SECTION 6.0 ALTERNATIVE 2 (TREATMENT AT EXISTING WWTFs WITH A REGIONAL GULF OF MAINE DISCHARGE) ANALYSIS

This Section identifies and describes the analysis of Alternative 2 (Gulf of Maine 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 Constriction Costs

6.1 ENVIRONMENTAL ANALYSIS

This alternative would result in continued reliance on existing wastewater facilities; however, treated effluent from individual wastewater treatment facilities (WWTFs) would be conveyed to a Regional Post-Treatment Facility (RPTF) for disinfection of the effluent and discharged through an outfall in the Gulf of Maine. The WWTFs would be upgraded to meet the 2025 ocean/gulf 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 occur should Alternative 2 be selected.

6.1.1 Land Use and Growth

Land Use Compatibility and Aesthetics. Under this alternative, the existing WWTFs would continue to be used. Upgrades to existing WWTFs are anticipated to be required as needed to meet limits for discharge to the Gulf of Maine. Therefore, land use impacts at the WWTFs are expected to be relatively minor in nature. Effluent from these WWTFs would be conveyed through regional infrastructure to a RPTF and discharged to the Gulf of Maine. Specific alignments of the conveyance pipelines have not been determined as part of this study; however, a conceptual alignment has been developed to assist with the analysis of this alternative (see Figure 3-3). It is anticipated that the conveyance route would use as many rights-of-way (roads, gas pipeline routes, electrical distribution system routes, etc.) as possible to minimize the quantity of un-cleared cross country routes and land acquisition that would be required. Land acquisitions and/or easements are anticipated for portions of the conveyance piping crossing private property.

The specific location of the above ground RPTF has not been determined for this study. Depending on the final siting location of the RPTF, the facility could result in an aesthetic impact to adjacent land uses. Effects could be mitigated through aesthetic design and landscaping.

Under this alternative the WWTF effluent flows would be conveyed via force mains rather than gravity sewers. Approximately 31 pump stations are anticipated along the proposed conveyance route. It was assumed that a permanent above ground pump station will be located at each WWTF, any place that two conveyance pipelines are joined into one pipeline, approximately every 10 miles along individual pipelines, and at the RPTF for discharge to the outfall under peak flow and high tide conditions. The pump stations at the WWTFs 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 for these pump stations, although this would need to be verified during subsequent design efforts. The pump stations located along the conveyance pipelines and at the RPTF would result in the permanent loss of land and potential aesthetic impact on the surrounding areas and any nearby dwelling units. However, these structures and their associated land requirements are anticipated to be relatively small. Aesthetic impacts would be mitigated by providing screening and landscaping around the pump station sites.

Land Area Impacted. The conveyance pipelines would be below ground, and disturbed surfaces would be restored upon completion of construction to the extent practicable; thus, the permanent land area impacted would be minimal. The RPTF and associated access drive and parking lot would result in a permanent loss of approximately one acre of land. The area of land impacted for each pump station varies depending on the volume of flow handled, ranging from approximately 3,000 square feet for the smallest pump station to approximately 22,500 square feet for the largest pump station.

Indirect Growth. In addition to growth associated with existing trends and patterns in the study area, as previously referenced for Alternative 1 (No Action), this alternative could potentially result in indirect growth and development as a result of the less restrictive treatment requirements for the gulf discharge. These less restrictive treatment requirements may allow the existing WWTFs to process additional flow that they may not be able to accommodate with stricter discharge limits. It is this potential to process additional flow that may result in indirect growth and development.

All effluent flows would be conveyed via force mains. Force mains will limit unapproved hookups to the conveyance system since all hookups would need to be pressurized. However, it is possible that a municipality or developer could tie into the conveyance pipeline if separate treatment and pumping were provided, pending approval by a future regional sewer governing association. These hookups from previously unsewered areas have the potential to induce growth within areas that might previously have been restricted, particularly those restricted due to on-site wastewater disposal limitations. A primary factor in predicting the likelihood for induced growth is the amount of developable land available in the vicinity of the proposed conveyance pipeline. A few communities are anticipated to have limited land available to accommodate projected baseline population growth (i.e. anticipated to approach buildout conditions), and consequently would be anticipated to experience relatively minor induced growth resulting from hookups to the regional conveyance system. These communities include Exeter, Hampton, New Castle, Portsmouth, Dover, and Somersworth. However, undeveloped land that could be subject to development is anticipated to remain available within a majority of study area communities.

6.1.2 Air Quality

Similar to Alternative 1 (No Action), continued operation of the WWTFs under Alternative 2, 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 would be below ground and would operate with little, if any, potential for impacts to air quality. The pump stations as well the RPTF would handle WWTF secondary effluent and odors are not anticipated to be an issue.

6.1.3 Surface Water Flow, Groundwater Recharge, and Water Quality

Under this alternative, flow that is currently discharged from existing WWTFs to various receiving waters would be collected and conveyed to the Gulf of Maine. The effect of this redirection of wastewater flow would impact receiving waters tributary to Great Bay as well as the Gulf of Maine. These receiving waters are discussed separately below.

Surface Water Flow and Groundwater Recharge. In Alternative 2, the WWTFs no longer discharge to the estuary system.

Great Bay

During low flow (7Q10) conditions, the total volume discharged by the rivers to the Great Bay is 30.1 cfs, while the average WWTF discharge volume (in September when low river flows typically occur) is 21.8 cfs (see Table 2 in Appendix C). This WWTF flow represents 72% of the river flows. Compared to the tidal flows, the volume of water discharged by the rivers during one tide cycle (under normal river flow conditions) is approximately 1% of the tidal prism (volume of water flowing in and out of the estuary during one tide cycle) (Ertürk et al, 2002).

As a result of the redirection of WWTF effluent to the Gulf, there would be a reduction in the existing receiving water surface flow and, potentially, groundwater levels downstream and in the vicinity of the existing WWTFs. The extent of this reduction is based on the percentage of flow contribution from the existing WWTFs. Table 6-1 summarizes the percentages of flow that would be redirected, under low flow (7Q10) conditions, for receiving waters within the project area. Low flow data were taken from the existing NPDES permits where available. For several of the receiving waters, there would be a fairly significant reduction in stream flow. WWTFs that contribute substantial flow to receiving waters (for example, greater than 10 percent of stream flow during low flow conditions) include the Farmington WWTF on the Cocheco River, the Newmarket WWTF on the Lamprey River, and the Rochester WWTF on the Cocheco River, which represent 11.6, 16.8, and 48.6 percent of local receiving water flow during low flow (7Q10) conditions, respectively.

