SECTION 9.0 ALTERNATIVES COMPARISON

This Section provides a relative comparison of the four alternatives based on the evaluation criteria used. It should be noted than a number of evaluation criteria are qualitative in nature and that some professional judgment has been used in the comparisons.

The general categories of analysis included the following:

- Environmental Analysis including:
  - Land Use and Growth
  - Surface Water Flow, Groundwater Recharge, and Water Quality
  - Air Quality
  - Wetland and Terrestrial Resources
  - Aquatic Resources
  - Rare and Endangered Species

- Non-Monetary Factor Analysis including:
  - Complexity
  - Public Testimony
  - Implementation

- Planning Level Construction Costs

The following is a summary of these comparisons.

9.1 ENVIRONMENTAL

The following provides a comparison of the environmental findings for the four alternatives. The comparison is organized by the same environmental parameters that were assessed for each alternative in Section 5.0 through Section 8.0. The comparisons are fairly broad in nature and summarize the general characteristics of the alternatives with regard to the different environmental parameters. As indicated in the previous sections, more detailed evaluation of environmental effects, including site specific effects, will need to be conducted for any alternative selected for further consideration.

9.1.1 Land Use and Growth

Alternative 1 (No Action) would result in the least amount of direct impacts to land use since no new facilities or infrastructure are proposed and upgrades would largely occur within WWTF properties. The Regional Post-Treatment Facility (RPTF) and conveyance pump stations anticipated to be required for Alternative 2 (Gulf of Maine Discharge) would result in relatively minor direct impacts to land use, whereas the decentralized systems and land application sites required for Alternative 3 (Decentralized Discharge) and Alternative 4 (Land Application), respectively, would directly impact hundreds of acres of land.

It is anticipated that growth and development patterns would continue to follow existing trends and patterns under Alternative 1. Alternative 2 would potentially result in indirect growth and development as a result of the less restrictive treatment anticipated achieved by directing flow to the gulf. Also, it is possible that a municipality or developer could tie into the conveyance pipeline proposed for this alternative if separate treatment and pumping were provided, pending approval by a future regional sewer governing association. These hookups and associated provision of sewers to previously unsewered areas would have the potential to induce growth within areas that might previously have been limited due to poor soils or lot size restrictions for on-site wastewater disposal. Alternative 4 could potentially result in some indirect growth as a result of

greater WWTF treatment capacities achieved by discharging treated effluent to groundwater if land is available, while the Alternative 3 could potentially limit growth by restricting new development from tying into existing sewer systems. Since wastewater from two-thirds of new development would need to be directed to decentralized systems, the amount of growth would depend on the availability of suitable discharge sites.

9.1.2 Air Quality

Minimal impacts to air quality are anticipated regardless of the alternative. For all alternatives, treated wastewater would be of fairly high quality, and odor control is not anticipated to be needed at pump stations or at the RPTF (anticipated to be required for Alternative 2). Facilities would need to comply with relevant state and local regulatory requirements and community mandates, as appropriate.

9.1.3 Surface Water Flow, Groundwater Recharge, and Water Quality

Minimal impacts to surface water flow are anticipated for the Alternative 1 (No Action), Alternative 3 (Decentralized Discharge), and Alternative 4 (Land Application). While there may be localized reduction in surface water flow just downstream of WWTFs as a result of relocation of flow to land application sites or decentralized discharge sites, the overall water balance of the watershed should be maintained as groundwater would be recharged, providing indirect recharge to streams. Alternative 2 (Gulf of Maine Discharge) would result in a reduction in receiving water surface flow and also, potentially, groundwater levels downstream of some WWTFs. This reduction in stream flow and groundwater level would potentially affect a variety of downstream uses including provision of water supply and protection of coastal vegetation and aquatic habitat.

All alternatives, including Alternative 1, which assumes that WWTFs will need to comply with more stringent discharge standards in the future, would result in some potential improvements to water quality in Great Bay receiving waters, such as increased DO and reduced eutrophication. The potential water quality impacts of the different alternatives on the Great Bay estuary are summarized qualitatively in Table 9-1.

