SECTION 4.0
EVALUATION OF ALTERNATIVES

4.1 GENERAL

The Project is being implemented by the Partners to provide wastewater service for planned growth and development, and to comply with regulatory mandates issued by the EMC and NC DENR. In accordance with the regulatory mandates, the proposed Project must be operational and discharging effluent to the Cape Fear River by January 1, 2011.

The Project as proposed in this EIS is the culmination of a comprehensive alternatives evaluation which was conducted by the Partners from November 2002 to December 2004. The alternatives evaluation included the following:

1) Identification and evaluation of alternative wastewater discharge locations, and selection of a preferred wastewater discharge location;

2) Identification and evaluation of alternative wastewater management options, and selection of a preferred wastewater management option; and

3) Identification and evaluation of alternative wastewater facility locations, and selection of preferred wastewater facilities locations.

In addition to reviewing alternative wastewater treatment, management and disposal options, the Partners have also reviewed alternative raw wastewater and treated effluent pipeline alignments and pump station locations. This section of the EIS presents the findings of the Alternatives Evaluation conducted by the Partners.

4.2 ALTERNATIVE WASTEWATER DISCHARGE LOCATIONS

In consideration of the regulatory mandates issued by the EMC and DWQ, the Partners conducted an evaluation of alternative wastewater discharge locations. Beginning in January 2003, the Partners initiated consultations with representatives from DWQ to identify and evaluate alternative wastewater discharge location options. The alternative discharge locations reviewed with DWQ included the following:

1) Cape Fear River below Buckhorn Dam
2) New Hope Arm of Jordan Lake (above Jordan Lake Dam and below U.S. 64)
3) Cape Fear River/Haw River above Buckhorn Dam

4) Harris Lake/Utley Creek

Each of these alternatives is described further below.

4.2.1 Cape Fear River below Buckhorn Dam

DWQ representatives indicated that this is the most favorable discharge option for the Partners. The Cape Fear River below Buckhorn Dam was considered most favorable because recently completed water quality modeling suggests that this segment of the Cape Fear River can accommodate additional wastewater effluent loadings without creating unacceptable water quality conditions. The Division has concerns about nutrient loading in this section of the river, but believes it is the best discharge option. Available data indicate that excessive algal growth is occurring behind the lock and dam structures. DWQ evaluated data collected on the Middle Cape Fear River immediately above Buckhorn Dam and behind Lock & Dam No. 3 as part of the Cape Fear River Basinwide Water Quality Management Plan update. Data indicate that there are exceedances of the chlorophyll *a* standard in these locations. If additional analysis conducted by DWQ during the Basinwide Planning process confirms that portions of the river are impaired, they will be included on the 303(d) list submitted to EPA in the April 2006. Inclusion of these river segments on the EPA-approved 303(d) list will require consideration of a Total Maximum Daily Load (TMDL).

On May 24, 2004, the Project Partners submitted to DWQ a request for speculative effluent limits for a discharge to the Cape Fear River below Buckhorn Dam. Because of the concerns regarding nutrient loading, DWQ requested that the Project Partners develop an interim nutrient management strategy to address these issues until the TMDL requirement is further evaluated. Based on the interim nutrient strategy that was developed by the Partners, DWQ issued speculative effluent loading limits on December 15, 2004 including annual mass limits for nutrients based on 6 mg/L total nitrogen and 2 mg/L total phosphorus. In addition, DWQ issued speculative limits for oxygen-consuming wastes of 5/10 mg/L (Summer/Winter BOD_5) and 1/2 mg/L (Summer/Winter NH_3-N). The speculative limits letter is included in Appendix D.

4.2.2 New Hope Arm of Jordan Lake (above Jordan Lake Dam and below U.S 64)

The Partners requested DWQ to review information regarding a discharge to the New Hope Creek arm of Jordan Lake. The Partners determined that there are a number of benefits associated with discharging water reclamation facility effluent to Jordan Lake. The benefits include, but are not limited to, the following:

- Maintaining water supply and water quality pools during extended droughts.
- Keeping water reclamation and conveyance facilities in close proximity to western Wake County local government service areas to encourage additional reuse.
- Reducing facilities required by eliminating longer conveyance to the Cape Fear River below Buckhorn Dam.
- Minimizing the potential and/or perceived water quality impacts downstream of Jordan Lake to downstream users and other interested parties.
- Continuing western Wake County local government efforts toward sound water resources and environmental management.

In addition, the results of the Regional Wastewater Treatment Studies Project Phase I Study indicated that the potential savings in the cost of pumping and conveyance facilities for a Jordan Lake discharge versus a Cape Fear River discharge is on the order of $15- to $20-million.

The upper New Hope Creek arm of Jordan Lake was placed on the 2002 303(d) list for nutrients based on the chlorophyll *a* standard of 40 µg/L. The Division of Water Quality (DWQ) updated a water quality model for the lake upon which to base a TMDL for nutrients. The Partners applied this model to determine the impact of a proposed discharge on chlorophyll a in the lake; the results indicated that there was little difference in the frequency of predicted chlorophyll *a* standard violations. This information was presented to DWQ.

DWQ indicated that the Environmental Protection Agency (EPA) would not allow DWQ to permit an increased pollutant load to an impaired water body if it will exacerbate the water quality impairment. Although the modeling results indicated that predicted water quality is virtually identical with a new discharge achieving state-of-the-art nutrient removal, DWQ indicated that it could not permit an increase in nutrient loading to the lake because the water quality modeling and water quality sampling indicates that Jordan Lake is an impaired water body based on the percentage of exceedances of the chlorophyll *a* standard. DWQ indicated that if the Partners could purchase a nutrient allocation from another discharger in the watershed, then an NPDES permit could be attained. DWQ also indicated that the Partners would need to fund a study which evaluated the impacts of trading with an NPDES facility upstream of Jordan Lake since some loss of nutrients will occur as a nutrient load from an upstream source travels downstream.

4.2.3 Cape Fear River/Haw River above Buckhorn Dam

In earlier studies, some of the Partners evaluated the potential to discharge to either the Haw or Cape Fear Rivers upstream of Buckhorn Dam. DWQ advised them that they should pursue a discharge downstream of Buckhorn Dam based on observed chlorophyll *a* exceedances and unusual variation in dissolved oxygen levels behind Buckhorn Dam. DWQ continues to maintain this position.

4.2.4 Harris Lake/Utley Creek

The Partners also evaluated discharging to Harris Lake. The Town of Holly Springs Utley Creek WWTP currently discharges to Utley Creek, a tributary of Harris Lake. DWQ has informed the Town that it must remove its discharge from Utley Creek because of nutrient-related water quality concerns downstream on Utley Creek and in the White Oak Creek arm of Harris Lake. DWQ encouraged them to evaluate regional wastewater treatment and disposal alternatives.

4.3 ALTERNATIVE WASTEWATER MANAGEMENT OPTIONS

The proposed Project and additional alternatives were evaluated and compared. The factors in this analysis included the following:

1) Effectiveness in meeting the purpose and need
2) Direct environmental impacts
3) Project costs

The categories of environmental impacts would be similar for each of the alternatives. Impacts would differ primarily in the degree to which specific aspects of the environment may be affected. The impacts of the proposed Project and the project alternatives are presented in a comparative form in Table 4-1a.

A description of each alternative and a brief discussion of environmental impacts are presented in the following sections and Table 4-1b. The impacts are evaluated, by category, for all pertinent aspects of the man-made and natural environments. All alternatives would generate some impacts which may be insignificant when considered singularly. However, the collective impacts of any of the alternatives may be significant. For comparison purposes, a linear relationship between conveyance structure length and the number of stream crossings is assumed unless otherwise noted. When possible, direct impacts for the major alternatives are quantified in Table 4-1c.

TABLE 4-1A

Summary of Direct Environmental Effects of Project Alternatives

Evaluation Criteria	Regional System Cape Fear Discharge	Regional System Jordan Lake Discharge	Independent Systems	Land Application	No Action
Man-Made Environment					
Land Use		Similar to preferred	Similar to preferred	Greater than preferred	Less than preferred
Cultural Resources		Similar to preferred	Greater than preferred	Greater than preferred	Less than preferred
Natural Environment					
Topography		Similar to preferred	Greater than preferred	Greater than preferred	Less than preferred
Soils		Less than preferred	Greater than preferred	Greater than preferred	Less than preferred
Prime or Unique Farmland		Less than preferred	Greater than preferred	Greater than preferred	Less than preferred
Water Resources					
Groundwater		Similar to preferred	Similar to preferred	Similar to preferred	Less than preferred
Surface water		Greater than preferred for water quality; Less than preferred for water supply	Similar to preferred	Less than preferred for water quality; Greater than preferred for water supply	Less than preferred
Air Quality		Similar to preferred	Greater than preferred	Greater than preferred	Less than preferred
Noise Levels		Similar to preferred	Greater than preferred	Greater than preferred	Less than preferred
Vegetation resources		Similar to preferred	Greater than preferred	Greater than preferred	Less than preferred
Wetlands		Similar to preferred	Similar to preferred	Greater than preferred	Less than preferred
Terrestrial Wildlife Resources		Similar to preferred	Greater than preferred	Greater than preferred	Less than preferred
Aquatic Wildlife Resources		Similar to preferred	Greater than preferred	Greater than preferred	Less than preferred
Natural and Scenic Areas		Similar to preferred	Greater than preferred	Greater than preferred	Less than preferred
Toxic Substances		Similar to preferred	Similar to preferred	Similar to preferred	Less than preferred

TABLE 4-1B

Direct Environmental Effects of Project Alternatives

Evaluation Criteria	Regional System Cape Fear Discharge	Independent Systems*	Land Application**	No Action
Description of Alternative	-Regional WRF -Beaver Creek PS	-Regional WRF -Beaver Creek WRF - Beaver Creek PS	-Collection WRF -Application Field	No construction activities
Man-Made Environment				
Land Use	-Impacts at the Regional WRF include 69 acres that will be modified from predominantly forested/agricultural land to a utility use. -At the Regional WRF 125 additional acres will remain undeveloped and the land use will not change -Impacts at the Beaver Creek PS will include 4.2 acres of land that will be modified from a forested land use to a utility use. -Impacts along the pipeline routes will be minimal changes to existing land use because most routes follow existing rights of way. -The Partners will require a permanent easement along all pipeline alignments to allow for unobstructed access to the pipelines for routine inspection and maintenance.	-Impacts at the Regional WRF, Beaver Creek PS, and pipeline routes will be the same as the Regional System alternative. -The Beaver Creek WRF would develop 69 acres where the land use will be modified from a forested /agricultural use to a utility use.	-Impacts will include construction and operation of a WRF and associated pipelines, similar to the Regional system. -Approximately 10,300 acres will be required for land application of treated effluent and land use will likely change at this site.	-There will be no land use changes resulting from construction or operational activities.