TABLE 6-1. WWTF FLOW AS A PERCENTAGE OF TOTAL FLOW DURING LOW FLOW CONDITIONS

WWTF	Receiving Water	WWTF Average Annual Flow in 2004 (MGD)	WWTF Average Annual Flow in 2004 (CFS)	7Q10 (CFS)	Total (WWTF+7Q10) (CFS)	WWTF % of Total Flow
Epping	Lamprey River	0.20	0.30	3.00	3.30	9.1
Newmarket	Lamprey River	0.64	0.99	4.91	5.90	16.8
Farmington	Cocheco River	0.21	0.33	2.52	2.85	11.6
Rochester	Cocheco River	2.90	4.49	4.74	9.23	48.6
Milton	Salmon Falls River	0.05	0.08	25.4	25.48	0.3
Rollinsford	Salmon Falls River	0.10	0.15	28.7	28.85	0.5
Somersworth	Salmon Falls River	1.10	1.70	28.7	30.40	5.6

This reduction in river flow would potentially affect a variety of downstream uses including provision of water supply and sustaining of coastal vegetation and aquatic habitat. For example, the Lamprey River is a designated Wild and Scenic River and protected by Instream Flow Rules. Compliance with flow standards is required, and any reduction in stream flow would jeopardize the ability to comply.

Under this alternative, there would be no increases in groundwater recharge with the exception of discharges from new on-lot systems within the study area. It is possible that with the reduction in stream flows that the migration of groundwater to these streams may increase. The subsequent effect of this increased migration is the possible lowering of groundwater levels which may result in the reduction in groundwater supplies and habitat in the study area. If this alternative is to be carried further, a detailed analysis of the impact on groundwater levels and availability due to the relocation of WWTF effluents will need to be conducted.

Gulf of Maine

The redirection of wastewater flow to any of the three candidate outfall locations is not anticipated to impact flow in the Gulf of Maine.

Water Quality. The following is a summary of the water quality analysis for Alternative 2. This includes changes to the Great Bay salinity, a qualitative Great Bay pollutant loading analysis, and Gulf of Maine water quality impacts.

Great Bay Salinity Changes

As a result of the reduction in freshwater flow, there is a potential for an increase in salinity concentrations and or movement of the salt wedge in the receiving waters that are under tidal influence. These receiving waters include the Lamprey River in the vicinity of the Newmarket WWTF, the Oyster River in the vicinity of the Durham WWTF, the Squamscott River in the vicinity of the Newfields WWTF, and Piscataqua River in the vicinity of the Peirce Island (Portsmouth) WWTF. Modeling was conducted to determine the effect of redirection of flow on salinity in these receiving waters (see Section 6.1.3 and Appendix C). The modeling indicated that salinity the increases on these receiving waters would be fairly minor, on the order of 1 to 2 ppt during extreme low flow (7Q10) conditions. Calculated salinities for Alternative 2 with the WWTF flows removed are shown in Figure 5 in Appendix C.

An increase of 1 to 2 ppt would not likely represent a significant effect on water quality, as this variation in salinity is experienced daily due to tidal fluctuation. However, given the sensitivity of resources in the estuary, should this alternative be selected for possible implementation, more detailed modeling to determine localized effects due to stratification and potential salinity changes should be conducted.

Great Bay Pollutant Loading Analysis

In both the freshwater and tidal receiving waters, the removal of WWTF effluent from the local receiving waters would potentially result in local receiving water quality improvements. As noted in the Preliminary Findings Report, a number of the receiving waters are identified by the Department of Environmental Services as being impaired for a variety of uses. For many of the receiving waters, TMDLs are required to be prepared for a certain number of parameters. Some of these parameters, such as low dissolved oxygen (DO), are possibly related to the discharges from the existing wastewater treatment facilities, in addition to stormwater and other non-point source discharges. The removal of WWTF discharges from the tributaries would likely result in a small increase in DO due to reduced BOD loadings. This alternative would also eliminate the discharge of toxics and reduce the risk of accidental discharge of pathogens from wastewater effluent.

Studies have been prepared documenting the contribution of nutrients to Great Bay from the existing WWTFs. In 2002, WWTFs were estimated to contribute 34 percent of the total amount of nitrogen that entered Great Bay and the Upper Piscataqua Estuary (NHEP, 2006). A report prepared in 2003 summarizing the evaluation of Effects of Wastewater Treatment Discharge on Estuarine Water Quality (Bolster et al, 2003) noted that ammonia nitrogen loading is the most significant nitrogen species being discharged to the Bay. This alternative would result in some reduction in the potential for eutrophication due to elimination of nutrients from WWTF discharges.

One potential concern with regard to water quality in the Great Bay would be the effect that reduction in stream flow would have on downstream dilution for other pollutant sources. In receiving waters where the WWTF flow represents a significant percentage of downstream flow, such as in the Cocheco River downstream of the Rochester WWTF, it is possible that water quality conditions could be degraded to some degree as a result of less dilution for pollutants from other non-point sources, such as on-lot septic systems.

Gulf of Maine Water Quality Impacts

This section presents a summary of the findings of the Gulf of Maine discharge modeling. A complete discussion of the development of the outfall concepts and assumptions in the modeling is presented in Appendix D.

Discharges to the Gulf of Maine would achieve higher initial dilution of the effluent, as compared to discharges to rivers and estuaries. Initial dilution is a function of the discharge flow rate, the instantaneous current speed, and the water column stratification. Note the discharge flow rate used is that of the year 2055 due to the expected 50 year service life of a marine outfall.

Initial dilution primarily controls the acute and chronic toxicity of the discharge. The time of travel in the effluent plume from the discharge point to the end of the zone of initial dilution is usually short enough to avoid toxic impacts to entrained organisms. Therefore, the end of the zone of initial dilution (ZID) is usually selected as the point of application of toxicity criteria. These criteria involve the Criteria Maximum Concentration (CMC) to protect against acute effects and the Criteria Continuous Concentration (CCC) to protect against chronic effects (USEPA, 1991). EPA recommends averaging periods of 1 hour and 4 days respectively for acute and chronic criteria, with an exceedence frequency of once every 3 years (USEPA, 1991).