For Alternative 2, the redirection of wastewater flow to any of the three candidate offshore outfall locations is not anticipated to impact flow in the Gulf of Maine. However, the effluent from the regional outfall would increase cumulative contribution of nitrogen and other wastewater constituents to Gulf of Maine. The other alternatives would have minimal, if any, effect on the Gulf's water quality.

9.1.4 Wetland and Terrestrial Resources

Minimal impacts to wetland and terrestrial resources are anticipated for Alternative 1 (No Action), Alternative 3 (Decentralized Discharge), and Alternative 4 (Land Application) since overall hydrology is not anticipated to be significantly altered. As noted above, there may be localized effects in some sub-basins as a result of the relocation of flow from existing surface water discharge locations to land application sites or to decentralized discharge sites. This has the potential to alter some wetlands habitat, particularly downstream of those WWTFs that discharge high volumes of treated effluent that represent a significant percentage of flow to the stream during low flow periods. It is expected that additional groundwater recharge resulting from decentralized treatment and discharge and land application of treated effluent for Alternatives 3 and 4, respectively, would help support wetlands in the project area. Some upland/terrestrial habitat would be lost to accommodate the land application sites in Alternative 4.

TABLE 9-1. WATER QUALITY IMPACTS OF ALTERNATIVES ON GREAT BAY

Parameter	Alternatives			
	1 No Action	2 Regional Gulf of Maine Discharge	3 Decentralized Treatment plus Existing WWTFs	4 Existing WWTFs with Land Application
Flows	WWTF flows are projected to increase by an average of about 8.2% from 2004 to 2025.	WWTF flows to the estuary would be entirely eliminated.	Direct WWTP discharges to the estuary would increase by about 2.7%, and indirect discharge would increase by about 5.5%[1].	Direct WWTF discharges to the estuary would be eliminated. Indirect discharges would increase by about 8.2%[1].
Salinity	Decreased salinity due to increased WWTF flows to river.	Increased salinity due to decreased WWTF flows to rivers.	Slightly decreased salinity when decentralized systems wastewater reaches the estuary[1].	Decreased salinity when land applied wastewater reaches the estuary[1].
Dissolved oxygen	Small changes, due to reductions in BOD and nutrient loadings, where regulatory requirements become more stringent[2].	Small increase in DO levels due to reduced BOD and nutrient loadings[3].	Small changes, due to reductions in BOD and nutrient loadings, where regulatory requirements are strengthened[2].	Increase in DO levels due to reduced BOD and nutrient loadings[3].
Eutrophication[4]	Some changes due to reductions nutrient loading where regulatory requirements become more stringent[2].	Reduced eutrophication due to eliminated nutrient load[5].	Some changes due to reductions nutrient loading where regulatory requirements are strengthened[2].	Reduced due to nitrogen limit of 10mg/l for land application, and travel time[6].
Pathogens	No change.	Eliminated risk of accidental discharge.	No change.	Eliminated risk of accidental discharge.
Toxics	Slight increase due to increased flow and incomplete removal during treatment.	Eliminated.	Slight increase due to minor increases in future flows.	Largely eliminated, since many toxics do not travel in groundwater.

Notes:
[1] Indirect discharges to the Great Bay are for land application discharges that will eventually reach the estuary through groundwater flow.
[2] Regulatory limits are projected to be more stringent for some plants.
[3] The increase in DO will be small inasmuch as current DO deficits are generally low and occasional deficits exceeding 25% of saturation may not be related to the WWTF discharges (NHEP, 2006).
[4] Eutrophication effects include increased turbidity and algae and reduced eelgrass.
[5] Nitrogen loadings from WWTFs will be eliminated representing about 34% of all nitrogen loadings to Great Bay and Upper Piscataqua River.
[6] Some additional nitrogen reduction would occur in groundwater as the effluent plume travels. Plumes would take several years to reach the estuary.