TABLE 4-1B

Direct Environmental Effects of Project Alternatives

Evaluation Criteria	Regional System Cape Fear Discharge	Independent Systems*	Land Application**	No Action
Cultural Resources	-Potential adverse impacts to the New Hill Historic District and other historic properties are visual, odor, noise, traffic and light-spill. Measures will be in place to mitigate many of these impacts. -A Historic Structure is located within a mile of the Beaver Creek PS and could be impacted by those listed above. -Impacts along the pipeline routes will be minimal due to most routes follow existing rights of way.	-Impacts at the Regional WRF, Beaver Creek PS, and pipeline routes will be the same as described in the Regional System alternative. -Additional impacts will include a WRF facility near the Beaver Creek PS and a Historic Structure, but impacts will be mitigated through similar measures as at the WRF.	-Impacts are difficult to determine without a location for land application and associated facilities. -It is expected that due to the large area needed for this alternative impacts would be greater than the other project alternatives.	-There will be no impacts due to construction or operational activities.
Natural Environment				
Topography	-The proposed site plans for the Regional WRF and Beaver Creek PS would impact approximately 73 acres of soils through construction and grading activities. -Construction of the buried wastewater force mains and effluent transmission mains will involve temporary disturbances to topography. -The existing grade of the topography will be restored after installation of the pipelines.	-Impacts at the Regional WRF, Beaver Creek PS, and pipeline routes will be the same as the Regional System. -At the Beaver Creek WRF an additional 69 acres would be impacted by construction activities that would impact existing topography.	-Impacts will include construction and operation of a WRF and associated pipelines, similar to the Regional system. -It is expected that due to the large area needed for the application field, impacts could be much greater than the other project alternatives.	-There will be no impacts due to construction or operational activities.

TABLE 4-1B

Direct Environmental Effects of Project Alternatives

Evaluation Criteria	Regional System Cape Fear Discharge	Independent Systems*	Land Application**	No Action
Soils	-At the Regional WRF, Beaver Creek PS, and along the pipelines, impacts will be minimized during clearing and grading (some soils will be eroded) by following an approved sedimentation and erosion control plan that conforms to the requirements of the North Carolina Sedimentation Pollution Control Act of 1973 and mulching and seeding with native grasses after grading is completed. In addition, requirements of NPDES stormwater construction permit will be followed.	-Impacts at the Regional WRF, Beaver Creek PS, and pipeline routes will be the same as the Regional System. -Additional impacts from the Beaver Creek WRF will be 69 acres near the Beaver Creek PS where construction activities would impact existing soils.	-Impacts will include construction and operation of a WRF and associated pipelines, similar to the Regional system.	-There will be no impacts due to construction or operational activities.
Prime or Unique Farmlands	- Approximately 38 acres of prime farmland may be impacted at the WRF site based on Wake County soils data.	- Impacts at the Beaver Creek WRF would likely occur.	-Prime farmlands may impacted by the large area needed for the application field	-There will be no impacts due to construction or operational activities.
Water Resources				
Groundwater	-At the Regional WRF and Beaver Creek PS measures will be taken during operation to minimize direct impacts to groundwater quality, including storage of chemicals in covered double containment systems and monitoring. -Groundwater resource impacts after construction at the Regional WRF, Beaver Creek PS and pipelines will be negligible. -Pipelines will be monitored to determine if leaks occur and repairs will be made if leaks are detected.	-Impacts at the Regional WRF, Beaver Creek PS, and pipeline routes will be the same as described in the Regional System alternative. -Additional impacts due the Beaver Creek WRF will be negligible.	-Impacts due to WRF and pipeline operation are expected to be similar to the regional and independent systems alternatives. -Impacts could occur from infiltration of the effluent.	-There will be no impacts due to construction or operational activities.

TABLE 4-1B

Direct Environmental Effects of Project Alternatives

Evaluation Criteria	Regional System Cape Fear Discharge	Independent Systems*	Land Application**	No Action
Surface water	-Impacts will be minimized through a Stormwater Pollution Prevention Plan. -At the Regional WRF and Beaver Creek PS the riparian and forested buffers that will be maintained on site will serve as an additional sedimentation and erosion control measure. -Transmission lines will cross each stream at approximately a 90-degree angle to ensure stability of the line and prevent erosion; or the line will be installed utilizing trenchless technology where practicable. -The combined permitted flow from the proposed Western Wake WRF and from the Holly Springs Utley Creek WRF is 38 mgd at build-out. The in-stream waste concentration during 7Q10 conditions is 10 percent. This change in flow should not impact in-stream aquatic habitat of the Cape Fear River.	-Impacts at the Regional WRF, Beaver Creek PS, and pipeline routes will be the same as the Regional System alternative. -Additional impacts due to the Beaver Creek WRF are not expected due to mitigation measures.	-Impacts due to WRF and pipeline construction and operation are expected to be similar to the regional and independent systems alternatives -During wet weather there are potential impacts for effluent to enter surface waters through runoff. - During drought conditions, the lack of return flow to the Cape Fear River will impact available water in Jordan Lake to meet downstream water release requirements (because additional releases of flow that will be required from the lake to meet river flow targets in comparison to what will be required for either the Regional or Independent Discharge Systems.	-There will be no impacts due to construction or operational activities. - Will not provide return flows to the Cape Fear River in accordance with IBT certificate.
Air Quality	- The Regional WRF biosolids will be transported offsite for final treatment and disposal; therefore, air quality impacts from biosolids management will not occur. -Best management practices and equipment selection will be used to reduce, or eliminate, the potential for nuisance odor migration at the Regional WRF and Beaver Creek PS. -No significant direct impacts to air quality will result from construction of the pipelines for the proposed Project.	-Impacts at the Regional WRF, Beaver Creek PS, and pipeline routes will be the same as the Regional System alternative. -Additional impacts due to operation of the Beaver Creek WRF are expected.	-Impacts due to WRF and pipeline construction and operation are expected to be similar to the regional and independent systems alternatives. -Additional impacts are expected from land application of treated effluent, including increased odor.	-There will be no impacts due to construction or operational activities.

TABLE 4-1B

Direct Environmental Effects of Project Alternatives

Evaluation Criteria	Regional System Cape Fear Discharge	Independent Systems*	Land Application**	No Action
Noise Levels	-Potential sources of operational noise will be located a minimum of 300 feet from the property boundary at the Regional WRF. -Blowers and stand-by-power generators will be part of the regional WRF equipment, these items will be equipped with sound reduction devices and located inside insulated enclosures to minimize noise impacts. -At the Beaver Creek PS only temporary impacts of noise due to back-up generators are expected.	-Impacts at the Regional WRF, Beaver Creek PS, and pipeline routes will be the same as the Regional System alternative. -Some additional impacts due to operation of the Beaver Creek WRF are expected, however a forested buffer would likely mitigate such impacts.	-Impacts due to WRF and pipeline operation are expected to be similar to the regional and independent systems alternatives.	-There will be no impacts due to construction or operational activities.
Vegetation Resources	-At the Regional WRF site, 69 acres will be developed and vegetation cleared. -At the Beaver Creek PS approximately 4.2 acres will be developed and vegetation cleared. -A large portion of the Regional WRF site (125 acres) will remain forested after completion of Phase I and II construction of the WRF. -Easements along all pipeline alignments will permanently reduce vegetation. -Impacts of easements will be minimized by the use of existing rights-of-way	-Impacts at the Regional WRF, Beaver Creek PS, and pipeline routes will be the same as the Regional System. -An additional 69 acres near the Beaver Creek PS will be used for the Beaver Creek WRF, and would be cleared.	-Impacts are difficult to determine without a location for land application and associated facilities, but impacts due to WRF and pipeline construction and operation are expected to be similar to the regional and independent systems alternatives. -It is expected that due to the large area needed for this alternative, impacts, particularly on forested lands, would be much greater than the other project alternatives.	-There will be no impacts due to construction or operational activities.

TABLE 4-1B

Direct Environmental Effects of Project Alternatives

Evaluation Criteria	Regional System Cape Fear Discharge	Independent Systems*	Land Application**	No Action
Wetlands	-The Regional WRF and Beaver Creek PS site plans will be developed to minimize impacts to wetland areas. - Large areas of high quality wetlands that exist on the WRF site have been avoided with the construction layout. -Wetlands will be temporarily impacted where pipelines cross streams, but will be restored upon construction completion. -Approximately 0.9 acres of wetlands will be impacted by the construction of the access road to the WRF and from site construction activities.	-Impacts at the Regional WRF, Beaver Creek PS, and pipeline routes will be the same as the Regional System alternative. -Additional impacts due to construction and operation of the Beaver Creek WRF are not expected.	-Impacts are difficult to determine without a location for land application and associated facilities, but impacts due to WRF and pipeline construction and operation are expected to be similar to the regional and independent systems alternatives. -It is expected that due to the large area needed for this alternative impacts would be much greater than the other project alternatives.	-There will be no impacts due to construction or operational activities.
Terrestrial Wildlife Resources	-At the Regional WRF site, 69 acres will be cleared that will result in a permanent loss of habitat. -Other impacts to wildlife will be displacement due to noise during construction activities (temporary impacts) and operation of the WRF. -The Beaver Creek PS will develop 4.2 acres that will permanently remove habitat. -Long term noise impacts to wildlife will be minimized by housing noise producing machinery in insulated enclosures. -Rights-of-way where pipeline construction is planned currently provides little wildlife habitat due to previous disturbance and maintenance activities.	-Impacts at the Regional WRF, Beaver Creek PS, and pipeline routes will be the same as the Regional System. -An additional 69 acres near the Beaver Creek PS will be used for the Beaver Creek WRF, and construction activities would result in a permanent loss of habitat.	-Impacts are difficult to determine without a location for land application and associated facilities, but impacts due to WRF and pipeline construction and operation are expected to be similar to the regional and independent systems alternatives. -It is expected that due to the large area needed for this alternative impacts would be much greater than the other project alternatives.	-There will be no impacts due to construction or operational activities.