The lowest initial dilution will be achieved for peak flow, at slack tide, during the summer (with stratified receiving water). Since stratification persists for several months, and slack tide occurs four times a day, coincidence with peak flow can be expected to occur at least once every three years and last for approximately one hour. Therefore, the dilution calculated for peak hour flow, zero current speed and stratified conditions is relevant for comparison with the CMC. The comparison for the CCC is examined under average flow conditions.

Initial dilution estimates were developed using calibrated models for different receiving water regimes (Tian et al, 2004a, 2004b; Daviero et al, 2006). The results are summarized in Table 6-2. The initial dilution values listed are the *minimum* dilution at the end of the zone of initial dilution (ZID). See Appendix D for more detail. The initial dilution increases from Sites 1 to 3. The CMC dilution, which essentially corresponds to the worst case that can be expected to occur in a three-year period, varies from 50 at Site 1 to 116 at Site 3. The CCC dilution varies from 115 at Site 1 to 269 at Site 3.

To determine the probable toxicity effects to marine organisms, the concentrations of wastewater constituents after dilution were compared to acute (CCC) and chronic (CMC) water quality and aquatic life criteria for various marine life species (see Section 6.1.4).

It is expected that continued discharge of treated wastewater effluent to the gulf would increase cumulative contribution of nitrogen and other wastewater constituents to the marine environment, and that monitoring would be needed to ascertain the magnitude of increase and effects on water quality. No adverse effects from changes in salinity are expected to occur in the gulf due to the high dilution at each of the potential outfall sites. Additionally, benthic communities are not anticipated to be impacted since the effluent is expected to rise immediately after discharge as its density is lighter than saltwater; however, it is expected that salinity would need to be monitored over the long-term should this alternative be considered for implementation.

TABLE 6-2. CANDIDATE OUTFALL CHARACTERISTICS AND INITIAL DILUTION PERFORMANCE

Characteristics				Site 1	Site 2	Site 3
Distance from shore (mi)				4.3	8.0	11.6
Depth at low water (ft)				60	120	160
Outfall length (mi)				4.3	15.5	20.0
Diffuser Design						
Length (ft)				1,290	2,580	3,440
Number of ports				44	44	44
Port diameter (inches)				6.0	6.0	6.0
Initial dilution (minimum at edge of Zone of Initial Dilution)						
Summer Conditions						
Slack tide						
	2055 Average Flow	24.7	MGD	75	119	166
	2055 Max day flow	65.3	MGD	58	94	130
CMC >	**2055 Peak hour flow**	**102.6**	**MGD**	**50***	**84**	**116**
Median Current (0.3 ft/s)						
CCC >	**2055 Average Flow**	**24.7**	**MGD**	**115**	**189**	**269**
	2055 Max day flow	65.3	MGD	72	137	194
	2055 Peak hour flow	102.6	MGD	57	118	167

* Plume surfaces

6.1.4 Wetland and Terrestrial Resources

Increase/Decrease or Relocation of Flow. The hydrologic changes, including reduction in stream flow and potential reduced groundwater levels that would occur as a result of redirecting wastewater flow to the Gulf of Maine, may result in changed wetland and terrestrial habitat in receiving waters, including reduced wetland acreage. Examples of locations where effects on wetlands and terrestrial resources may be possible include an 83-acre wetland located less than one mile downstream from the Farmington WWTF. This wetland is considered significant for surface and groundwater quality protection (Blue Moon Environmental, Inc. 2004). The Farmington WWTF contributes a significant percentage (greater than 10 percent) of the flow to the Cocheco River during extreme low flow (7Q10) conditions. Other noteworthy wetlands are located on the Squamscott River. Designated prime wetlands adjacent to the Squamscott River immediately upstream and downstream of the Exeter WWTF and wetlands located proximate to the Newfields WWTF would also be sensitive to hydrologic alterations.

It is not expected that the potential increase in salinity due to relocation of freshwater flow would have much if any effect on the composition of vegetation in the coastal area. As noted in Section 6.1.3, the increase in salinity is expected to be on the order of 1 to 2 ppt, which is well within the range of salinity variation the coastal vegetation currently experiences due to tidal influences. Because of the sensitivity of wetlands vegetation and coastal habitat in estuaries, it is recommended, however, that more detailed analysis of salinity be conducted if this alternative is selected for further consideration. For example, a wetland community that may be sensitive to changes in salinity includes the high salt marsh, which is listed as a significant natural community along the floodplains of the Lamprey and Oyster Rivers. High salt marshes are among the most biologically productive systems on earth and support a vast array of plants and animals, including many species of migratory birds (NHNHB, 2005). Another significant natural community that would be sensitive to changes in salinity is the low brackish tidal riverbank marsh, also found along the floodplain of the Lamprey River. This is a habitat inundated by salt and/or brackish tide waters on a daily or irregular frequency.

Improvements/Degradation of Water Quality. Reduced loadings from the WWTFs due to the redirection of flow to the Gulf of Maine may benefit wetland habitat in the estuary. The Hampton/Seabrook Harbor includes approximately eight square miles (more than 5,000 acres) of continuous salt marsh, and reduction of wastewater flow to the harbor could reduce pollutant assimilation in the salt marsh.

The siting of facilities, including conveyance pipelines and pump stations, may require taking of terrestrial habitat. As noted in Section 6.1.1, it is expected that attempts will be made to site these components in public rights-of-way to extent possible. However, some loss of terrestrial/upland habitats would be expected. Terrestrial wildlife may also be indirectly impacted by adverse impacts to aquatic resources and riparian communities.

No wetland and terrestrial resources would be expected to be adversely effected in the Gulf of Maine due to the offshore locations of the candidate outfall sites.

6.1.5 Aquatic Resources

Impacts to aquatic resources due to the redirection of wastewater flow to the Gulf of Maine differ between the Great Bay receiving waters and the Gulf of Maine; therefore, the two areas are discussed separately below.

