SECTION 8.0 ALTERNATIVE 4 (TREATMENT AT EXISTING WWTFs AND DISCHARGE TO LAND APPLICATION SITES) ANALYSIS

This Section identifies and describes the analysis of Alternative 4 (Land Application). 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

8.1 ENVIRONMENTAL ANALYSIS

This alternative would result in continued reliance on existing wastewater facilities; however, treated effluent from individual wastewater treatment facilities (WWTFs) would be discharged at land application sites. The WWTFs would be upgraded to meet the projected 2025 groundwater discharge limits (see Appendix L of the Preliminary Findings Report for a summary of projected 2025 WWTF effluent limits). The following discussion summarizes the trends that would be likely to continue should Alternative 4 be selected.

8.1.1 Land Use and Growth

Land Use Compatibility and Aesthetics. Under this alternative, the existing WWTFs would continue to be used to treat existing and projected wastewater flows. Upgrades to the existing WWTFs are anticipated for this alternative (see Section 3.4.1), which would result in some potential land use impacts. Impacts would vary by WWTF depending on the availability of land at the WWTFs and proximity to sensitive receptors.

All treated effluent from the individual WWTFs would be discharged at land application sites via rapid infiltration basins rather than the existing surface water discharges. A two-phase process was conducted to examine the feasibility of providing a land application site for each WWTF. This process identified locations within the study area that met land application siting criteria; however, specific sites were not identified as part of this study (see Section 3.4). The land application sites would result in a permanent taking of parcels within the WWTF communities. Similar to decentralized systems, undeveloped land would be the most likely candidates for siting the decentralized systems. Thus, operation of these systems would result in a permanent change in land use. The land application sites would also result in an aesthetic impact since the rapid infiltration basins would be partially above ground and finished as open, gravel-lined beds. The magnitude of the aesthetic impact would be dependant on the final siting and size of the land application sites. If required, screening would be provided to minimize this impact.

Effluent from the WWTFs would be conveyed to the land application sites through pipelines. The exact alignments of the conveyance pipelines have not been determined as part of this study; however, approximate lengths have been developed for each WWTF based on the two-phase land application feasibility process noted above (see Table 3-8). Similar to the regional conveyance route described for Alternative 2, it is anticipated that the pipeline routes would use as many rights-of-way as possible to minimize land use impacts. The pipelines would be below ground, and disturbed surfaces would be restored upon completion of construction to the extent practicable. Land acquisitions and/or easements are anticipated for portions of the conveyance piping crossing private property.

The WWTF effluent flows would be conveyed via force mains rather than gravity sewers, and it is anticipated that one pump station would be required at each WWTF (for a total of 17 pump stations). The pump stations would be expected result in minimal land use and aesthetic impacts

since they would be located adjacent to existing buildings at the WWTF sites and land acquisition or displacement of existing land uses is not anticipated, although this would need to be verified during subsequent design efforts.

Land Area Impacted. In addition to land needed for upgrades and pump stations at the WWTFs, there would be a need for land suitable for land application of the wastewater effluent. Table 3-8 summarizes the total anticipated land area required for the application sites for each WWTF, including land anticipated for associated buffers, roads, and ditches. The anticipated land area requirements vary greatly by WWTF based on projected future flows, ranging from less than three acres for the Milton and Newfields WWTFs to well over 100 acres for the Portsmouth and Rochester WWTFs.

Indirect Growth. In addition to growth associated with existing trends and patterns in the study area, as previously referenced for Alternative 1, this alternative could potentially result in indirect growth and development as a result of greater WWTF treatment capacities achieved by directing flow to groundwater. This change could allow additional sewer extensions to areas that might previously have been restricted due to on site wastewater disposal limitations and/or WWTF surface water discharge limitations, provided additional land area is available for application sites. Communities could use this additional WWTF treatment capacity as a way to direct or guide denser development to target areas of growth that otherwise could not accommodate the preferred density by strategically approving sewer extensions. This would require local planning efforts by municipalities and coordination with developers.

8.1.2 Air Quality

Similar to Alternative 1, 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. The proposed conveyance pipelines to the land application sites would be below ground and would operate with little, if any, potential for impacts to air quality. The rapid infiltration basins would handle highly treated wastewater effluent, and odors are not anticipated to be an issue.