The hydraulic changes for Alternative 2 (Gulf of Maine Discharge) that would result from the redirection of wastewater flow to the Gulf of Maine may result in changed wetland and terrestrial habitat in the Great Bay receiving waters, including reduced wetland acreage. It is expected that the potential increase in salinity in estuary receiving waters due to relocation of freshwater flow would be in the order of 1 to 2 ppt, well within the normal range of salinities experienced in the tidal waters, and thus would not be expected to significantly alter the composition of vegetation in the coastal area. Siting of facilities anticipated for this alternative, including force mains and pump stations, would result in the loss of some terrestrial/upland habitat.

9.1.5 Aquatic Resources

For Alternative 1 (No Action) and Alternative 3 (Decentralized Discharge), no significant effects on aquatic life are anticipated, as major changes in stream flow are not anticipated to occur as a result of implementation of either of these alternatives. It is not expected that there would be any substantial change in stream flow on a basin-wide level for Alternative 4 (Land Application). However, in some instances the land application sites anticipated for this alternative may be in a different sub-basin than the existing receiving water discharge locations, and some localized effects on stream flow may occur that could have an effect on aquatic life immediately downstream of the surface water discharge location. All alternatives have the potential to result in some improvements to water quality in Great Bay receiving waters that would benefit aquatic resources

Alternative 2 (Gulf of Maine Discharge) would result in a reduction in base flow to Great Bay receiving waters, which would have potential adverse effect on aquatic resources. The regional outfall proposed under Alternative 2 would result in minimal salinity changes to the Gulf of Maine. While no exceedence of the acute aquatic life criterion for ammonia is expected with regard to discharges of treated wastewater to the Gulf, there is the potential for exceedence of chronic values for certain highly sensitive saltwater species at two of the candidate outfall locations. According to published chronic toxicity values for saltwater species, the chronic value for inland silversides would be exceeded at outfall candidate sites 1 and 2. While inland silversides would not be expected to be located at the outfall locations, as they are typically found in more estuarine environments, they do serve as a surrogate for other sensitive saltwater species. Thus, further study of species present at any candidate outfall location would need to be conducted if Alternative 2 is selected for further consideration.

9.1.6 Rare and Endangered Species

Alternative 1 (No Action), no significant alterations to rare and endangered species habitat are anticipated. Similarly, no significant effects are anticipated for Alternative 3 (Decentralized Discharge) since it is expected that siting of community systems could be done to avoid impacting protected species. Under Alternative 2 (Gulf of Maine Discharge), rare and endangered species habitat in Great Bay receiving waters may be altered due to reduction of surface water flow and resulting effects on groundwater levels. Localized effects to stream flow resulting from Alternative 4 (Land Application) could diminish coastal habitat or function immediately downstream of the existing WWTF discharges if those discharges currently represent a significant percentage of stream flow. However, it is anticipated that sensitive habitat would be avoided during site selection for the land application sites required for this alternative.

9.2 NON-MONETARY FACTOR COMPARISON

The four alternatives were evaluated for a number of non-monetary factors. The paragraphs below describe the comparisons of the alternatives as they relate to these factors.

9.2.1 Complexity. The four alternatives were evaluated for their level of complexity as it relates to the treatment, conveyance, and disposal components of each alternative.

Treatment. The treatment complexity is based on the effluent limits required for the different alternatives. In general, Alternative 4 (Land Application) has the most stringent effluent limits. Alternative 1 (No Action) and Alternative 3 (Decentralized Discharge) will have the same WWTF effluent limits, which are the second most stringent limits of the alternatives evaluated. Finally Alternative 2 (Gulf of Maine Discharge) has the least stringent effluent limits of the four alternatives evaluated.

As a result of these effluent limits is expected that Alternative 4 will have the most complex treatment. Alternative 1 and Alternative 3 are expected to have the second most complex treatment. Finally Alternative 2 will have the least complex treatment.