TABLE 4-1B

Direct Environmental Effects of Project Alternatives

Evaluation Criteria	Regional System Cape Fear Discharge	Independent Systems*	Land Application**	No Action
Aquatic Wildlife Resources	-Impacts to aquatic resources will be minimal at the WRF and Beaver Creek PS sites due to a Sedimentation Pollution Control Act and the required stormwater pollution prevention plan. -In order to minimize impacts to fish and other aquatic organisms, the force main and other lines will be directionally bored where practicable. - Impacts to aquatic wildlife could occur during outfall construction; construction details not known at this time.	-Impacts at the Regional WRF, Beaver Creek PS, and pipeline routes will be the same as the Regional System. -An additional 69 acres near the Beaver Creek PS will be used for the Beaver Creek WRF, and impacts are not expected to increase due to mitigation techniques. - Similar impacts to aquatic wildlife during outfall construction as Regional system. However, two outfall structures would be constructed, so slightly higher impacts would occur.	-Due to the large area needed for land application, it is expected that impacts to aquatic resources could be very large due to increased surface runoff as a result of conversion of land to land application which is a form of agriculture	-There will be no impacts due to construction or operational activities.
Natural and Scenic Areas	-The access road to the Regional WRF site is located on Wildlife Resources Commission (WRC) gamelands and approximately 25 acres will be removed from gameland use. Pipeline easements will cross public or recreational lands (gamelands), but impacts should be minimal and temporary in nature. - American Tobacco Trail and game lands located in close proximity to Jordan Lake will be temporarily impacted during construction. -After construction, the ATT and game land areas will be restored to their full-functionality as recreational resources. -The tree canopy along the ATT, in areas that the transmission pipeline will cross, will be preserved to the greatest extent practicable.	-Impacts at the Regional WRF, Beaver Creek PS, and pipeline routes will be the same as the Regional System. -An additional 69 acres near the Beaver Creek PS will be used for the Beaver Creek WRF, and impacts are not expected to increase.	-Due to the large area needed for land application it is expected that impacts to natural and scenic areas would be very large due to the amount of land required.	-There will be no impacts due to construction or operational activities.

TABLE 4-1B

Direct Environmental Effects of Project Alternatives

Evaluation Criteria	Regional System Cape Fear Discharge	Independent Systems*	Land Application**	No Action
Toxic Substances	-Measures will be taken during construction of the Regional WRF and Beaver Creek PS to avoid contamination of soils and water including; storage of chemicals in covered double containment systems and will be monitored to indicate spills. -Impacts from pipelines will be reduced due to monitoring to determine if leaks occur and repairs will be made if leaks are detected. - Impacts to Cape Fear River should be minimal as chlorine will not be used for disinfection.	-Impacts at the Regional WRF, Beaver Creek PS, and pipeline routes will be the same as the Regional System. -An additional 69 acres near the Beaver Creek PS will be used for the Beaver Creek WRF, and impacts are not expected to occur due to mitigation measures. - Impacts to Cape Fear River should be similar to Regional WRF.	-Impacts due to WRF and pipeline construction and operation are expected to be similar to the regional and independent systems alternatives. -Treatment at the WRF will ensure that land application is not toxic.	-There will be no impacts due to construction or operational activities.

*The Independent Systems alternative includes all impacts from the Regional System impacts and additional impacts from a WRF near the Beaver Creek PS site. Impacts associated with the Beaver Creek WRF were based on a general site layout and would change if a detailed site layout was developed. No additional impacts from transmission lines were calculated for the Independent Systems alternative, because routes were not available.

**Land Application impacts are based on a general plan. These impacts do not include impacts from transmission lines. If a detailed site layout for the associated WRF is developed and transmission line locations are known, the listed impacts for the Land Application alternative would increase.

TABLE 4-1C

Summary of Direct Environmental Impacts of Project Alternatives

	Regional System Area Impacted (acres)	Independent Systems Area Impacted (acres)	Land Application Area Impacted (acres)
Total Area[1]	156	209	11700
Land Use[2]			
Bottomland Forest/Hardwood Swamps	20	32	3342
Mixed Hardwoods/Conifers	38	39	2541
Cultivated	0	12	2122
Deciduous Shrubland	1	1	0
Evergreen Shrubland	1	1	1854
Low Intensity Developed	1	1	0
Unconsolidated Sediment	1	1	0
Managed Herbaceous Cover	9	13	949
Mixed Upland Hardwoods	0	0	890
Southern Yellow Pine	85	108	2
Soils			
Prime Farmlands	38	61	3662
Hydric[3]	27	27	1943
Stream Crossings	45 crossings	45 crossings	No data
Forest Resources	143	167	3433

Land Use data is from the best available information and is provided so that relative comparisons can be made. Information on Land Use for the Land application alternative is based on hypothetical site in Wake County, sites in Chatham or Harnett Counties would likely have different land use percentages and thus impacts.

[1]Includes a 54 to 60 foot wide area along the transmission lines for Regional System and Independent Systems (based on the size of pipeline to be installed) to determine impacts. Independent Systems impacts do not include impacts from additional transmission lines. If a detailed site layout for the associated WRF is developed and additional transmission line locations are known, the listed impacts for the Independent Systems alternative would increase.

[2] Impacted Area for Land Application was determined by multiplying total area (11700 acres) by the percent that land use occurs in Wake County. Source: NCGIA BasinPro v 8. This presents a typical scenario since no site has been identified.

[3] Impacted Area For Land Application was calculated by multiplying total area (11700 acres) by the percent of hydric soils in Wake County. Source: Wake County GIS data. This presents a typical scenario since no site has been identified.

4.3.1 The Proposed Project – Regional System with Cape Fear River Discharge

For the proposed Project, a single regional water reclamation facility will be constructed to provide wastewater treatment services for the towns of Apex, Cary, Morrisville, and the Wake County portion of RTP South. Holly Springs will continue to treat wastewater at the Utley Creek WWTP, and the entire discharge from the Utley Creek WWTP will be removed from Harris Lake and conveyed to a common outfall that will serve the Western Wake Regional WRF and the Utley Creek WWTP. The common outfall will discharge treated effluent to the Cape Fear River downstream of Buckhorn Dam.

The Project is being implemented by the Partners to provide wastewater service for planned growth and development, and to comply with regulatory mandates issued by the EMC and NC DENR. In accordance with the regulatory mandates, the proposed Project must be operational and discharging effluent to the Cape Fear River by January 1, 2011.

The proposed Project will be implemented in two phases. The Project Phase 1 facilities, which must be operational by January 1, 2011, will provide for a discharge capacity of 24 million gallons per day (mgd) to the Cape Fear River. The Project Phase 2 facilities, which are projected to be online by July 1, 2020, will provide for a discharge capacity of 38 mgd to the Cape Fear River. The Project Phase 1 and Project Phase 2 facilities will accommodate the wastewater service needs of the Partners to the year 2030.

Facilities for the proposed project are shown on Figure 4-1 and summarized as follows:

4.3.1.1 New Raw Wastewater Transmission Facilities

Raw wastewater transmission facilities would be constructed to convey raw wastewater from the Haw River portion of the Morrisville service area, the West Cary service area, RTP South and the Cape Fear River portion of the Apex service area to the new Western Wake WRF. The raw wastewater transmission facilities would consist of two regional pump stations and associated force mains and gravity sewers. The West Cary Pump Station, force mains and gravity interceptor would convey raw wastewater from the White Oak Creek subbasin to the second regional pump station located in the Beaver Creek subbasin. The West Cary Pump Station is currently under construction as part of another project for the Town of Cary, and the environmental impacts have been assessed in a separate environmental document that has been accepted by NC DENR. The wastewater pipelines discharging to the West Cary Pump Station are being

constructed to handle 2030 flow and are not included as part of this EIS. For this project, the West Cary Pump Station would have an initial peak flow (PF) capacity of approximately 31 mgd and a future (2030) capacity of 44 mgd (PF). The force mains from the West Cary Regional Pump Station would consist of a single 36-inch force main constructed initially, and a parallel 24-inch force main constructed by 2020. The force mains would discharge to a single 54-inch gravity interceptor, which would convey the raw wastewater to the Beaver Creek Pump Station.

The Beaver Creek Pump Station would convey raw wastewater from the Apex White Oak Creek and Beaver Creek service areas, plus raw wastewater from the West Cary Regional Pump Station and water treatment plant residuals from the Cary/Apex Water Treatment Plant (WTP), to the Western Wake WRF. The Beaver Creek Pump Station would have an initial capacity of approximately 40 mgd (PF) and a future (2030) capacity of 58 mgd (PF). The force mains from the Beaver Creek Pump Station would consist of a single 42-inch force main constructed initially, and a parallel 36-inch force main constructed by 2020.

A later project would consist of a new raw wastewater pump station in the North Cary service area, the Upper Crabtree Pump Station, and its associated force main and gravity interceptor, to convey flows in excess of the existing 12 mgd capacity of the North Cary WRF to the Western Wake WRF. The Upper Crabtree Pump Station, force main and gravity interceptor to the West Cary Pump Station are expected to be constructed by 2020. These facilities are not evaluated in this EIS; a separate environmental document will be prepared for these facilities prior to permitting and constructing them.

4.3.1.2 New Water Reclamation Facilities

A new Western Wake WRF, with an initial maximum month average flow (MMF) capacity of 18 mgd and a future (2020-2030) capacity of 30 mgd (MMF), would be constructed along U.S. 1 near New Hill to serve the Cape Fear River portion of the Apex service area, the Haw River portion of the Morrisville service area, the western Cary service area, and RTP South. The new WRF would have an effluent pump station and force mains to allow discharge of treated effluent to the Cape Fear River below Buckhorn Dam. DWQ has indicated that the discharge should be sited downstream of Buckhorn Dam because of water quality concerns upstream of the dam. The discharge would consist of wastewater treated at the new Western Wake WRF and the Town of Holly Springs' Utley Creek WWTP. The 2030 discharge to the Cape Fear River from these two facilities is projected to be approximately 38 mgd at maximum month average

conditions. The effluent force mains would consist of an initial single 48-inch force main, and a second 42-inch parallel force main constructed by 2020.