8.1.3 Surface Water Flow, Groundwater Recharge, and Water Quality

Surface Water Flow and Groundwater Recharge. For Alternative 4, direct WWTF discharges to the estuary would be essentially eliminated, and indirect discharges (groundwater flows from the land application sites going to the estuary) would increase by 8.2%. This increase in groundwater recharge would help to sustain groundwater levels for both habitat protection and water supply.

Many of the streams in the study area are likely groundwater fed, thus the overall net effect to stream flow in the Great Bay watershed would be expected to be fairly minor. However, there may still be localized changes in stream flow within certain sub-basins, depending on the proximity of the land application discharge site to the existing WWTF discharge location and the time it would takes for this groundwater to recharge the stream flow. It is possible that the location of the land application discharge may be in a different sub-basin, and thus some amount of stream flow reduction might be expected in the downstream flow of the existing receiving water at the point of current discharge. Appendix F describes the ranking and potential availability and proximity of land application sites for the various WWTFs. For some WWTFs, such as Durham, Exeter, Hampton, Newfields, Newington, Portsmouth, and Rockingham County WWTFs, the nearest candidate sites are over two miles from the treatment facility. Table 3-8 summarizes the distances between the WWTFs and the closest identified land application sites. Further analysis would be needed to identify individual sub-basins and determine if cross basin transfer of effluent would occur. Should this alternative be selected for possible implementation, further study of localized effects on stream flow should be conducted.

Water Quality. The following is a summary of the water quality analysis for Alternative 4. This includes changes to the Great Bay salinity and a qualitative Great Bay pollutant loading analysis.

Great Bay Salinity Changes

The impact of the land application the WWTFs on the salinity in the Great Bay is also dependent upon the location of the land application sites and the existing WWTF discharge sites relative to sub-basins. Assuming that the land application sites are all within the same sub-basins as the existing discharges, the impact of the land application of WWTF effluent on the salinity in the Great bay is anticipated to be similar to that of Alternative 1 (No Action) due to their same increase in WWTF effluent discharge. See Section 5.1.3 for a description of the salinity impacts expected for Alternative 1.

Pollutant Loading Analysis

The extent to which the treated effluent may affect groundwater quality in the vicinity of a land application site is dependent on treatment level, and also on soil and other hydro-geologic conditions. As indicated in Section 3.4, the WWTF effluent will be required to meet proposed discharge limits for land application, including total nitrogen limits. There is the potential for land application to actually improve the quality of groundwater fed streams, as the groundwater will have the additional treatment of passing through the unsaturated zones of the soil. Long-term groundwater monitoring would be recommended if this alternative is implemented.

The elimination of the direct discharge of WWTF effluent to the Great Bay under this alternative would result in a significant reduction in pollutant loadings. These reduced pollutant loadings are anticipated to improve water quality. The exception might be in those few cases where the WWTF effluent represents such a significant portion of the stream flow that it provides dilution for other pollutant inputs (stormwater and other non-point sources). Further analysis would be needed to confirm if this might be the case for the Rochester WWTF on the Cocheco River, where effluent contribution from the WWTF represents a significant percentage of stream flow during extreme low flow periods (7Q10).

Implementation of this alternative would result in a small increase in dissolved oxygen (DO) due to reduced biological oxygen demand (BOD) loadings. The increase in DO will be small as current DO deficits are generally low and occasional deficits exceeding 25% of saturation may not be related to WWTF discharges (NHEP, 2006). There would be reduced eutrophication due to the nitrogen limit of 10 mg/l for land application and the further reduction in total nitrogen as the land applied WWTF effluent passes through the unsaturated zones of the soil. It is also anticipated that groundwater discharge plumes would take several years to reach the estuary. This alternative would eliminate the risk of accidental discharge of pathogens to the Great Bay. Additionally, toxics would be largely eliminated since many toxics do not travel in groundwater.