Conveyance. The conveyance complexity of the alternatives were evaluated based on the number of components anticipated to be required to convey the treated WWTF effluent to its disposal location.

Alternative 1 (No Action) and Alternative 3 (Decentralized Discharge) are not anticipated to require the addition of any conveyance components and therefore have the least complex conveyance of the alternatives. Alternative 4 (Land Application) is anticipated to require the addition of 17 pump stations and approximately 30 miles of effluent force mains. This alternative has the second most complex conveyance. Finally Alternative 2 (Gulf of Maine Discharge) has the most complex conveyance of the alternatives evaluated. The potential conveyance routing proposed for Alternate 2 (see Figure 3-3) is anticipated to require the addition of 30 pump stations and more than 90 miles of effluent force mains.

Disposal. The disposal complexity of the alternatives was evaluated based on the number of components and the level of sophistication anticipated to be required for the disposal of the WWTF effluents.
Alternative 1 (No Action) and the WWTF portion of Alternative 3 (Decentralized Discharge) will use the existing WWTF outfalls for the disposal of WWTF effluents. However, Alternative 3 will use a number of community on-lot decentralized systems to dispose of two-thirds of the new wastewater generated between the year 2004 and the year 2025. Approximately 200 decentralized systems are anticipated to be required to dispose of this flow. These systems will need to be sited, constructed, and maintained. While the decentralized systems are not complex individually, it is the large number of these systems and their operation, inspection, and maintenance (whose responsibility often lies with the WWTF utility) that is complicated. The disposal component of Alternative 2 (Gulf of Maine Discharge) would be complex. This alternative is anticipated to require the siting and construction of a RPTF and a marine outfall. The RPTF would provide disinfection of all of the study area WWTF effluent prior to discharge to the Gulf of Maine outfall as well as an effluent pump station to allow discharge under high tidal and peak flow conditions. The disposal component of Alternative 4 (Land Application) would also be complex. This alternative is anticipated to require the construction of rapid infiltration basins and supporting facilities at 17 different land application sites.

9.2.2 Public Testimony. Public testimony of the four alternatives was evaluated to assess the general positive or negative testimony related to each alternative. The following is a comparison of the public testimony for the four alternatives.

Alternative 1 (No Action) received little direct positive or negative public testimony. However, indirectly there was some public testimony that indicated that it would be preferable for the wastewater effluent originating from groundwater wells be put back on to the ground from where it came and not be “thrown away”. This could be perceived as a negative comment against this alternative.

Alternative 2 (Gulf of Maine Discharge) produced the majority of negative public testimony throughout the duration of the project. The majority of this negative public testimony was related to either inter-basin water transfer issues, concerns of negatively impacting the water quality and environmental quality outside of the Great Bay estuary, and concern that the development of a regional sewer system would result in a rapid and uncontrolled population growth within the study area.

Alternative 3 (Decentralized Discharge) was included as an alternative as a direct result of the amount of public testimony that was in support of examining a decentralized system alternative. The support of this alternative was due to this alternative addressing, in part, the concerns inter-basin water transfer, reduction of pollutant loading to the Great Bay, and reducing secondary growth potential.

Alternative 4 (Land Application) received little direct positive or negative public testimony. However, indirectly there was some public testimony that indicated that it would be preferable for the wastewater effluent (originating from groundwater wells) be put back into to the ground from where it came and not be “thrown away”. This could be perceived as a positive comment about this alternative as wastewater effluent would be discharged to the ground.

9.2.3 Implementation. The ease or difficulty of implementing each alternative was addressed. Some items related to implementation that were addressed included: the need for a regional sewage agreement, public reaction issues, technical feasibility (e.g. ability to find acceptable land application sites or site the large number of decentralized systems), and operational issues (ex. ownership and operation of the regional conveyance system or decentralized systems). The following is a comparison of the ease or difficulty of implementing the four alternatives.