The new WRF will include biological nutrient removal and will have a high quality effluent suitable for reuse. The WRF is being designed to meet the BOD5, ammonia, solids and nutrient limits outlined in the speculative limits letter included in Appendix D. The effluent will be disinfected using ultraviolet light before being discharged to the Cape Fear River. Biosolids will be thickened onsite, but transported to an offsite facility for disposal. Additional information on the treatment facilities is found in the PER (Appendix B), in technical memoranda 8 through 24. Figure 4-2 outlines the potential disturbed area of the WRF site.

4.3.1.3 Expanded Wastewater Treatment Facilities

The Town of Holly Springs would expand the Utley Creek WWTP to provide an initial expanded capacity of 6 mgd (MMF), and a future (2030) expanded capacity of 8.3 mgd (MMF). The treated effluent from the expanded Utley Creek WWTP would be conveyed to the Western Wake WRF and discharged with the treated effluent from the Western Wake WRF to the Cape Fear River below Buckhorn Dam.

The Apex Middle Creek WWTP would remain in service at its current capacity of 3.6 mgd to treat wastewater flow from the Neuse River portion of the Apex service area. The North and South Cary WRFs would continue to treat wastewater flows from their tributary service areas, and would not be expanded.

4.3.1.4 Other Facilities

A later project would consist of a new effluent pump station at the South Cary WRF and associated force main to ensure compliance with the IBT certificate. The IBT return flow pump station and force main to the Western Wake WRF are expected to be constructed by 2025. These facilities are not evaluated in this EIS; a separate environmental document will be prepared prior to permitting and constructing these facilities.

4.3.1.5 Direct Impact Analysis

Direct impacts of the proposed Project are discussed in Section 5.

4.3.1.6 Project Costs

The costs associated with WRF and infrastructure are summarized in Table 4-2.

TABLE 4-2
Present Worth Costs for Proposed Project

Item	Total Capital Cost	Land/Easement Cost	O&M Cost	Total Capital, Land and O&M Cost	Salvage Value	Total Cost
West Cary Pump Station (Phase I Firm Capacity 31 MGD, Phase II Firm Capacity 44 MGD)						
Phase 1	$6,687,000	$400,000	$1,282,000	$8,369,000	($281,000)	$8,088,000
Phase 2	$904,000	$0	$985,000	$1,889,000	($216,000)	$1,673,000
Subtotal	$7,591,000	$400,000	$2,267,000	$10,258,000	($497,000)	$9,761,000
Force Mains - West Cary to Transition to Gravity (Phase I 36-inch @ 16,150 ft., Phase II 24-inch @ 16,150 ft.)						
Phase 1	$6,725,000	$510,000	$237,000	$7,472,000	($547,000)	$6,925,000
Phase 2	$3,100,000	$0	$43,000	$3,143,000	($484,000)	$2,659,000
Subtotal	$9,825,000	$510,000	$280,000	$10,615,000	($1,031,000)	$9,584,000
Gravity Sewer from West Cary to Beaver Creek Pump Station (Phase I 54-inch @ 11,345 ft.)						
Phase 1	$12,855,000	$261,000	$167,000	$13,283,000	($436,000)	$12,847,000
Phase 2	-	-	-	-	-	-
Subtotal	$12,855,000		$167,000	$13,283,000	($436,000)	$12,847,000
Beaver Creek Pump Station (Phase I Firm Capacity 40 MGD, Phase II Firm Capacity 58 MGD)						
Phase 1	$14,417,000	$580,000	$2,407,000	$17,404,000	($792,000)	$16,612,000
Phase 2	$753,000	$0	$1,958,000	$2,711,000	($180,000)	$2,531,000
Subtotal	$15,170,000	$580,000	$4,365,000	$20,115,000	($972,000)	$19,143,000
Beaver Creek Force Mains to Western Wake WRF (Phase I 42-inch @ 23,560 ft, Phase II 36-inch @ 23,560 ft.)						
Phase 1	$13,985,000	$744,000	$346,000	$15,075,000	($953,000)	$14,122,000
Phase 2	$6,513,000	$0	$63,000	$6,576,000	($880,000)	$5,696,000
Subtotal	$20,498,000	$744,000	$409,000	$21,651,000	($1,833,000)	$19,818,000
Western Wake WRF (Phase I - 18 MGD, Phase II - 30 MGD)						
Phase 1	$97,480,000	$7,585,000	$27,710,000	$132,775,000	($7,199,000)	$125,576,000
Phase 2	$36,377,000	$0	$29,427,000	$65,804,000	($9,634,000)	$56,170,000
Subtotal	$133,857,000	$7,585,000	$57,137,000	$198,579,000	($16,833,000)	$181,746,000

TABLE 4-2
Present Worth Costs for Proposed Project

Item	Total Capital Cost	Land/Easement Cost	O&M Cost	Total Capital, Land and O&M Cost	Salvage Value	Total Cost
Western Wake WRF Effluent Pump Station (Phase I 24 MGD MMF, Phase II 38 MGD MMF)						
Phase 1	$8,726,000	$0	$1,261,000	$9,987,000	($367,000)	$9,620,000
Phase 2	$525,000	$0	$1,520,000	$2,045,000	($95,000)	$1,950,000
Subtotal	$9,251,000		$2,781,000	$12,032,000	($462,000)	$11,570,000
Western Wake Effluent Force Mains to Cape Fear River & Discharge Structure (Phase I 48-inch @ 61,250 ft, Discharge Structure and Diffuser. Phase II 42-inch @ 61,250 ft.)						
Phase 1	$33,998,000	$1,339,000	$923,000	$36,260,000	($2,524,000)	$33,736,000
Phase 2	$15,448,000	$0	$163,000	$15,611,000	($2,714,000)	$12,897,000
Subtotal	$49,446,000	$1,339,000	$1,086,000	$51,871,000	($5,238,000)	$46,633,000
Project Total	$258,493,000	$11,158,000	$68,492,000	$338,404,000	($27,302,000)	**$311,102,000**

Assumptions:
All costs are present worth costs.
Total Capital Cost includes 15% Construction Contingency, 10% Engineering and Construction Services, 5% Legal and Financial costs, Stream Crossing
mitigation costs, and Wetlands mitigation costs.
Financing Interest Rate (Cost of Capital) is assumed to be 5.875%.
O&M Costs for Water Reclamation Facility is assumed to be $1000/MG treated
O&M Costs for Pump Stations assume the following:
(1) Staffing @10 hours per week and a labor cost of $40 per hour, including benefits.
(2) Staffing @ 1 hour per week and a labor cost of $60 per hour, including benefits.
(3) Power cost of $0.07 per kwh.
(4) Mechanical maintenance @ 1 percent of capital cost per year.
(5) Assumes 25 ppm H2S concentration, NaOH @ $0.3/gallon, and NaOCL @ $0.75/gallon, and 6 air changes per hour for Wetwell and Bar Screens.
O&M Costs for pipelines assumed to be $6,700/mile. For parallel force mains the O&M costs for the second FM is assumed to be $3,350/mile.
O&M Costs for Phase I Pump Stations and the WRF includes O&M for the first 10 years.
O&M Costs for Phase II Pump Stations and the WRF includes O&M for the second 10 years.
Salvage Value Assumptions:
Mechanical Equipment is assumed to have a service life of 20 years.
Piping and Structures are assumed to have a service life of 40 years.

4.3.2 Alternative A – Regional System with Jordan Lake Discharge

Alternative A is the same as the proposed project except that the discharge from the Western Wake WRF would be to the lower New Hope Creek arm of Jordan Lake rather than to the Cape Fear River below Buckhorn Dam. Facilities for Alternative A are shown on Figure 4-3.

4.3.2.1 Direct Impact Analysis

This alternative is similar to the preferred alternative and it is assumed that direct impacts associated with construction of the WRFs will be the same as the preferred alternative for the man-made environment and all aspects of the natural environment, except for soils, wetlands and water resources. Since the discharge for this alternative is to Jordan Lake which is in closer proximity to the WRFs it is assumed that less construction associated with conveyance structures will be needed and therefore there will be less soil movement, fewer stream crossings and less direct impacts to wetlands associated with those stream crossings. Based on information compiled during prior project work, the Jordan Lake alternative will include approximately 46,000 feet of force main. The majority of this line will be along existing road with the exception of approximately 2000 feet on the plant site and approximately 950 feet to get to the outfall site from a road near Jordan Lake. From a review of USGS topographical maps, 4 stream crossings would occur under this alternative. Under the preferred alternative, there are 14 stream crossings between the WRF and the Cape Fear River based on hydrography data available from CGIA (2004), and 17 stream crossings in Wake County based on the Wake County stream data layer.

DWQ informed the Project Partners that a direct discharge to Jordan Lake would not be permitted unless they could purchase nutrient allocation from another facility in the watershed. The upper portion of New Hope Creek arm of Jordan Lake is on the 303(d) list and the remainder of the lake has been identified as impaired in the Draft Cape Fear River Basinwide Water Quality Plan (DWQ, 2005). A draft TMDL and nutrient management strategy have been developed, and significant reductions in nitrogen and phosphorus will be needed from the point sources in the watershed. Additional permitted nutrient loads will not be allowed through the TMDL and nutrient management strategy.

From a surface water supply perspective, impacts from this alternative would be less than impacts from the preferred alternative. Rules concerning allocation of water from Jordan Lake require that 50 percent of the safe yield from Jordan Lake be returned to the lake's watershed. Returning water directly to Jordan Lake would enhance its ability

to provide water supply and provide flexibility in managing the water supply and water quality pools within the lake.

4.3.2.2 Project Costs

The costs associated with a discharge to Jordan Lake are summarized in Table 4-3.

4.3.3 Alternative B – Independent Systems

Alternative B, Independent Systems involves the minimum collaboration for wastewater collection and treatment among the Project Partners, and would consist of two new WRFs to serve the western Wake service area. Facilities for Alternative B are shown on Figure 4-4 and summarized in the following sections. For Alternative B, the site locations shown on Figure 4-4 are for illustrative purposes. Actual site locations have not been identified. The site locations shown were logically placed at the bottom of subbasins to maximize the use of gravity sewer construction.