Great Bay Receiving Waters

Increase/Decrease in Flow. As a result of the modifications in base flow, aquatic resources could potentially be adversely affected in some receiving waters. Great Bay has been designated as Essential Fish Habitat for feeding, breeding, nursing, and protection during juvenile and larval stages for many fish species; thus, alterations in flow that would affect aquatic life would be of concern. Alterations to aquatic resources would be most likely in receiving waters where WWTF discharges comprise close to or greater than ten percent of the base flow during low flow conditions. This includes the Lamprey River, which is designated as a Wild and Scenic River for an 11.5-mile stretch from downstream of the Epping WWTF to upstream of the Newmarket WWTF, and the Cocheco River. As indicated in Table 6-2, the Epping and Newmarket WWTFs on the Lamprey River, and the Farmington and Rochester WWTFs on the Cocheco River, all comprise close to or greater than ten percent of receiving water base flow during 7Q10 conditions. Of these four WWTFs, only the Newmarket WWTF discharges to tidal receiving waters.

There is concern that relocation of Newmarket WWTF discharge from the Lamprey River to the Gulf of Maine could affect downstream salinity concentrations in the river, which could in turn affect resident fish. The Lamprey River is tidally influenced downstream of the Macallen Dam; however, site specific resident fisheries data downstream of the dam are not available. Table 6-3 lists species identified in the Great Bay Estuary in 1980 and 1981, some of which may also occur in this section of the river during certain times of year. Of these species, the twelve freshwater species would be more susceptible to changes in salinity levels if present in the lower section of the river. Freshwater species that could be affected by significant changes in salinity include bluegill, smallmouth bass, and largemouth bass. However, these species are all tolerant to slight changes in salinity. Should the 26 marine and estuarine species occur in the lower section of the river, these species are by definition tolerant of increases in salinity due to their estuarine nature; therefore, changes in salinity would not impact estuarine fish. Anadromous fish would not be affected by changes in salinity, as by nature they migrate between fresh and saltwater.

TABLE 6-3. RESIDENT FINFISH COLLECTED BY FYKE, HAUL SEINES, TRAWLS, AND GILL NETS IN THE GREAT BAY ESTUARY IN 1980 AND 1981.

MARINE		ESTUARINE		FRESHWATER	
Common Name	**Scientific Name**	**Common Name**	**Scientific Name**	**Common Name**	**Scientific Name**
American sand lance	*Ammodytes americanus*	Atlantic silverside	*Menidia menidia*	White sucker	*Catastomus commersoni*
Windowpane flounder	*Scopthalmus aquosus*	Grubby	*Myoxocephalus aenaeus*	Pumpkinseed	*Lepomis gibbosus*
Sea raven	*Hemitripterus americanus*	Common mummichog	*Fundulus heteroclitus*	Bluegill	*Lepomis macrochirus*
Lumpfish	*Cyclopterus lumpus*	Striped mummichog	*Fundulus majalis*	Smallmouth bass	*Micropterus dolomieui*
Atlantic cod	*Gadus morhua*	Atlantic tomcod	*Microgadus tomcod*	Largemouth bass	*Micropterus salmoides*
Pollack	*Pollachius virens*	4-spine stickleback	*Apeltes quadracus*	Golden shiner	*Notemigonus crysoleucas*
Red hake	*Urophycis chuss*	3-spine stickleback	*Gasterosteus aculeatus*	Spottail shiner	*Notropis hudsonius*
White hake	*Urophycis tenuis*	9-spine stickleback	*Pungitius pungitius*	Fallfish	*Semotilus corporalis*
Cunner	*Tautogolabrus adspersus*	White perch	*Morone americanus*	Chain pickerel	*Esox niger*
Rock gunnel	*Pholis gunnellus*	Smooth flounder	*Liopsetta putnami*	Brown bullhead	*Ictalurus nebulosus*
Bluefish	*Pomatomus saltatrix*	Winter flounder	*Pseudopleuronectes americanus*	Yellow perch	*Perca flavescens*
Little skate	*Raja erinacea*	Northern pipefish	*Syngnathidae fuscus*	Rainbow trout	*Oncorhynchus mykiss*
Winter skate	*Raja ocellata*				
Black sea bass	*Centropristis striata*				

Source: Nelson 1981, as referenced in Jones 2000.

Shellfish species are not expected to be impacted by localized decreases in flow and resultant changes in salinity. For example, oysters, soft shell clams and mussels are generally tolerant to small changes in salinity. Based on salinity modeling results presented in Section 6.1.3, it is expected that the effects on aquatic resources would be negligible as these portions of the tidal reaches see great fluctuation in salinity depending on tidal cycle, season, and weather conditions. However, as recommended with regard to wetlands and terrestrial species, more detailed evaluation of effects at specific locations would be recommended should this alternative be considered for future implementation.

Improvement/Degradation in Water Quality. Aquatic life would also be affected by potential changes in water quality that may occur as a result of the relocation of WWTF effluent to the Gulf. To the extent that wastewater flow is relocated from receiving waters that currently experience closed shellfishing areas due to potential releases of untreated wastewater from WWTFs, the relocation may allow more areas to be opened to the public for potential harvest. As noted above in Section 6.1.3, some water quality improvements would be anticipated to occur as a result of relocating the flow. A decrease in nutrients and a potential increase in DO would be expected.

For example, the section of the Lamprey River below the Epping WWTF experiences low DO periods in the summer, which may partially be linked to BOD loadings from WWTFs. The elimination of BOD may reduce these low DO conditions in this stretch of river. However, much of the low DO is attributed to non-point sources. This may have beneficial effect on aquatic life downstream of these facilities. However, as was previously noted, the removal of flow from those receiving waters that are heavily dominated by WWTF flow may result in lower dilution ratios downstream, and thus pollutants from other sources such as septic systems may have greater localized effect on water quality.

Gulf of Maine Discharge

Increase/Decrease or Relocation of Flow. No effects on aquatic life in the gulf are anticipated due to increases in flow volume.

Improvement/Degradation of Water Quality. The evaluation of the anticipated concentration of pollutants in the effluent discharge was conducted based on the end of pipe concentration and the anticipated dilution available at the three candidate outfall locations during various tidal conditions (see detailed discussion in Section 6.1.3 and Appendix D). Pollutant concentrations were evaluated at average day, maximum day, and peak hour flow at both slack and median tides during both winter and summer conditions. At the point of discharge at the three candidate outfall locations, dilution would vary due to the discharge flow depth. To determine the probable toxicity effects to marine organisms, the predicted concentrations of wastewater constituents accounting for dilution were compared to water quality criteria or to the aquatic life criteria for either surrogate species or intolerant species which may be founds in the vicinity of the outfall (based on sensitivity level as determined from EPA, 1989).