8.1.4 Wetland and Terrestrial Resources

Wetland Resources. To the extent that sub-basin hydrology is altered as a result of redirecting treated effluent to land application sites, there could be minor alterations in areal extent and/or function of wetlands resource areas. However, as noted above, the overall effect on hydrology within the basin is not anticipated to be significantly altered as groundwater would be expected to recharge stream flow in many locations. Land application sites would also provide recharge to groundwater fed wetlands. Localized effects would be most pronounced where the treated effluent represents a fairly high percentage of existing discharge to receiving waters, and the land application sites are in a different sub-basin. In order to verify effects more combined surface and groundwater modeling would be needed.

As noted above, this alternative may result in some improvements to surface water quality which would have a beneficial effect on wetlands function in those wetlands that are dependent on surface hydrology.

Terrestrial Resources. There would be a loss of terrestrial habitat for the construction of the land application sites. As noted in Table 3-8, sites of up to 100 acres may be needed for some of the larger WWTFs. Depending on the site characteristics of the land application areas, there may be loss of breeding, nesting, and feeding habitat of terrestrial wildlife. There may also be disruption or loss of portions of wildlife corridors. It is possible that the discharge basins could act as a draw to birdlife, although access by other wildlife would be expected to be fairly minimal as the area is expected to be fenced for security reasons. To the extent that local tributaries maintain stream flow, terrestrial wildlife would be expected to benefit from the water sources.

8.1.5 Aquatic Resources

Similar to the effect on wetland resources, the potential effects to aquatic resources would depend on changes in stream flow, which is essential to aquatic life. Changes in stream flow or stream habitat could affect breeding and nesting. As noted above, it is not expected that there would be any substantial change in stream flow on a basin-wide level. However, several WWTFs (Durham, Exeter, Hampton, Newfields, Newington, Portsmouth, and Rockingham County) are not in close proximity to candidate land application sites, and should the land application sites be in a different sub-basin than the existing receiving water discharge locations, some localized effects on stream flow may occur. At these locations, relocation of the flow from surface water discharge to land application discharge could have an effect on aquatic life immediately downstream of the surface water discharge location. More detailed analysis of localized effects would need to be conducted if this alternative is selected for further consideration.

As with wetland resource areas, improvements to water quality resulting from treatment through land application would be of benefit to aquatic resources. In particular, reduced BOD and nitrogen loading would be expected to result in increase dissolved oxygen, which would be beneficial for aquatic life.

8.1.6 Rare and Endangered Species

The anticipated effects to rare and endangered species are very similar to those described above for both wetland resources and for aquatic life. To the extent that stream flows are maintained, and water quality is improved, there would be a benefit to the species and to the habitats that support them. If, however, there are localized effects to stream flow which could diminish coastal habitat or function, then the species would be adversely affected. It is expected that areas known for presence of protected species would be avoided during the site selection procedure. Coordination would need to occur with the New Hampshire Department of Fish and Game during the site selection and development process if this alternative is selected for further consideration.

8.2 NON-MONETARY TECHNICAL ANALYSIS

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

- Complexity
- Public Testimony
- Implementation

8.2.1 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.

In this alternative, the WWTFs are anticipated to require significant upgrades to achieve the permit limits for groundwater discharge. In general, the treatment component of this alternative will require a sophisticated treatment process at each of the WWTFs.

The conveyance component of this alternative is relatively complex. It is anticipated that this alternative would require many smaller conveyance systems (one for each WWTF). The proposed conveyance systems (described in Section 3.4) are anticipated to require 28 miles of effluent force mains and 17 pump stations. Many of these pipelines would be located away from the WWTFs and would require regular maintenance.

The disposal component of this alternative is also complex. It was assumed that this alternative would require the construction of a rapid infiltration basins and supporting facilities (buffers, roads, ditches, etc.) at the land application sites. These land application sites and disposal components would be remote to the WWTFs and would require periodic maintenance. In addition, monitoring of the groundwater in the areas around the land application sites would likely be required to confirm that the effluent discharge was not impacting the groundwater quality.

8.2.2 Public Testimony

This alternative received little direct positive or negative public testimony. However, indirectly there was some public testimony that indicated it would be preferable for the wastewater effluent (originating from groundwater wells) to be put back into the ground from where it came and not be “thrown away”. This could be perceived as a positive comment for this alternative as wastewater effluent would be discharged to the ground.