Alternative 1 (No Action) would be the easiest alternative to implement as each WWTF would remain with some plant specific upgrades. This alternative would require little or no agreement between the municipalities and is anticipated to require the least amount of construction to implement. For Alternative 3 (Decentralized Discharge), the WWTF component of the alternative would be relatively easy to implement, similar to Alternative 1. 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 strict 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. Another issue affecting the implementation of the decentralized systems is the ability to find and acquire the amount of land required to site these systems. The areas currently sewered are areas of municipalities that tend to be more congested. Finding and siting community on-lot systems in these areas may prove difficult due to the limited land available.

The implementation of Alternative 4 (Land Application) would be difficult. A preliminary evaluation of potential land application sites for discharge of WWTF effluent found that many WWTFs did not have favorable or large enough land application sites close to the WWTFs (see Appendix F). More detailed studies would need to be performed for each WWTF to determine if possible land application sites could be found (large enough, close enough to WWTFs, 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). The implementation of this alternative would also require the siting of the wastewater effluent pipelines.

The implementation of Alternative 2 (Gulf of Maine Discharge) would be the most difficult of the four alternatives evaluated. This alternative would require agreement between the municipalities to implement (for construction, maintenance, revenue production and expense sharing). Under this alternative each town would lose part of its wastewater autonomy. This alternative would also require the siting of the regional conveyance pipelines and pump stations, the RPTF as well as siting Gulf of Maine outfall. Siting of the components is anticipated to be difficult from environmental and public acceptance points of view. Also, as a result of the negative public

testimony received during the feasibility study, it is anticipated that this alternative would produce significantly more negative public feedback in reaction to taking further steps to implement this alternative.

9.3 PLANNING LEVEL CONSTRUCTION COSTS

Planning level cost estimates were developed for the treatment, conveyance and disposal components each of the four alternatives. These planning level costs are intended to be comparative costs used for relative comparison only and not be used for budgeting purposes. The purpose of preparing costs for these alternatives is only to compare the relative costs among the four alternatives. These costs have been based on engineering judgment and experience with other projects. If any of these alternatives are carried forward then more detailed evaluations of costs would be preformed as the concepts and component details become better defined. Table 9-2 summarizes the planning level costs for the four alternatives.

TABLE 9-2 ALTERNATIVE TREATMENT, CONVEYANCE, AND DISPOSAL PLANNING LEVEL ESTIMATED CONSTRUCTION COST ESTIMATES

Alternative	Treatment Cost	Conveyance Cost	Disposal Costs	Total
Alternative 1 – No Action	$ 110,600,000	$ -	$ -	**$ 110,600,000**
Alternative 2 – Treatment at Existing WWTFs with a Regional Gulf of Maine Discharge	$ 73,800,000	$ 396,000,000	$ 119,300,000	**$ 589,100,000**
Alternative 3 – Decentralized Treatment and Continued Use of Existing WWTFs	$ 92,000,000	$ -	$ 119,500,000	**$ 211,500,000**
Alternative 4 – Treatment at Existing WWTFs with Land Application Discharge	$ 172,000,000	$ 113,900,000	$ 26,800,000	**$ 312,700,000**

It should be noted that the discharge cost associated with Alternative 3 (Decentralized Discharge) is the estimated costs of the decentralized systems. This cost may or may not be considered as part of the overall cost of the Alternative 3 depending on who (i.e. municipality or property developer) would bear the costs of the decentralized systems. In some cases, developers of new residential and commercial units would pay for the installation of decentralized systems and would pass the cost of the decentralized systems on to the buyers. In other cases, the wastewater utility would bear the cost of the installation of the decentralized systems and would pass the cost of the decentralized systems on to its sewer users.

In general, the treatment costs are larger for alternative that have more stringent WWTF effluent requirements and therefore require sophisticated treatment. The conveyance costs are larger for alternatives that have greater distances of conveyance (long pipelines and more pump stations). Finally, the disposal costs are more expensive for alternatives with the most complicated or highest number of discharge components.