Table 6-4 compares the diluted ammonia concentrations, anticipated to occur at peak hour flow during summer slack tide conditions at each of the candidate outfall sites, to the aquatic life acute criterion for ammonia based on sensitivity levels as determined from EPA, 1989. It should be noted that the WWTF discharge ammonia concentration has been assumed to be 15 mg/l. This value assumes medium strength wastewater (25 mg/l) and 40 percent removal at the WWTF (M&E, 2003). The highest diluted concentration is expected to occur at Site 1. Even during these conditions, the ammonia concentration anticipated would be less than the acute aquatic life criterion for winter flounder (*Pseudopleuronectes americanus*) larvae, which is considered to be the most susceptible stage of the most sensitive salt water species for ammonia. Larval stages of winter flounder most likely would not occur near the Site 1 outfall location, as their habitat is closer to shore within eelgrass beds. However, winter flounder larvae are a good surrogate species for other benthic and epibenthic species which may occur at the site. The LC-50 concentration for ammonia for American lobster (*Homarus americanus*), which would be present in the Gulf of Maine in the vicinity of the candidate outfall locations, is higher (2.21 mg/l) than the criterion for winter flounder; thus, no toxicity impacts would be expected to occur on lobsters.

TABLE 6-4. AMMONIA CONCENTRATIONS PREDICTED AT THE THREE CANDIDATE OUTFALL SITES COMPARED TO ACUTE AQUATIC LIFE CRITERION FOR AMMONIA IN SALTWATER (1).

	Acute Aquatic Life Criterion(2) (mg/l)	Concentration at Site 1 (mg/l)	Concentration at Site 2 (mg/l)	Concentration at Site 3 (mg/l)
Species: Winter Flounder	LC50-0.492 (un-ionized ammonia)	0.30	0.179	0.129

(1) Ammonia concentrations are based on peak hour flow during summer slack tide conditions
(2) Source: EPA, 1989.

Ammonia concentrations of the diluted effluent at the candidate outfall locations during average flow median current conditions were also compared to chronic toxicity values of ammonia to aquatic life. Only two saltwater species have published chronic criteria for ammonia (US EPA, 1989). These two species are mysid shrimp (*Mysidopsis bahia*) and inland silverside (*Memidia beryllima*), with chronic values of 0.232 mg/l and 0.061 mg/l, respectively. Table 6-5 compares the concentration of ammonia at the three candidate outfall sites to the chronic concentrations.

As noted in Table 6-5, no exceedence of the chronic life criterion for Mysid shrimp would occur at any of the three outfall sites. Mysid shrimp are small, shrimp-like crustaceans found primarily in the Gulf of Mexico and the eastern coast of Florida. They commonly occur at salinities above 15 ppt and are found in greatest abundance at salinities near 30 ppt. Although Mysid shrimp will not be found at the outfall locations, it is a good surrogate species for other species of shrimp or invertebrates that may occur in the vicinity of the outfall locations. Therefore, chronic ammonia toxicity is not expected for other species of shrimp.

The predicted ammonia concentration at two of the three candidate outfall sites would exceed the chronic value for inland silversides (Table 6-5). There would be no exceedence at Site 3, the site most distant from shore. The chronic toxicity values are derived from data collected for the most sensitive life stages (i.e. eggs and larvae). Since inland silversides spawn and typically reside in estuarine habitats (salinity below 15 ppt) (Weinsteid, 1996), it is unlikely that either eggs or larvae would be exposed to the ammonia concentrations anticipated to occur at the candidate outfall locations. Although inland silversides are unlikely to be found in the vicinity of candidate sites 1 and 2, more detailed evaluations of the possible toxicity to other species would be recommended should this alternative be considered for implementation.

TABLE 6-5. AMMONIA CONCENTRATIONS FOR SALTWATER SPECIES AT THE THREE CANDIDATE OUTFALL SITES COMPARED TO CHRONIC AQUATIC LIFE CRITERION FOR AMMONIA IN SALTWATER (1)

	Chronic Aquatic Life Criterion(2) (mg/l)	Concentration at Site 1 (mg/l)	Concentration at Site 2 (mg/l)	Concentration at Site 3 (mg/l)
Species: Mysid Shrimp	0.232	0.130	0.079	0.056
Species: Inland Silverside	0.061	0.130	0.079	0.056

(1) Ammonia concentrations are based on average flow median current conditions
(2) Source: EPA, 1989

Other parameters of concern in WWTF effluent discharges include BOD, TSS, and inorganic nitrogen. Aquatic life criteria or saltwater quality standards specific to these parameters are not available, generally due to the fact that these parameters are not toxic, but instead can contribute to DO deficits, which is detrimental to aquatic life and the smothering of benthic organisms

In addition, locally anticipated changes in salinity are not likely to pose an adverse effect to aquatic species. Effects on salinity levels are expected to be negligible due to the high dilution rate. The WWTF effluent would be lighter than the gulf waters, and would be expected to rise in the water column, entraining ambient water in its travel to the surface. Depending on the season, and the temperature of the gulf waters, the WWTF effluent may rise all the way to the surface or it may rise to an intermediate level, due to temperature stratification in the water column. As explained in Section 6.1.3 and Appendix D, the dilution up to a point just beyond the surface impingement or the final height of the rise is called the “initial dilution” and is the basis for the evaluation of effects to aquatic life described above.

6.1.6 Rare and Endangered Species

The redirection of wastewater flow may have an effect on rare and endangered species in Great Bay receiving waters, but is not anticipated to adversely affect rare and endangered species in the Gulf of Maine. Therefore, each is discussed separately below.

Great Bay Receiving Waters

Increase/Decrease or Relocation in Flow. To the extent that surface water flow and groundwater levels are reduced due to the transfer of WWTF effluent out of the basins to a Gulf of Maine discharge, the habitat of local rare and endangered species may be altered. It is expected that the greatest potential for alteration is in those receiving waters where a high percentage of flow in the river or stream is currently represented by the flow from the WWTF. Based on available data from the existing NPDES permits, sensitive receiving waters include the Lamprey and Cocheco Rivers (refer to Section 6.1.3). Existing data show that in these receiving waters, seven rare and endangered plant species and one exemplary community are identified in the vicinity of the Newmarket WWTF. Rare and endangered species in the vicinity of the Rochester WWTF, which represents the highest percentage of flow contribution of all WWTFs listed in Table 6-1, include three plant and three vertebrate species and two exemplary natural communities. Of these species, endangered plant species including the large salt marsh aster (*Aster tenuifolius)* and the mudwort (*Limosella australis*) on the Lamprey River and the red maple floodplain forest on the Cocheco River would be most likely to be directly affected by alterations in hydrology.