8.2.3 Implementation

The implementation of this alternative would be relatively difficult. A preliminary evaluation of potential land application sites for WWTF effluent found that many alternatives did not have favorable land application sites close to the WWTFs (see Appendix F). More significant studies would need to be performed for each WWTF to determine if possible land application sites could be found (large enough, close enough, and with the proper soil conditions). In addition, this alternative would require that each land application site apply for a groundwater discharge permit (NHDES Env-Ws 1500). Some of the requirements of a New Hampshire groundwater discharge permit application include:

- Basic information (facility name, owners, contacts, location, other permit requirements, etc.)
- Inventory of Abutters and Potential Receptors
- Hydrologic Studies
- Hydrologic Design and Operation Parameters
- Standard Site Control Measures
- Facility Plan

This alternative would also require the siting of the wastewater effluent pipelines.

Although this alternative does not require an agreement between municipalities for construction or operation of these facilities, it does allow the possibility that the multiple towns 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.).

8.3 PLANNING LEVEL CONSTRUCTION COSTS

Included herein are estimated planning level costs for Alternative 4. The planning level costs have been divided into three sub-categories: treatment, conveyance, and disposal.

The Alternative 4 planning level treatment upgrade costs for each WWTF are presented in Table 8-1. The planning level conveyance costs for each WWTF are presented in Table 8-2, and the planning level disposal costs for each WWTF are presented in Table 8-3. Table 8-4 presents the total planning level costs for treatment, conveyance, and disposal on a WWTF basis.

In summary, the estimated planning level cost for Alternative 4 is:

- Treatment Costs $ 172,000,000
- Conveyance Costs $ 113,900,000
- Disposal Costs $ 26,800,000
- **Total Cost** **$ 312,700,000**