In general, DWQ prefers regional solutions to wastewater management as they generally minimize environmental impacts. Beginning in January 2003, DWQ advised the Partners that it would be preferable for the local governments to work together to identify a regional solution for wastewater management and disposal that would serve the long-range wastewater needs of western Wake County. The Partners have been proceeding in accordance with this guidance.

4.3.3.1 New Raw Wastewater Transmission Facilities

Raw wastewater transmission facilities would be constructed to convey raw wastewater from the western Cary service area and the Cape Fear River portion of the Apex service area to the new Western Cary WRF and to the new Western Apex WRF. The raw wastewater transmission facilities would consist of two new regional pump stations and associated force mains and gravity interceptors.

The West Cary Pump Station and its associated force mains and gravity interceptor would convey raw wastewater from the western Cary service area to the Western Cary WRF. The West Cary Pump Station would have an initial capacity of approximately 31 mgd (PF) and a future (2030) capacity of 44 mgd (PF). The force mains from the West Cary Pump Station would consist of a single 36-inch force main constructed initially, and a parallel 24-inch force main constructed by 2020. The force mains would discharge to a single 54-inch gravity interceptor, which would convey the raw wastewater to the Western Cary WRF.

The Beaver Creek Pump Station would convey raw wastewater from the Apex White Oak Creek and Beaver Creek service areas to the Western Apex WRF. It would also provide treatment for water treatment plant residuals from the Cary/Apex WTP. The Beaver Creek Pump Station would have an initial capacity of approximately 9 mgd (PF) and a future (2030) capacity of 14 mgd (PF). The force mains for the Beaver Creek Pump Station would consist of a single 24-inch force main that increases to a 30-inch force main at Little Beaver Creek constructed initially, and a parallel 18-inch force main constructed by 2020.

A later project would consist of a new raw wastewater pump station in the North Cary service area, the Upper Crabtree Pump Station, and its associated force main and gravity interceptor, to convey flows in excess of the existing 12 mgd capacity of the North Cary WRF to the Western Cary WRF. The Upper Crabtree Pump Station, force main and gravity interceptor to the West Cary Pump Station are expected to be constructed by 2020.

4.3.3.2 New Water Reclamation Facilities

A new Western Cary WRF with an initial capacity of 12 mgd (MMF) and a future (2030) capacity of 18 mgd (MMF) would be constructed at Beaver Creek to serve the western Cary service area, part of the North Cary service area, the Haw River portion of the Morrisville service area, and RTP South. This WRF would have an effluent pump station and force mains and would discharge to the Cape Fear River below Buckhorn Dam.

A new Western Apex WRF with an initial capacity of 6 mgd (MMF) and a future (2030) capacity of approximately 12 mgd (MMF) would be constructed near Little White Oak Creek to serve the Cape Fear River portion of the Apex service area and water treatment plant residuals from the Cary/Apex WTP. Tables 4-1b and 4-1c assume that this WRF would be at the same location as the preferred alternative and therefore have the same impacts as the preferred alternative, The Apex Middle Creek WRF would remain in service at its current capacity of 3.6 mgd to treat wastewater flow from the Neuse River portion of the Apex service area. The Western Apex WRF would also discharge to the Cape Fear River below Buckhorn Dam through separate force mains.

TABLE 4-3
Present Worth Costs for Alternative A - Discharge to Jordan Lake

Item	Total Capital Cost	Land Cost	O&M Cost	Total Capital, Land and O&M Cost	Salvage Value	Total Cost
West Cary Pump Station (Phase I Firm Capacity 31 MGD, Phase II Firm Capacity 44 MGD)						
Phase 1	$6,687,000	$400,000	$1,282,000	$8,369,000	($281,000)	$8,088,000
Phase 2	$904,000	$0	$985,000	$1,889,000	($216,000)	$1,673,000
Subtotal	$7,591,000	$400,000	$2,267,000	$10,258,000	($497,000)	$9,761,000
Force Mains - West Cary to Transition to Gravity (Phase I 36-inch @ 16,150 ft, Phase II 24-inch @ 16,150 ft)						
Phase 1	$6,725,000	$510,000	$237,000	$7,472,000	($547,000)	$6,925,000
Phase 2	$3,100,000	$0	$43,000	$3,143,000	($484,000)	$2,659,000
Subtotal	$9,825,000	$510,000	$280,000	$10,615,000	($1,031,000)	$9,584,000
Gravity Sewer from West Cary to Beaver Creek Pump Station (Phase I 54-inch @ 11,345 ft)						
Phase 1	$12,855,000	$261,000	$167,000	$13,283,000	($436,000)	$12,847,000
Phase 2	-	-	-	-	-	-
Subtotal	$12,855,000		$167,000	$13,283,000	($436,000)	$12,847,000
Beaver Creek Pump Station (Phase I Firm Capacity 40 MGD, Phase II Firm Capacity 58 MGD)						
Phase 1	$14,417,000	$580,000	$2,407,000	$17,404,000	($792,000)	$16,612,000
Phase 2	$753,000	$0	$1,958,000	$2,711,000	($180,000)	$2,531,000
Subtotal	$15,170,000	$580,000	$4,365,000	$20,115,000	($972,000)	$19,143,000
Beaver Creek Force Mains to Western Wake WRF (Phase I 42-inch @ 23,560 ft, Phase II 36-inch @ 23,560 ft)						
Phase 1	$13,985,000	$744,000	$346,000	$15,075,000	($953,000)	$14,122,000
Phase 2	$6,513,000	$0	$63,000	$6,576,000	($898,000)	$5,678,000
Subtotal	$20,498,000	$744,000	$409,000	$21,651,000	($1,851,000)	$19,800,000
Western Wake WRF (Phase I - 18 MGD, Phase II - 30 MGD)						
Phase 1	$97,480,000	$7,585,000	$27,710,000	$132,775,000	($7,199,000)	$125,576,000
Phase 2	$36,377,000	$0	$29,427,000	$65,804,000	($9,634,000)	$56,170,000
Subtotal	$133,857,000	$7,585,000	$57,137,000	$198,579,000	($16,833,000)	$181,746,000

TABLE 4-3
Present Worth Costs for Alternative A - Discharge to Jordan Lake

Item	Total Capital Cost	Land Cost	O&M Cost	Total Capital, Land and O&M Cost	Salvage Value	Total Cost
Western Wake WRF Effluent Pump Station (Phase I 24 MGD MMF, Phase II 38 MGD MMF)						
Phase 1	$8,726,000	$0	$1,261,000	$9,987,000	($367,000)	$9,620,000
Phase 2	$525,000	$0	$1,520,000	$2,045,000	($95,000)	$1,950,000
Subtotal	$9,251,000		$2,781,000	$12,032,000	($462,000)	$11,570,000
Western Wake Effluent Force Mains to Cape Fear River & Discharge Structure (Phase I 48-inch @ 44,600 ft, Discharge Structure and Diffuser. Phase II 42-inch @ 44,600 ft.)						
Phase 1	$26,063,000	$987,000	$678,000	$27,728,000	($1,892,000)	$25,836,000
Phase 2	$12,033,000	$0	$118,000	$12,151,000	($2,062,000)	$10,089,000
Subtotal	$38,096,000	$987,000	$796,000	$39,879,000	($3,954,000)	$35,925,000
Project Total	$247,143,000	$10,806,000	$68,202,000	$326,412,000	($26,036,000)	**$300,376,000**

Assumptions:

All costs are present worth costs.
Total Capital Cost includes 15% Construction Contingency, 10% Engineering and Construction Services, 5% Legal and Financial costs, Stream Crossing
mitigation costs, and Wetlands mitigation costs.
Financing Interest Rate (Cost of Capital) is assumed to be 5.875%.
O&M Costs for Water Reclamation Facility is assumed to be $1000/MG treated
O&M Costs for Pump Stations assume the following:
(1) Staffing @10 hours per week and a labor cost of $40 per hour, including benefits.
(2) Staffing @ 1 hour per week and a labor cost of $60 per hour, including benefits.
(3) Power cost of $0.07 per kwh.
(4) Mechanical maintenance @ 1 percent of capital cost per year.
(5) Assumes 25 ppm H2S concentration, NaOH @ $0.3/gallon, and NaOCL @ $0.75/gallon, and 6 air changes per hour for Wetwell and Bar Screens.
O&M Costs for pipelines assumed to be $6,700/mile. For parallel force mains the O&M costs for the second FM is assumed to be $3,350/mile.
O&M Costs for Phase I Pump Stations and the WRF includes O&M for the first 10 years.
O&M Costs for Phase II Pump Stations and the WRF includes O&M for the second 10 years.
Salvage Value Assumptions:
Mechanical Equipment is assumed to have a service life of 20 years.
Piping and Structures are assumed to have a service life of 40 years.

4.3.3.3 Expanded Wastewater Treatment Facilities

The Town of Holly Springs would expand the Utley Creek WWTP to provide an initial expanded capacity of 6 mgd (MMF), and a future (2030) expanded capacity of 8.3 mgd (MMF). The treated effluent from the expanded Utley Creek WRF would be conveyed to the Western Apex WRF and discharged with the treated effluent from the Western Apex WRF to the Cape Fear River below Buckhorn Dam.

The Middle Creek WWTP would remain in service at its current capacity of 3.6 mgd to treat wastewater flow from the Neuse River portion of the Apex service area. The North and South Cary WRFs would continue to treat wastewater flows from their tributary service areas, and would not be expanded.

4.3.3.4 Other Facilities

A later project would consist of a new effluent pump station at the South Cary WRF and associated force main to convey interbasin transfer (IBT) return flows to the Western Apex WRF effluent force main for discharge to the Cape Fear River below Buckhorn Dam. The IBT return flow pump station and force main to the Western Apex WRF are expected to be constructed by 2025.