As noted above, the modeling indicates that the change in salinity in tidal receiving waters is expected to be negligible during low flow conditions. However, because of the presence of protected species in several of these receiving waters, it is recommended that the effects during 7Q10 conditions be evaluated in greater detail if this alternative is considered further for implementation.

Improvement/Degradation in Water Quality. While specific modeling results for nitrogen loading are not available, it is expected that the reduced nutrient loading in the Great Bay receiving waters would have a beneficial effect on protected plant and wildlife species. Nitrogen loadings to Great Bay may be linked to algal blooms, macroalgal proliferation, and eelgrass loss during summer months (Jones, 2000). Indirectly, oxygen can become limited and can pose risk to aquatic species. A reduction of nitrogen loadings would reduce algal blooms and DO limitations, and thus provide overall benefit to the estuary.

Gulf of Maine Discharge

Increase/Decrease in Flow. No effects on rare or endangered species would be expected as a result of flow changes.

Improvement/Degradation of Water Quality. It is not expected that any of the rare and endangered species anticipated to be present in the vicinity of the offshore discharges would be adversely affected from the treated effluent discharge. For example, the acute aquatic life criterion for ammonia for winter flounder is above the anticipated concentration of 0.30 mg/l at Site 1, which has the lowest dilution rate under all conditions. However, it is recognized that effects to aquatic species are based on cumulative effects in both inland and offshore environments. Thus, while the discharge itself is not anticipated to adversely affect the species, the existing water quality and the contributions of other contaminants should be evaluated in future studies should this alternative be selected for further consideration.

6.2 NON-MONETARY TECHNICAL ANALYSIS

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

- Complexity
- Public Testimony
- Implementation

6.2.1 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, all of the WWTFs would maintain the same level of treatment as today with the exception of the Peirce Island WWTF, which would need to be upgraded to provide secondary treatment.

The conveyance component of this alternative is complex. It is anticipated that this alternative would require a large conveyance system. The proposed conveyance system for this alternative (described in Section 3.2) is anticipated to require more than 90 miles of effluent force mains and 30 pump stations. Many of these pump stations and pipelines are located in areas not necessarily adjacent to the existing WWTFs. These force mains and pump stations would require routine operational attention and regular maintenance.

The disposal component of this alternative is also complicated. It is anticipated that this alternative would require the construction of a RPTF. This facility would be used for disinfection and sampling of the regionally collected WWTF effluent prior to discharge. This facility would likely also include an effluent pump station. This pump station is anticipated in order to convey the effluent wastewater though the outfall under peak flow conditions an high tidal conditions (especially for the longer outfalls). A marine outfall pipe and diffusers would have to be constructed, periodically inspected, and potentially maintained. In addition, a significant outfall monitoring program would likely be required by the regulatory agencies.

6.2.2 Public Testimony

This alternative produced a significant amount of negative public testimony throughout the duration of the project. The majority of this negative public testimony can be divided into the following categories:

- Concerns related to inter-basin transfer and the “throwing away” of the wastewater effluent that originated from a groundwater source.

- Concerns of negatively impacting the water quality and environmental quality directly adjacent to the outfall discharge, around the outfall, as well as globally.

- Concern that the development of a regional sewer system would result in a rapid and uncontrolled expansion or secondary growth of the study area.

6.2.3 Implementation

The implementation of this alternative would be relatively difficult. This alternative would require agreement between the municipalities to implement (for construction, maintenance, revenue production and expense sharing). Under this alternative, each community 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, given the negative public testimony received during the feasibility phase, it is anticipated that implementing this alternative would result in additional negative public feedback.

This alternative does allow the possibility that the multiple communities could join together to share resources, leverage their combined purchase power, and potentially negotiate with regulators (nitrogen trading, etc.).

6.3 PLANNING LEVEL CONSTRUCTION COSTS

Included herein are estimated planning level costs for Alternative 2. The planning level costs have been divided into three sub-categories: treatment, conveyance, and disposal.

The treatment upgrade costs for each WWTF are presented in Table 6-6. The conveyance costs associated with this alternative are presented in Table 6-7 and the disposal costs are presented in Table 6-8. It should be noted that the outfall costs presented are for the candidate outfall site that is located closest to the shore (Site 1).

TABLE 6-8. ALTERNATIVE 2 - PLANNING LEVEL EFFLUENT DISPOSAL COST ESTIMATES

Component	Size	Length	Unit Price	Total Estimated Cost
Regional Post-Treatment Facility	30 minutes of detention time @ peak flow		$ 20,000,000	$ 20,000,000
Outfall Pump Station	84 MGD		$ 50,000,000	$ 50,000,000
Outfall Pipe	72 “ Diameter	4.3 miles (27,704 ft.)	$ 2,000 / linear feet	$ 45,400,000
Outfall Diffuser Section	72” w/ 44 - 6” ports	1,290 ft	$ 3,000 / linear feet	$ 3,900,000
			Total	**$ 119,300,000**

Table 6-9 presents the total Alternative 2 planning level costs for treatment, conveyance, and disposal on a town by town basis. The costs for conveyance and disposal assume that the costs for conveyance and disposal for an individual town would be proportionate to that community’s percentage of the total system flow.