Table 8-1. Alternative 4 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	0.3	yes	$ 1,580,000	yes	$ 6,820,000	yes	812.3	406.2	406.16	$ 4,150,000	no	$ -	IP, Pre, Dis	$5/gal + Dis $1/gal	$ 1,800,000	**$ 14,350,000**
DURHAM WWTF	1.71	1.8	0.80	C, TN	0.09	Fitration only	$ -	yes	$ 2,880,000	yes	300.2	150.1	150.12	$ 1,750,000	no	$ -	IP, Pre, Dis	$5/gal + Dis $1/gal all flow	$ 1,890,000	**$ 6,520,000**
EPPING WWTF	0.32	0.429	1.00	C, TN	0.109	yes new flow	$ 820,000	no MBR	$ -	yes	71.6	35.8	35.78	$ 520,000	no	$ -	Pre, Mem, Dis	$5.5/gal + Dis $1/gal	$ 710,000	**$ 2,050,000**
EXETER WWTF	3.6	3.9	0.70	AS, C, TN	0.3	All flow	$ 20,480,000	yes	$ 5,460,000	yes	650.5	325.3	325.26	$ 3,320,000	no	$ -	Pre, Dis	$2.5/gal + Dis $1/gal all flow	$ 3,480,000	**$ 32,740,000**
FARMINGTON WWTF	0.52	0.57	0.90	C, TN	0.05	yes	$ 340,000	yes	$ 1,030,000	yes	95.1	47.5	47.54	$ 620,000	no	$ -	IP, Pre	$5/gal	$ 250,000	**$ 2,240,000**
HAMPTON WWTF	3.3	3.7	0.70	C, TN	0.4	yes new flow	$ 3,000,000	yes	$ 5,180,000	yes	617.2	308.6	308.58	$ 3,150,000	no	$ -	Dis, SH	$5/gal + Dis $1/gal all flow	$ 4,590,000	**$ 15,920,000**
MILTON WWTF	0.08	0.09	1.00	AS, C, TN	0.01	All flow	$ 680,000	yes	$ 180,000	yes	15.0	7.5	7.51	$ 110,000	no	$ -	Dis	$1/gal all flow	$ 90,000	**$ 1,060,000**
NEWFIELDS WWTF	0.08	0.084	1.00	AS, C, TN	0.004	All flow	$ 630,000	yes	$ 170,000	yes	14.0	7.0	7.01	$ 100,000	no	$ -	Dis	$1/gal all flow	$ 80,000	**$ 980,000**
NEWINGTON WWTF	0.18	0.2	1.00	C, TN	0.02	Filtation Only	$ -	yes	$ 400,000	yes	33.4	16.7	16.68	$ 240,000	no	$ -	Air, Dis	$1/gal + Dis $1/gal all flow	$ 220,000	**$ 860,000**
NEWMARKET WWTF	1.04	1.16	0.80	AS, C, TN	0.12	All flow	$ 6,960,000	yes	$ 1,860,000	yes	193.5	96.7	96.74	$ 1,130,000	no	$ -	IP, Pre, Dis	$5/gal + Dis $1/gal all flow	$ 1,530,000	**$ 11,480,000**
PEASE DEVELOPMENT AUTHORITY WWTF	0.72	0.86	0.90	NR	0.14	Filtation Only	$ -	yes	$ 1,550,000	yes SBR mods		na	na	$ 100,000	no	$ -	Dis	$1/gal all flow	$ 770,000	**$ 2,420,000**
PORTSMOUTH WWTF	8.23	8.7	0.60	AS, C, TN	0.47	All flow	$ 39,150,000	yes	$ 10,440,000	yes	1451.2	725.6	725.58	$ 6,360,000	no	$ -	Dis	$1/gal all flow	$ 5,220,000	**$ 61,170,000**
ROCHESTER WWTF	5.51	6.1	0.60	C, TN	0.59	no	$ -	yes new flow	$ 710,000	yes new flow	1017.5	508.7	508.74	$ 4,460,000	no	$ -	2nd Clarifier, Dis	$1.5 M Clarifier + $1/gal	$ 2,090,000	**$ 7,260,000**
ROCKINGHAM COUNTY WWTF	0.085	0.118	1.00	AS, C, TN	0.033	All flow	$ 890,000	yes	$ 240,000	yes	19.7	9.8	9.84	$ 140,000	no	$ -	Dis	$1/gal	$ 30,000	**$ 1,300,000**
ROLLINSFORD WWTF	0.15	0.17	1.00	C, TN	0.02	Filtation Only	$ -	yes	$ 340,000	no				$ -	no	$ -	Dis	$1/gal all flow	$ 170,000	**$ 510,000**
SEABROOK WWTF	1.17	1.39	0.80	C, TN	0.22	yes new flow	$ 1,650,000	yes	$ 2,220,000	yes	231.9	115.9	115.93	$ 1,350,000	no	$ -	Dis	$1/gal all flow	$ 1,110,000	**$ 6,330,000**
SOMERSWORTH WWTF	1.79	1.9	0.80	C, TN	0.11	yes new flow	$ 820,000	yes new flow	$ 180,000	yes	316.9	158.5	158.46	$ 1,850,000	no	$ -	Pre, Dis	$2.5/gal + Dis $1/gal all flow	$ 1,800,000	**$ 4,650,000**
Totals	**33.055**	**36.041**			**2.986**		**$ 77,000,000**		**$ 39,660,000**		**5839.8**	**2919.9**	**2919.9**	**$ 29,350,000**		**$ -**			**$ 25,830,000**	**$ 171,840,000**

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 8-2. Alternative 4 WWTF Effluent Conveyance Planning Level Construction Cost Estimate