4.3.3.5 Direct Impact Analysis

This alternative proposes an additional WRF to the preferred alternative. These two new WRFs will involve construction activities associated at two sites as opposed to one for the preferred alternative. Therefore it is assumed that direct impacts to: topography, soils, air quality, noise levels, vegetation resources, terrestrial and aquatic wildlife resources and natural and scenic areas will be greater, if not doubled, compared to the preferred alternative. It is assumed that erosion and sediment controls at both construction sites will be as effective as the controls at one construction site and therefore direct impacts to water resources will be similar to the preferred alternative. Direct impacts to Cape Fear River water quality will also be similar since ultimate flows and treatment levels to the river would be approximately the same. Also, as in the preferred alternative, some of the impacts such as noise, are temporary, and long term direct impacts from the two WRFs will be similar. Impacts to historic structures may be greater under this alternative than under the preferred alternative. The Callie Lawrence house is on the study list for historic structures. Building a WRF to serve Cary and the Beaver Creek pump station at this site could have greater impacts to the structure than having only the pump station in its vicinity as under the preferred alternative. Table 4-1b and 4-1c summarize the direct impacts and provide quantification of impacts where possible.

Impacts were quantified by assuming that impacts would be similar to the Regional System alternative with additional impacts from the additional WRF. No impacts from additional transmission lines were quantified since routes were not developed.

4.3.3.6 Project Costs

The costs associated with this alternative are summarized in Table 4-4.

4.3.4 Alternative C – Purchasing Capacity from Other Systems

Purchasing wastewater treatment capacity from other systems was included in the preliminary screening of the original 24 wastewater management options and in the detailed evaluation of the seven options selected for detailed evaluation. The systems evaluated for providing capacity for the western Wake County service area included the City of Durham, Durham County and Harnett County. All of these systems have existing treatment facilities that discharge to waters in the Cape Fear River Basin. Only systems that discharge into the Cape Fear River Basin were considered because of the requirements of the IBT certificate (see Appendix C) to return water to the Cape Fear River beginning in 2011.

4.3.4.1 Purchase Capacity from Durham County

The options that involved purchase of capacity from Durham County consisted of conveyance of raw wastewater from the western Wake service area to the Durham County Triangle WWTP. The Town of Cary currently has a contract with Durham County for treatment of raw wastewater from the west Cary service area and the Haw River portion of Morrisville at the Triangle WWTP. The Town of Cary's contract with Durham County expires in 2011, but can be renewed after that date. However, excess capacity at the Durham County Triangle WWTP for wastewater flows from the western Wake service area is projected to be limited beginning in 2011 because of increased flows in the Durham County service area.

The build-out capacity of the Durham County Triangle WWTP is 12 mgd, and the build-out capacity requirements for the western Wake service area is 30 mgd. In addition, given that the New Hope Arm of Jordan Lake has been placed on the 303(d) list and a draft TMDL has been developed, it will be difficult to expand the discharge capacity of the Durham County Triangle WWTP and maintain compliance with the nutrient reduction requirements for nitrogen and phosphorus.

TABLE 4-4
Present Worth Costs for Alternative B

Item	Total Capital Cost	Land Cost	O&M Cost	Total Capital, Land and O&M Cost	Salvage Value	Total Cost
West Cary Pump Station (Phase I Firm Capacity 31 MGD, Phase II Firm Capacity 44 MGD)						
Phase 1	$6,687,000	$400,000	$1,282,000	$8,369,000	($281,000)	$8,088,000
Phase 2	$904,000	$0	$985,000	$1,889,000	($216,000)	$1,673,000
Subtotal	$7,591,000	$400,000	$2,267,000	$10,258,000	($497,000)	$9,761,000
Force Mains - West Cary to Transition to Gravity (Phase I 36-inch @ 16,150 ft, Phase II 24-inch @ 16,150 ft)						
Phase 1	$6,725,000	$510,000	$237,000	$7,472,000	($547,000)	$6,925,000
Phase 2	$3,100,000	$0	$43,000	$3,143,000	($484,000)	$2,659,000
Subtotal	$9,825,000	$510,000	$280,000	$10,615,000	($1,031,000)	$9,584,000
Gravity Sewer to Western Cary Water Reclamation Facility (54-inch @ 14,845 ft)						
Phase 1	$17,986,000	$376,000	$241,000	$18,603,000	($621,000)	$17,982,000
Phase 2	-		-	-	-	-
Subtotal	$17,986,000		$241,000	$18,603,000	($621,000)	$17,982,000
Western Cary Water Reclamation Facility (12 mgd MMF Phase I, 18 mgd MMF Phase II)						
Phase 1	$78,090,000	$7,000,000	$19,891,000	$104,981,000	($5,876,000)	$99,105,000
Phase 2	$15,564,000	$0	$18,421,000	$33,985,000	($3,995,000)	$29,990,000
Subtotal	$93,654,000	$7,000,000	$38,312,000	$138,966,000	($9,871,000)	$129,095,000
Western Cary WRF Effluent Pump Station (Phase I 12 MGD MMF, Phase II 18 MGD MMF)						
Phase 1	$6,987,000	$0	$1,350,000	$8,337,000	($294,000)	$8,043,000
Phase 2	$405,000	$0	$1,234,000	$1,639,000	($86,000)	$1,553,000
Subtotal	$7,392,000	$0	$2,584,000	$9,976,000	($380,000)	$9,596,000
Western Cary Effluent Force Mains to Cape Fear River (Phase I 42-inch @ 84,810 ft, Phase II 30-inch @ 84,810 ft)						
Phase 1	$39,850,000	$2,024,000	$1,247,000	$43,121,000	($3,066,000)	$40,055,000
Phase 2	$18,391,000	$0	$225,000	$18,616,000	($3,176,000)	$15,440,000
Subtotal	$58,241,000	$2,024,000	$1,472,000	$61,737,000	($6,242,000)	$55,495,000

TABLE 4-4
Present Worth Costs for Alternative B

Item	Total Capital Cost	Land Cost	O&M Cost	Total Capital, Land and O&M Cost	Salvage Value	Total Cost
Beaver Creek Pump Station (Phase I 9 MGD firm capacity, Phase II 14 MGD firm capacity)						
Phase 1	$5,061,000	$580,000	$861,000	$6,502,000	($398,000)	$6,104,000
Phase 2	$345,000	$0	$668,000	$1,013,000	($73,000)	$940,000
Subtotal	$5,406,000	$580,000	$1,529,000	$7,515,000	($471,000)	$7,044,000
Beaver Creek Force Mains to Western Apex WRF (Phase I 24-inch @ 16,815 ft and 30-inch @ 6,745 ft, Phase II 18-inch @ 23,560 ft)						
Phase 1	$9,666,000	$744,000	$346,000	$10,756,000	($737,000)	$10,019,000
Phase 2	$3,452,000	$0	$63,000	$3,515,000	($574,000)	$2,941,000
Subtotal	$13,118,000	$744,000	$409,000	$14,271,000	($1,311,000)	$12,960,000
Western Apex WRF (Phase I 6 MGD MMF, Phase II 12 mgd MMF)						
Phase 1	$56,910,000	$5,500,000	$8,991,000	$71,401,000	($4,338,000)	$67,063,000
Phase 2	$10,610,000	$0	$12,613,000	$23,223,000	($2,728,000)	$20,495,000
Subtotal	$67,520,000	$5,500,000	$21,604,000	$94,624,000	($7,066,000)	$87,558,000
Western Apex WRF Effluent Pump Station (Phase I 20 MGD MMF - includes Holly Springs flow)						
Phase 1	$5,486,000	$0	$1,211,000	$6,697,000	($231,000)	$6,466,000
Phase 2	-	-	-	-	-	-
Subtotal	$5,486,000		$1,211,000	$6,697,000	($231,000)	$6,466,000
Western Apex Effluent Force Mains to Cape Fear River (Phase I 42-inch @ 61,250 ft, Phase II 36-inch @ 61,250 ft)						
Phase 1	$28,373,000	$1,280,000	$901,000	$30,554,000	($2,140,000)	$28,414,000
Phase 2	$13,461,000	$0	$163,000	$13,624,000	($2,341,000)	$11,283,000
Subtotal	$41,834,000	$1,280,000	$1,064,000	$44,178,000	($4,481,000)	$39,697,000
Western Wake Effluent Discharge Structure and Diffuser (Phase I Discharge Structure, 60-inch effluent @ 1500 ft., and diffuser)						
Phase 1	$2,224,000	$60,000	$22,000	$2,306,000	($494,000)	$1,812,000
Phase 2						$0
Subtotal	$2,224,000	$60,000	$22,000	$2,306,000	($494,000)	$1,812,000
Project Total	**$330,277,000**	**$18,098,000**	**$70,995,000**	**$419,746,000**	**($32,696,000)**	**$387,050,000**

Table 4-4
Present Worth Costs for Alternative B

Assumptions:

All costs are present worth costs.
Total Capital Cost includes 15% Construction Contingency, 10% Engineering and Construction Services, 5% Legal and Financial costs, Stream Crossing
mitigation costs, and Wetlands mitigation costs.
Financing Interest Rate (Cost of Capital) is assumed to be 5.875%.
O&M Costs for Water Reclamation Facility is assumed to be $1000/MG treated
O&M Costs for Pump Stations assume the following:
(1) Staffing @10 hours per week and a labor cost of $40 per hour, including benefits.
(2) Staffing @ 1 hour per week and a labor cost of $60 per hour, including benefits.
(3) Power cost of $0.07 per kwh.
(4) Mechanical maintenance @ 1 percent of capital cost per year.
(5) Assumes 25 ppm H2S concentration, NaOH @ $0.3/gallon, and NaOCL @ $0.75/gallon, and 6 air changes per hour for Wetwell and Bar Screens.
O&M Costs for pipelines assumed to be $6,700/mile. For parallel force mains the O&M costs for the second FM is assumed to be $3,350/mile.
O&M Costs for Phase I Pump Stations and the WRF includes O&M for the first 10 years.
O&M Costs for Phase II Pump Stations and the WRF includes O&M for the second 10 years.
Salvage Value Assumptions:
Mechanical Equipment is assumed to have a service life of 20 years.
Piping and Structures are assumed to have a service life of 40 years.

Finally, this option would require the Town of Holly Springs to independently construct an outfall to the Cape Fear River, which would increase project costs for the Town.