In summary, the estimated planning level costs for Alternative 2 are:

- Treatment Costs $ 73,800,000
- Conveyance Costs $ 396,000,000
- Disposal Costs $ 119,300,000
- **Total Cost $ 589,100,000**

Table 6-6. Alternative 2 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	0.3	yes new flow	$ 1,580,000	no	$ -	no	na	na	na	$ -	no	$ -	IP, Pre	$5/gal	$ 1,500,000	**$ 3,080,000**
DURHAM WWTF	1.71	1.8	0.80	NR	0.09	no	$ -	no	$ -	no	na	na	na	$ -	no	$ -	IP, Pre	$5/gal	$ 450,000	**$ 450,000**
EPPING WWTF	0.32	0.429	1.00	C	0.109	yes new flow	$ 820,000	no	$ -	no	na	na	na	$ -	no	$ -	Pre, Mem	$5.5/gal	$ 600,000	**$ 1,420,000**
EXETER WWTF	3.6	3.9	0.70	AS, C	0.3	all flow	$ 20,480,000	no	$ -	no	na	na	na	$ -	no	$ -	Pre	$2.5/gal	$ 750,000	**$ 21,230,000**
FARMINGTON WWTF	0.52	0.57	0.90	C	0.05	yes new flow	$ 340,000	no	$ -	no	na	na	na	$ -	no	$ -	IP, Pre	$5/gal	$ 250,000	**$ 590,000**
HAMPTON WWTF	3.3	3.7	0.70	NR	0.4	no	$ -	no	$ -	no	na	na	na	$ -	no	$ -	SH	$5/gal	$ 2,000,000	**$ 2,000,000**
MILTON WWTF	0.08	0.09	1.00	C	0.01	yes new flow	$ 80,000	no	$ -	no	na	na	na	$ -	no	$ -	NR	na	$ -	**$ 80,000**
NEWFIELDS WWTF	0.08	0.084	1.00	C	0.004	yes new flow	$ 30,000	no	$ -	no	na	na	na	$ -	no	$ -	Air	$1/gal	$ -	**$ 30,000**
NEWINGTON WWTF	0.18	0.2	1.00	C	0.02	yes new flow	$ 150,000	no	$ -	no	na	na	na	$ -	no	$ -	Air	$1/gal	$ 20,000	**$ 170,000**
NEWMARKET WWTF	1.04	1.16	0.80	C	0.12	yes new flow	$ 720,000	no	$ -	no	na	na	na	$ -	no	$ -	IP, Pre	$5/gal	$ 600,000	**$ 1,320,000**
PEASE DEVELOPMENT AUTHORITY WWTF	0.72	0.86	0.90	NR	0.14	no	$ -	no	$ -	no	na	na	na	$ -	no	$ -	NR	na	$ -	**$ -**
PORTSMOUTH WWTF	8.23	8.7	0.60	AS, C	0.47	all flow	$ 39,150,000	no	$ -	no	na	na	na	$ -	no	$ -	SH	$5/gal	$ 2,350,000	**$ 41,500,000**
ROCHESTER WWTF	5.51	6.1	0.60	C	0.59	no	$ -	no	$ -	no	na	na	na	$ -	no	$ -	2nd Clarifier	$1.5 M Clarifier	$ 1,500,000	**$ 1,500,000**
ROCKINGHAM COUNTY WWTF	0.085	0.118	1.00	NR	0.033	no	$ -	no	$ -	no	na	na	na	$ -	no	$ -	NR	na	$ -	**$ -**
ROLLINSFORD WWTF	0.15	0.17	1.00	NR	0.02	no	$ -	no	$ -	no	na	na	na	$ -	no	$ -	NR	na	$ -	**$ -**
SEABROOK WWTF	1.17	1.39	0.80	NR	0.22	no	$ -	no	$ -	no	na	na	na	$ -	no	$ -	NR	na	$ -	**$ -**
SOMERSWORTH WWTF	1.79	1.9	0.8	NR	0.11	no	$ -	no	$ -	no	na	na	na	$ -	no	$ -	Pre, Air	$3.5/gal	$ 390,000	**$ 390,000**
Totals	**33.055**	**36.041**			**2.986**		**$ 63,350,000**		**$ -**		**0.0**	**0.0**	**0.0**	**$ -**		**$ -**			**$ 10,410,000**	**$ 73,760,000**

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 6-7. Alternative 2 WWTF Effluent Conveyance Planning Level Construction Cost Estimate