Anticipated Land Application Conveyance Components, Planning Level Sizing and Planning Level Costs											
From	**Year 2055 Flow, MGD**	**Distance from WWTF to Land Application Site, ft**	**Distance from WWTF to Land Application Site, miles**	**Year 2055 Pipe Size, in**	**Cost per Linear Foot**	**Pipeline Cost**	**Number of Pump Stations Anticipated**	**Pump Station Size, MGD**	**Cost Per Pump Station**	**Estimated Pump Station Costs**	**Total Estimated Conveyance Construction Costs**
FARMINGTON WWTF	0.91	1,000	0.19	8	$ 250	$ 250,000	1	0.91	$ 750,000	$ 750,000	$ 1,000,000
MILTON WWTF	0.24	500	0.09	4	$ 250	$ 130,000	1	0.24	$ 750,000	$ 750,000	$ 880,000
ROCHESTER WWTF	10.00	1,000	0.19	24	$ 350	$ 350,000	1	10.00	$ 12,500,000	$ 12,500,000	$ 12,850,000
ROLLINSFORD WWTF	0.36	4,224	0.80	6	$ 250	$ 1,060,000	1	0.36	$ 750,000	$ 750,000	$ 1,810,000
SOMERSWORTH WWTF	5.75	2,000	0.38	18	$ 300	$ 600,000	1	5.75	$ 5,000,000	$ 5,000,000	$ 5,600,000
DOVER WWWTF	12.74	2,000	0.38	30	$ 350	$ 700,000	1	12.74	$ 12,500,000	$ 12,500,000	$ 13,200,000
NEWINGTON WWTF	0.54	14,520	2.75	6	$ 250	$ 3,630,000	1	0.54	$ 750,000	$ 750,000	$ 4,380,000
PEASE WWTF	3.15	9,000	1.70	14	$ 300	$ 2,700,000	1	3.15	$ 2,000,000	$ 2,000,000	$ 4,700,000
DURHAM WWTF	5.35	13,200	2.50	18	$ 300	$ 3,960,000	1	5.35	$ 5,000,000	$ 5,000,000	$ 8,960,000
NEWMARKET WWTF	2.41	9,240	1.75	12	$ 300	$ 2,770,000	1	2.41	$ 2,000,000	$ 2,000,000	$ 4,770,000
NEWFIELDS WWTF	0.17	10,560	2	4	$ 250	$ 2,640,000	1	0.17	$ 750,000	$ 750,000	$ 3,390,000
EPPING WWTF	0.70	750	0.14	8	$ 250	$ 190,000	1	0.70	$ 750,000	$ 750,000	$ 940,000
ROCKINGHAM CO. WWTF	0.44	10,560	2.00	6	$ 250	$ 2,640,000	1	0.44	$ 750,000	$ 750,000	$ 3,390,000
EXETER WWTF	6.75	12,672	2.40	20	$ 300	$ 3,800,000	1	6.75	$ 5,000,000	$ 5,000,000	$ 8,800,000
SEABROOK WWTF	3.86	22,500	4.26	16	$ 300	$ 6,750,000	1	3.86	$ 2,000,000	$ 2,000,000	$ 8,750,000
HAMPTON WWTF	8.60	18,480	3.50	24	$ 350	$ 6,470,000	1	8.60	$ 5,000,000	$ 5,000,000	$ 11,470,000
PORTSMOUTH WWTF	22.00	15,840	3.00	36	$ 400	$ 6,340,000	1	22.00	$ 12,500,000	$ 12,500,000	$ 18,840,000
Total	**83.94**	**148,046**	**28.04**			**$ 44,980,000**	**17**			**$ 68,750,000**	**$ 113,730,000**

Flows are average of peak hour and peak day for 2055

Table 8-3 Alternative 4 WWTF Effluent Land Application Disposal Planning Level Construction Cost Estimate