4.3.4.2 Purchase Capacity from City of Durham

The option that involved purchase of capacity at the South Durham WRF from the City of Durham would involve the construction of a new wastewater conveyance system to deliver wastewater from the western Wake service area to the South Durham WRF, as well as an expansion of the South Durham WRF to provide capacity for the flows from the western Wake service area. This option was not selected for detailed evaluation in the Western Wake County Regional Wastewater Treatment Studies project because of: (1) increased institutional complexity associated with a new interlocal agreement with the City of Durham, (2) increased NPDES permitting requirements associated with expanding the capacity of the South Durham WRF and also providing a new discharge for the rest of the western Wake service area, and (3) less reclaimed water potential for the western Wake service area since the wastewater treatment would not be occurring in Wake County.

The current capacity of the South Durham WRF is 20 mgd, and the projected wastewater flows to the South Durham WRF are 30 mgd. The build-out capacity requirements for the western Wake service area is 30 mgd. In addition, given that the New Hope Arm of Jordan Lake has been placed on the 303(d) list and a draft TMDL has been developed, it will be difficult to expand the discharge capacity of the South Durham WRF and maintain compliance with the nutrient reduction requirements for nitrogen and phosphorus.

Finally, this option would require the Town of Holly Springs to independently construct an outfall to the Cape Fear River, which would increase project costs for the Town.

4.3.4.3 Purchase Capacity from Harnett County

The option of purchasing capacity from Harnett County is currently being pursued under a separate agreement between the Town of Fuquay-Varina and Harnett County. The Harnett County facilities do not have sufficient excess capacity to accommodate the 2030 demands for the western Wake service area. Therefore, purchase of capacity from Harnett County is not a feasible option for the western Wake service area.

4.3.4.4 Direct Impact Analysis

The direct impacts of this alternative were not assessed because it was not considered a feasible alternative to the proposed project in section 4.3.1. Only facilities in the Cape Fear River Basin were considered for this alternative in order to meet the conditions of the IBT certificate (See Appendix C).

4.3.4.5 Project Costs

Since this alternative is not feasible, the project costs were not evaluated.

4.3.5 **Alternative D – No Action**

The "no action" alternative is not considered a feasible alternative because existing treatment facilities do not have adequate capacity to meet treatment capacity needs for the 20-year planning period. In addition, the no action alternative would not meet the requirement of the IBT certificate (See Appendix C) to return water to the Cape Fear River by 2011, nor would it meet DWQ's requirement to remove Holly Springs' current wastewater discharge from Harris Lake. The no action alternative would require future development to be served by private wastewater treatment facilities or septic systems. Use of private wastewater treatment facilities is not acceptable because such facilities are likely to result in poor quality effluent discharged to receiving streams, including tributaries to Jordan Lake, Harris Lake, and the Cape Fear River upstream of Buckhorn Dam. Septic systems are also not acceptable because most of the soils in the service area have moderate to severe limitations for septic tanks, and because projected development is expected to be at urban densities throughout the service area. While the soil characteristics do not preclude the use of septic tanks in all cases, development standards for projects within the extraterritorial jurisdictions (ETJs) of the Towns in the western Wake service area encourage connection to a sewer system to make a project economically viable. Based on these factors, the "no action" alternative is not considered a feasible alternative to the proposed project.

4.3.5.1 Direct Impact Analysis

The direct impacts of this alternative will be less than the preferred alternative since no new construction activities will take place. However, this alternative does not meet the requirement of the IBT certificate (See Appendix C) to return water to the Cape Fear River by 2011, and it does not meet the long term growth needs of the communities.

While secondary and cumulative impacts are being addressed through the Secondary and Cumulative Impacts Master Mitigation Plans, those documents were developed for

the proposed infrastructure that will meet growth needs. The No Action alternative will not support the population projections included in that plan, but secondary and cumulative impacts will still occur. In general, population impacts will be over a greater area on larger lots promoting sprawl. Much of this growth will fall under thresholds established for stormwater control, erosion and sediment control, and other programs implemented by the local governments to minimize the environmental impacts of growth.

4.3.5.2 Project Costs

There are no new capital costs associated with this alternative.

4.3.6 Alternative E – Optimum Operation of Existing Facilities

4.3.6.1 Town of Apex and Town of Cary

The Town of Apex and the Town of Cary currently operate wastewater treatment facilities that discharge to the Neuse River Basin. The alternative of providing optimum operation of existing facilities would not provide adequate capacity to accommodate long-term wastewater treatment capacity needs, nor would this alternative satisfy the IBT certificate requirement (See Appendix C) to return treated effluent to the Cape Fear River by 2011. Finally, given that the Neuse River has been placed on the 303(d) list and a TMDL has been developed for total nitrogen, it will be difficult to expand the discharge capacity of the Apex and Cary wastewater facilities and maintain compliance with the nutrient reduction requirements for nitrogen.

4.3.6.2 Town of Holly Springs

The Town of Holly Springs operates a wastewater treatment facility that discharges to Harris Lake. The alternative of providing optimum operation of existing facilities would not comply with DWQ's requirement for the Town to remove its discharge from Harris Lake.

4.3.6.3 Direct Impact Analysis

The direct impacts of this alternative were not assessed because it was not considered a feasible alternative to the proposed project in section 4.2.6. Also, this alternative does not meet the requirement of the IBT certificate (See Appendix C) to return water to the Cape Fear River by 2011.

4.3.6.4 Project Costs

Since this alternative is not feasible, the project costs were not evaluated.

4.3.7 Alternative F – Land Application

The land application alternative would involve the construction of secondary-type treatment facilities followed by land application to a dedicated land application site. The land application site would have a cover crop to take up the moisture and nutrients from the wastewater effluent. The land area required for land application of a wastewater volume equal to the 18-mgd capacity of the Project Phase 1 for the proposed Western Wake WRF is estimated at approximately 6,300 acres. This is based on a land application rate of approximately ¾ inches per week through a spray irrigation system. The spray fields would be cultivated with suitable annual crops. Additional land would be required for buffers around the site, for facilities for the treatment of the raw wastewater, and for operation and maintenance buildings.

Based on a conventional secondary treatment system, and the requirements for on-site effluent storage, the additional land area required for treatment and storage facilities is estimated at approximately 700 acres, for a total area of approximately 7,000 acres. This land area would only be sufficient for the Project Phase 1 (2020) capacity for the western Wake service area, and a total area of approximately 11,700 acres (10,300 acres for land application and 1,400 acres for buffers and other facilities) would be required to meet the 30-mgd capacity needs through the planning period (to year 2030). Finding a suitable land application site within a reasonable distance of the western Wake service area is unlikely. Use of this land for land application of wastewater would also raise water quality concerns because available land in close proximity to the western Wake service area drain to Jordan Lake, the Cape Fear River upstream of Buckhorn Dam, or Harris Lake. This would mean that suitable land would have to be found in Chatham or Harnett Counties. This would require working with additional local governments and a greater number of property owners which will make permitting more difficult. In addition, the high cost of the land required, plus the additional facilities for pretreatment and raw wastewater transportation, would make this alternative more costly than the proposed Project. For these reasons, land application is not considered a feasible alternative.

4.3.7.1 Direct Impact Analysis

Direct impacts to land use would be greater than the preferred alternative due to the large area of land (10,300 acres) needed for application. Direct impacts to groundwater would be similar to the preferred alternative. It is assumed that pretreatment of wastewater would be to a level that would not impact groundwater resources and thus, impacts to groundwater quality would be similar. This alternative could improve

groundwater recharge, and thus, impacts to groundwater quantity would be less. Impacts to surface water quality would likely be less than impacts under the preferred alternative. Discharging treated effluent to land would reduce nutrient impacts to the Cape Fear River; DWQ has indicated that the Cape Fear River will likely be included on the 2006 303(d) list due to elevated nutrients. However, surface water impacts to quantity would be more than the preferred alternative. The proposed discharge to the Cape Fear River will require less water to be released from Jordan Lake to meet downstream flow targets that maintain water quality and available supply for downstream users on the Cape Fear River. If all of the wastewater is land applied, this water will not be available to maintain flow targets under low flow/extended drought conditions. Direct impacts to cultural resources, noise, wetlands, topography, soils, vegetation, wetlands, aquatic and terrestrial wildlife, and natural and scenic areas would be greater than the preferred alternative due to the greater amount of conveyance facilities, and the associated stream crossings and other unavoidable impacts that this alternative would require. Many of the noise impacts would be temporary during construction. Tables 4-1b and 4-1c summarize direct impacts and provide quantification of impacts where possible. Since no site location for the Land Application alternative was selected in this analysis, direct impacts were quantified for a hypothetical site in Wake County. For each of the categories analyzed in Table 4-1c, data was obtained for all of Wake County. Percentages of those categories were then determined, and these percentages were then multiplied by the 11,700 acres needed for the Land Application alternative. This analysis is presented as a general comparison only. If a site location for the Land Application alternative was selected or a hypothetical site was considered in the counties neighboring Wake (Chatham or Harnett), the impacts would most likely change.

4.3.7.2 Project Costs

The costs associated with this alternative are summarized in Table 4-5.

4.3.8 **Alternative G – Water Reuse System**

Water reuse systems in the Piedmont region of North Carolina are generally irrigation-based systems that experience high demands during the hot, dry summer season, and little to no demands during the cool, wet winter season. Data collected by the Town of Cary in its Northeast Reclaimed Water Service Area indicated that reclaimed water customers used the same amount of potable water in winter as non-reclaimed water users, and used less in the summer (CDM and Hazen & Sawyer, 2004).

Because a reclaimed water system in the Piedmont region of North Carolina offers limited disposal capacity in the cool, wet winter season, water reuse is not considered a feasible option. Under this alternative it would still be necessary to construct 38 mgd of wastewater treatment and disposal capacity to accommodate the 2030 demands for the Partners during the cool, wet winter season. In addition, in order to comply with the regulatory mandates of the EMC and DWQ, reuse opportunities during the high demand summer months would need to be in the Cape Fear River Basin and the discharge location for effluent disposal during the cool, wet winter season would need to be in the Cape Fear River downstream of Buckhorn Dam.

It is important to note that while it is not deemed feasible to achieve 100-percent effluent disposal via a reclaimed water program, the Partners are committed to maintaining and expanding the existing reclaimed water programs. The Western Wake WRF will be planned and designed to provide reclaimed water for non-potable uses to residents, businesses and industries located in close proximity to the facility.