Pipe Routing and Flow Combining: From	To	Flow (MGD)	Pipe Length, ft	Pipe Length, Miles	2055 Flow, MGD	2055 Pipe Size, in	$ per Foot	Estiamted Pipeline Cost	Number of Pump Stations Anticipated	Approximate Pump Station Size, MGD	Estimated Cost Per Pump Station	Total Estimated Conveyance Costs
FARMINGTON WWTF	Northeast Main 1	0.91 MGD	35,000	6.63	0.91	8	$ 250	$ 8,750,000	1	0.91	$ 750,000	$ 750,000
MILTON WWTF	Northeast Main 1	0.24 MGD	26,000	4.92	0.24	4	$ 250	$ 6,500,000	1	0.24	$ 750,000	$ 750,000
Northeast Main 1	Northeast Main 2	1.15 MGD	20,000	3.79	1.15	10	$ 250	$ 5,000,000	1	1.15	$ 2,000,000	$ 2,000,000
ROCHESTER WWTF	Northeast Main 2	10.00 MGD	4,000	0.76	10.00	24	$ 350	$ 1,400,000	1	10.00	$ 12,500,000	$ 12,500,000
Northeast Main 2	Northeast Main 3	11.15 MGD	35,000	6.63	11.15	30	$ 350	$ 12,250,000	1	11.15	$ 12,500,000	$ 12,500,000
ROLLINSFORD WWTF	Rollinsford Submain 1	0.36 MGD	12,000	2.27	0.36	5	$ 250	$ 3,000,000	1	0.36	$ 750,000	$ 750,000
SOMERSWORTH WWTF	Rollinsford Submain 1	5.75 MGD	-	0	5.75	18	$ 300	$ -	1	5.75	$ 5,000,000	$ 5,000,000
Rollinsford Submain 1	Northeast Main 3	6.11 MGD	19,000	3.60	6.11	20	$ 300	$ 5,700,000	1	6.11	$ 5,000,000	$ 5,000,000
Northeast Main 3	Northeast Main 4	17.25 MGD	28,000	5.30	17.25	36	$ 400	$ 11,200,000	1	17.25	$ 12,500,000	$ 12,500,000
DOVER WWTF	Northeast Main 4	12.74 MGD	4,000	0.76	12.74	30	$ 350	$ 1,400,000	1	12.74	$ 12,500,000	$ 12,500,000
Northeast Main 4	Northeast Main 5	29.99 MGD	30,000	5.68	29.99	42	$ 400	$ 12,000,000	1	29.99	$ 22,500,000	$ 22,500,000
NEWINGTON WWTF	Northeast Main 5	0.54 MGD	5,000	0.95	0.54	6	$ 250	$ 1,250,000	1	0.54	$ 750,000	$ 750,000
PEASE WWTF	Northeast Main 5	3.15 MGD	3,000	0.57	3.15	14	$ 300	$ 900,000	1	3.15	$ 2,000,000	$ 2,000,000
Northeast Main 5	Ocean Outfall Main	33.67 MGD	13,000	2.46	33.67	48	$ 500	$ 6,500,000	1	33.67	$ 22,500,000	$ 22,500,000
DURHAM WWTF	Durham Submain 1	5.35 MGD	31,000	5.87	5.35	18	$ 300	$ 9,300,000	1	5.35	$ 5,000,000	$ 5,000,000
NEWMARKET WWTF	Durham Submain 1	2.41 MGD	-		0.69	12		$ -	1	2.41	$ 2,000,000	$ 2,000,000
Durham Submain 1	Durham Submain 2	7.76 MGD	14,000	2.65	7.76	24	$ 350	$ 4,900,000	1	7.76	$ 5,000,000	$ 5,000,000
NEWFIELDS WWTF	Durham Submain 2	0.17 MGD	-		0.17	4	$ 250	$ -	1	0.17	$ 750,000	$ 750,000
Durham Submain 2	Southeast Inland Main 1	7.928 MGD	8,000	1.52		24	$ 350	$ 2,800,000	1	7.93	$ 5,000,000	$ 5,000,000
EPPING WWTF	Epping Submain 1	0.70 MGD	9,000	1.70	0.70	8	$ 250	$ 2,250,000	1	0.70	$ 750,000	$ 750,000
ROCKINGHAM CO. WWTF	Epping Submain 1	0.44 MGD	4,000	0.76	0.44	5	$ 250	$ 1,000,000	1	0.44	$ 750,000	$ 750,000
Epping Submain 1	Southeast Inland Main 1	1.14 MGD	30,000	5.68	1.14	10	$ 250	$ 7,500,000	1	1.14	$ 2,000,000	$ 2,000,000
EXETER WWTF	Southeast Inland Main 1	6.75 MGD	12,000	2.27	6.75	20	$ 300	$ 3,600,000	1	6.75	$ 5,000,000	$ 5,000,000
Southeast Inland Main 1	Coastal Submain 2	15.81 MGD	43,000	8.14	15.81	30	$ 350	$ 15,050,000	1	15.81	$ 12,500,000	$ 12,500,000
SEABROOK WWTF	Coastal Submain 1	3.86 MGD	25,000	4.73	3.86	16	$ 300	$ 7,500,000	1	3.86	$ 2,000,000	$ 2,000,000
HAMPTON WWTF	Coastal Submain 1	8.60 MGD	6,000	1.14	8.60	24	$ 350	$ 2,100,000	1	8.60	$ 5,000,000	$ 5,000,000
Coastal Submain 1	Coastal Submain 2	12.46 MGD	42,000	7.95	12.46	30	$ 350	$ 14,700,000	1	12.46	$ 12,500,000	$ 12,500,000
Coastal Submain 2	Ocean Outfall Main	28.27 MGD	12,000	2.27	28.27	42	$ 400	$ 4,800,000	1	28.27	$ 22,500,000	$ 22,500,000
Ocean Outfall Main	Post Treatment Facility	61.94 MGD	2,000	0.38	61.94	60	$ 500	$ 1,000,000	1	61.94	$ 35,000,000	$ 35,000,000
PORTSMOUTH WWTF	Post Treatment Facility	22.00 MGD	8,000	1.52	22.00	36	$ 400	$ 3,200,000	1	22.00	$ 12,500,000	$ 12,500,000
		Totals	**480,000**	**90.91**				**$ 155,550,000**	**30**			**$ 240,250,000**
											Total Conveyance Cost	**$ 395,800,000**

Notes:
- All flows in MGD
- All flows are the average of 2055 peak hour and peak day flows
- See Figure 3-3 for planning level conveyance routes used to develop this table
- (yellow) - Indicates flow originating from individual WWTFs

Table 6-9. Estimated Planning Level Construction Costs for Alternative 2

FACILITY	Treatment Cost	Conveyance Cost	Discharge Costs	Total Estimated Construction Costs
DOVER WWTF	$ 3,100,000	$ 50,600,000	$ 15,200,000	$ 68,900,000
DURHAM WWTF	$ 500,000	$ 19,500,000	$ 5,900,000	$ 25,900,000
EPPING WWTF	$ 1,400,000	$ 3,800,000	$ 1,200,000	$ 6,400,000
EXETER WWTF	$ 21,200,000	$ 37,300,000	$ 11,200,000	$ 69,700,000
FARMINGTON WWTF	$ 600,000	$ 4,600,000	$ 1,400,000	$ 6,600,000
HAMPTON WWTF	$ 2,000,000	$ 49,700,000	$ 15,000,000	$ 66,700,000
MILTON WWTF	$ 100,000	$ 1,100,000	$ 300,000	$ 1,500,000
NEWFIELDS WWTF	$ -	$ 1,000,000	$ 300,000	$ 1,300,000
NEWINGTON WWTF	$ 200,000	$ 2,800,000	$ 900,000	$ 3,900,000
NEWMARKET WWTF	$ 1,300,000	$ 13,700,000	$ 4,100,000	$ 19,100,000
PEASE DEVELOPMENT AUTHORITY WWTF	$ -	$ 9,200,000	$ 2,800,000	$ 12,000,000
PORTSMOUTH WWTF	$ 41,500,000	$ 92,200,000	$ 27,800,000	$ 161,500,000
ROCHESTER WWTF	$ 1,500,000	$ 62,100,000	$ 18,700,000	$ 82,300,000
ROCKINGHAM COUNTY WWTF	$ -	$ 2,000,000	$ 600,000	$ 2,600,000
ROLLINSFORD WWTF	$ -	$ 2,000,000	$ 600,000	$ 2,600,000
SEABROOK WWTF	$ -	$ 21,300,000	$ 6,400,000	$ 27,700,000
SOMERSWORTH WWTF	$ 400,000	$ 23,100,000	$ 6,900,000	$ 30,400,000
TOTAL	**$ 73,800,000**	**$ 396,000,000**	**$ 119,300,000**	**$ 589,100,000**

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