Year 2025 Maximum Month. Flow, MGD	Incremental Flow Increase, GPD	Flow to Decentralized Systems (2/3rds), GPD	Number of Systems Required @ 10K GPD/ system	Estimated Construction Cost @ $600K/ system
DOVER	4.57	4.87	300,000	200,000	20.0	$ 12,000,000
DURHAM	1.71	1.80	90,000	60,000	6.0	$ 3,600,000
EPPING	0.32	0.43	109,000	72,667	7.3	$ 4,360,000
EXETER	3.60	3.90	300,000	200,000	20.0	$ 12,000,000
FARMINGTON	0.52	0.57	50,000	33,333	3.3	$ 2,000,000
HAMPTON	3.30	3.70	400,000	266,667	26.7	$ 16,000,000
MILTON	0.08	0.09	10,000	6,667	0.7	$ 400,000
NEWFIELDS	0.08	0.08	4,000	2,667	0.3	$ 160,000
NEWINGTON	0.18	0.20	20,000	13,333	1.3	$ 800,000
NEWMARKET	1.04	1.16	120,000	80,000	8.0	$ 4,800,000
PEASE DEVELOPMENT AUTHORITY	0.72	0.86	140,000	93,333	9.3	$ 5,600,000
PORTSMOUTH	8.23	8.70	470,000	313,333	31.3	$ 18,800,000
ROCHESTER	5.51	6.10	590,000	393,333	39.3	$ 23,600,000
ROCKINGHAM COUNTY	0.09	0.12	33,000	22,000	2.2	$ 1,320,000
ROLLINSFORD	0.15	0.17	20,000	13,333	1.3	$ 800,000
SEABROOK	1.17	1.39	220,000	146,667	14.7	$ 8,800,000
SOMERSWORTH	1.79	1.90	110,000	73,333	7.3	$ 4,400,000
Total	**33.06**	**36.04**	**2,986,000**	**1,990,667**	**199.1**	**$ 119,440,000**

Table 7-4. Estimated Planning Level Construction Costs for Alternative 3

FACILITY	Treatment Cost	Conveyance Cost	Discharge Costs (Decentralized Systems)	Total Estimated Construction Costs
DOVER WWTF	$ 5,900,000	na	$ 12,000,000	$ 17,900,000
DURHAM WWTF	$ 2,200,000	na	$ 3,600,000	$ 5,800,000
EPPING WWTF	$ 700,000	na	$ 4,400,000	$ 5,100,000
EXETER WWTF	$ 24,500,000	na	$ 12,000,000	$ 36,500,000
FARMINGTON WWTF	$ 2,500,000	na	$ 2,000,000	$ 4,500,000
HAMPTON WWTF	$ 1,700,000	na	$ 16,000,000	$ 17,700,000
MILTON WWTF	$ 1,100,000	na	$ 400,000	$ 1,500,000
NEWFIELDS WWTF	$ 800,000	na	$ 200,000	$ 1,000,000
NEWINGTON WWTF	$ 300,000	na	$ 800,000	$ 1,100,000
NEWMARKET WWTF	$ 8,500,000	na	$ 4,800,000	$ 13,300,000
PEASE DEVELOPMENT AUTHORITY WWTF	$ 200,000	na	$ 5,600,000	$ 5,800,000
PORTSMOUTH WWTF	$ 40,100,000	na	$ 18,800,000	$ 58,900,000
ROCHESTER WWTF	$ 2,000,000	na	$ 23,600,000	$ 25,600,000
ROCKINGHAM COUNTY WWTF	$ 1,000,000	na	$ 1,300,000	$ 2,300,000
ROLLINSFORD WWTF	$ -	na	$ 800,000	$ 800,000
SEABROOK WWTF	$ 100,000	na	$ 8,800,000	$ 8,900,000
SOMERSWORTH WWTF	$ 400,000	na	$ 4,400,000	$ 4,800,000
TOTAL	**$ 92,000,000**	**$ -**	**$ 119,500,000**	**$ 211,500,000**