Estimated Planning Level Land Application Disposal Construction Costs

FACILITY	2004 Flow	2055 Annual Ave Flow, MGD	Anticipated Land Required @ 30 acres /MGD, (acres)	Anticipated Additional Land Required for Buffers, Roads, and Ditches, (acres)	2055 Total Anticipated Land Required, (acres)	2025 Construction Costs Disposal System (1)	Estimated 2025 Land Acquisition Costs, Based on $15K/acre	Estimated Total Construction Cost
DOVER WASTEWATER	2.54	3.05	91.50	4.58	96.08	$ 1,870,000	$ 1,440,000	$ 3,310,000
DURHAM WASTEWATER	0.996	1.20	36.00	1.80	37.80	$ 800,000	$ 570,000	$ 1,370,000
EPPING WATER & SEWER	0.197	0.23	7.02	1.05	8.07	$ 190,000	$ 120,000	$ 310,000
EXETER WASTEWATER	1.86	2.30	69.00	3.45	72.45	$ 1,430,000	$ 1,090,000	$ 2,520,000
FARMINGTON WASTEWATER	0.21	0.30	9.00	1.35	10.35	$ 220,000	$ 160,000	$ 380,000
HAMPTON WASTEWATER	2.4	3.10	93.00	4.65	97.65	$ 1,840,000	$ 1,460,000	$ 3,300,000
MILTON WASTEWATER	0.05	0.07	2.10	0.32	2.42	$ 60,000	$ 40,000	$ 100,000
NEWFIELDS WASTEWATER	0.045	0.06	1.80	0.27	2.07	$ 60,000	$ 30,000	$ 90,000
NEWINGTON WASTEWATER	0.13	0.18	5.40	0.81	6.21	$ 150,000	$ 90,000	$ 240,000
NEWMARKET WASTEWATER	0.64	0.82	24.60	2.46	27.06	$ 590,000	$ 410,000	$ 1,000,000
PEASE DEVELOPMENT AUTHORITY	0.38	0.66	19.80	1.98	21.78	$ 410,000	$ 330,000	$ 740,000
PORTSMOUTH WASTEWATER	4.7	5.60	168.00	8.40	176.40	$ 3,190,000	$ 2,650,000	$ 5,840,000
ROCHESTER WASTEWATER	2.9	4.10	123.00	6.15	129.15	$ 2,250,000	$ 1,940,000	$ 4,190,000
ROCKINGHAM COUNTY WWTF	0.078	0.13	3.90	0.59	4.49	$ 110,000	$ 70,000	$ 180,000
ROLLINSFORD WASTEWATER	0.09	0.13	3.90	0.59	4.49	$ 100,000	$ 70,000	$ 170,000
SEABROOK WASTEWATER	0.98	1.35	40.50	2.03	42.53	$ 870,000	$ 640,000	$ 1,510,000
SOMERSWORTH WASTEWATER	1.1	1.40	42.00	2.10	44.10	$ 930,000	$ 660,000	$ 1,590,000
Totals	**19.30**	**24.68**	**740.52**	**42.56**	**783.08**	**$ 15,070,000**	**$ 11,770,000**	**$ 26,840,000**

(1) Based on EPA Technology Fact Sheet

Table 8-4. Estimated Planning Level Construction Costs for Alternative 4

FACILITY	Treatment Cost	Conveyance Cost	Discharge Costs	Total Estimated Construction Costs
DOVER WWTF	$ 14,400,000	$ 1,000,000	$ 3,300,000	$ 18,700,000
DURHAM WWTF	$ 6,500,000	$ 900,000	$ 1,400,000	$ 8,800,000
EPPING WWTF	$ 2,100,000	$ 12,900,000	$ 300,000	$ 15,300,000
EXETER WWTF	$ 32,700,000	$ 1,800,000	$ 2,500,000	$ 37,000,000
FARMINGTON WWTF	$ 2,200,000	$ 5,600,000	$ 400,000	$ 8,200,000
HAMPTON WWTF	$ 15,900,000	$ 13,200,000	$ 3,300,000	$ 32,400,000
MILTON WWTF	$ 1,100,000	$ 4,400,000	$ 100,000	$ 5,600,000
NEWFIELDS WWTF	$ 1,000,000	$ 4,700,000	$ 100,000	$ 5,800,000
NEWINGTON WWTF	$ 900,000	$ 9,000,000	$ 200,000	$ 10,100,000
NEWMARKET WWTF	$ 11,500,000	$ 4,800,000	$ 1,000,000	$ 17,300,000
PEASE DEVELOPMENT AUTHORITY WWTF	$ 2,400,000	$ 3,400,000	$ 700,000	$ 6,500,000
PORTSMOUTH WWTF	$ 61,200,000	$ 900,000	$ 5,800,000	$ 67,900,000
ROCHESTER WWTF	$ 7,300,000	$ 3,400,000	$ 4,200,000	$ 14,900,000
ROCKINGHAM COUNTY WWTF	$ 1,300,000	$ 8,800,000	$ 200,000	$ 10,300,000
ROLLINSFORD WWTF	$ 500,000	$ 8,800,000	$ 200,000	$ 9,500,000
SEABROOK WWTF	$ 6,300,000	$ 11,500,000	$ 1,500,000	$ 19,300,000
SOMERSWORTH WWTF	$ 4,700,000	$ 18,800,000	$ 1,600,000	$ 25,100,000
TOTAL	**$ 172,000,000**	**$ 113,900,000**	**$ 26,800,000**	**$ 312,700,000**

REFERENCES

New Hampshire Estuary Project. 2006. State of the Estuaries.

Metcalf & Eddy, Inc. 2006. *Water Reuse, Issues, Technologies, and Applications*. Published by McGraw Hill.