4.3.8.1 Direct Impact Analysis

The direct impacts of this alternative were not assessed because it was not considered a feasible alternative to the proposed Project. As indicated in Section 4.3.8, treatment and disposal facilities are still required (and could require multiple treatment systems) and may add additional conveyance and storage facilities.

TABLE 4-5
Present Worth Costs for Alternative F - Land Application

Item	Total Capital Cost	Land Cost	O&M Cost	Total Capital, Land and O&M Cost	Salvage Value	Total Cost
West Cary Pump Station (Phase I Firm Capacity 31 MGD, Phase II Firm Capacity 44 MGD)						
Phase 1	$6,687,000	$400,000	$1,282,000	$8,369,000	($281,000)	$8,088,000
Phase 2	$904,000	$0	$985,000	$1,889,000	($216,000)	$1,673,000
Subtotal	$7,591,000	$400,000	$2,267,000	$10,258,000	($497,000)	$9,761,000
Force Mains - West Cary to Transition to Gravity (Phase I 36-inch @ 16,150 ft, Phase II 24-inch @ 16,150 ft)						
Phase 1	$6,725,000	$510,000	$237,000	$7,472,000	($547,000)	$6,925,000
Phase 2	$3,100,000	$0	$43,000	$3,143,000	($484,000)	$2,659,000
Subtotal	$9,825,000	$510,000	$280,000	$10,615,000	($1,031,000)	$9,584,000
Gravity Sewer from West Cary to Beaver Creek Pump Station (Phase I 54-inch @ 11,345 ft)						
Phase 1	$12,854,600	$260,400	$166,800	$13,281,800	($436,400)	$12,845,400
Phase 2	-	-	-	-	-	-
Subtotal	$12,854,600		$166,800	$13,281,800	($436,400)	$12,845,400
Beaver Creek Pump Station (Phase I Firm Capacity 40 MGD, Phase II Firm Capacity 58 MGD)						
Phase 1	$14,417,000	$580,000	$2,407,000	$17,404,000	($792,000)	$16,612,000
Phase 2	$753,000	$0	$1,958,000	$2,711,000	($180,000)	$2,531,000
Subtotal	$15,170,000	$580,000	$4,365,000	$20,115,000	($972,000)	$19,143,000
Beaver Creek Force Mains to Western Wake WRF (Phase I 42-inch @ 70,700 ft, Phase II 36-inch @ 70,700 ft)						
Phase 1	$38,762,000	$2,232,000	$1,040,000	$42,034,000	($3,151,000)	$38,883,000
Phase 2	$19,546,000	$0	$188,000	$19,734,000	($5,763,000)	$13,971,000
Subtotal	$58,308,000		$1,228,000	$61,768,000	($8,914,000)	$52,854,000
Western Wake WRF (Phase I - 18 MGD, Phase II - 30 MGD)						
Phase 1	$83,999,000	$3,200,000	$27,710,000	$114,909,000	($6,219,000)	$108,690,000
Phase 2	$32,772,000	$0	$29,427,000	$62,199,000	($8,696,000)	$53,503,000
Subtotal	$116,771,000	$3,200,000	$57,137,000	$177,108,000	($14,915,000)	$162,193,000

TABLE 4-5
Present Worth Costs for Alternative F - Land Application

Item	Total Capital Cost	Land Cost	O&M Cost	Total Capital, Land and O&M Cost	Salvage Value	Total Cost
Western Wake WRF Land Application Facilities (Phase I - 18 MGD, Phase II - 30 MGD)						
Phase 1	$41,472,000	$184,000,000	$6,640,000	$232,112,000	($62,979,000)	$169,133,000
Phase 2	$16,025,000	$0	$5,401,000	$21,426,000	($3,528,000)	$17,898,000
Subtotal	$57,497,000	$184,000,000	$12,041,000	$253,538,000	($66,507,000)	$187,031,000
Project Total	$278,016,600	$188,690,000	$77,484,800	$546,683,800	($93,272,400)	**$453,411,400**

Assumptions:
All costs are present worth costs.
Total Capital Cost includes 15% Construction Contingency, 10% Engineering and Construction Services, and 5% Legal and Financial costs.
Total Capital Cost includes Streams and Wetlands Mitigation Cost.
Financing Interest Rate (Cost of Capital) is assumed to be 5.875%.
O&M Costs for Water Reclamation Facility is assumed to be $1000/MG treated
O&M Costs for Pump Stations assume the following:
(1) Staffing @10 hours per week and a labor cost of $40 per hour, including benefits.
(2) Staffing @ 1 hour per week and a labor cost of $60 per hour, including benefits.
(3) Power cost of $0.07 per kwh.
(4) Mechanical maintenance @ 1 percent of capital cost per year.
(5) Assumes 25 ppm H2S concentration, NaOH @ $0.3/gallon, and NaOCL @ $0.75/gallon, and 6 air changes per hour for Wetwell and Bar Screens.
O&M Costs for pipelines assumed to be $6,700/mile. For parallel force mains the O&M costs for the second FM is assumed to be $3,350/mile.
O&M Costs for Phase I Pump Stations and the WRF includes O&M for the first 10 years.
O&M Costs for Phase II Pump Stations and the WRF includes O&M for the second 10 years.
Salvage Value Assumptions:
Mechanical Equipment is assumed to have a service life of 20 years.
Piping and Structures are assumed to have a service life of 40 years.

4.3.8.2 Project Costs

Because this is not a feasible alternative, cost estimates were not developed for this option.

4.4 ALTERNATIVE WATER RECLAMATION FACILITY SITES

The WRF site selection process has been conducted in three phases, and the Project Partners have considered both technical factors and service factors to identify a preferred water reclamation facility site. A more expanded discussion of the WRF site selection process is presented in PER TM 05 (Appendix B). As part of the site selection process an Environmental Justice Assessment was prepared and is included in Appendix G.

4.4.1 WRF Site Selection Process Overview

Site Selection was accomplished in a three phase process. This process was in addition to the two phase study that was performed to determine the project alternatives (Western Wake County Regional Wastewater Treatment Studies Project: Phase I study was conducted from November 2002 to September 2003 and Western Wake County Regional Wastewater Treatment Studies Project: Phase II was conducted from October 2003 to July 2004). WRF Site Selection Phase I (January 2004) was conducted using broad evaluation criteria and previous reports to identify 29 general areas that could possibly support a new WRF. During Phase I of the WRF site selection process, the Project Partners were concurrently evaluating four alternative wastewater management options: Option 1, Option 5, Option 9, and Modified Option 10D as described in Section 2.2.3.2. The four wastewater management options under consideration proposed to construct either one or two new water reclamation facilities to serve the wastewater treatment service needs of all four Partners.

To accommodate the service area demands and wastewater treatment service needs (service factors) of the Project Partners, the WRF site selection process focused on four drainage sub-basins located in western Wake County. The four drainage sub-basins were White Oak Creek at Jordan Lake, Beaver Creek (tributary to Jordan Lake), Little White Oak Creek (tributary to Harris Lake), and White Oak Creek at Harris Lake. All of these drainage sub-basins are located north and west of the Holly Springs' service area, which was used to define the southern most boundary for the site selection process.

Using the selected criteria, as well as information and data from previous reports, 29 areas that could possibly support a new WRF were identified. A map presenting the

general location of the 29 areas is shown on Figure 4-5. Once the 29 general areas were identified, the Project Partners conducted general visual inspections from the public right-of-way for each area. Using the broad evaluation criteria and general visual inspections, the Project Partners selected 12 sites for additional data collection and analysis.

4.4.2 Phase II WRF Site Selection Process

WRF Site Selection Phase II (July 2004) was conducted using site-specific information and data (technical factors) to compare the 12 short listed sites on features as number of property owners, number of residences, wetland area, site slope conditions, number of streams, and other features and characteristics that could be quantified using readily available information and data. Using the technical factors as well as weighting factors, a technical score was calculated for each of the 12 sites. Once the technical scores were calculated, each site was ranked based on its respective technical score. The weighted scores and overall rankings for the 12 shortlisted sites are shown in Table 4-6. Further information on the scoring criteria is found in PER TM 05 (Appendix B).

TABLE 4-6
Weighted Technical Scores and Ranking for Phase II Site Selection

Site No.	3	6	9	11/12	14	16	20	21	22	25	26	28
Property Owners	7.5	5.1	6.3	3.5	2.3	3.5	1.5	1.9	1.9	2.5	2.1	2.9
Existing Land Use	7.5	6.4	3.8	4.1	1.5	3.5	1.5	1.5	1.8	1.5	1.8	2.6
Adjacent Land Use	5.0	2.9	2.9	1.5	3.1	2.7	1.0	1.1	1.2	1.7	1.8	2.1
County Location	1.0	3.0	1.0	5.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Impact on Project Costs	1.4	1.5	0.9	1.0	1.1	1.3	1.4	1.2	1.3	0.5	2.5	0.5
Environmental	5.0	3.7	1.3	2.5	3.7	1.8	1.0	1.0	3.5	1.0	3.2	1.0
Other/Miscellaneous	5.0	1.0	1.0	1.0	1.0	1.0	1.0	5.0	1.0	1.0	1.0	1.0
Area Ratio	1.5	1.5	7.5	1.5	1.5	5.0	5.2	4.4	1.5	4.6	4.4	1.5
Distance to Proposed Site	1.5	2.5	4.9	3.6	5.9	5.0	6.7	7.1	7.5	5.8	5.8	7.0
Total Weighted Score	35.4	27.5	29.7	23.7	21.2	24.6	20.4	24.3	20.7	19.5	23.6	19.6
Rank	12	10	11	7	5	9	3	8	4	1	6	2

Concurrent with completing the scoring for Phase II of the site selection process, the Project Partners selected Modified Option 10D as the preferred wastewater management solution. Each of the four options (Options 1, 5, 9, and Modified 10D) selected for additional evaluation were determined to be equal with respect to level of service, quality of service, regulatory review and approval requirements, and technical

complexity. With each of these factors judged to be relatively equal, Modified Option 10D was selected because it represented the lowest present-worth cost (capital and O&M) for the Project Partners. Under the recommended Modified Option 10D, a single regional WRF will be constructed to provide wastewater treatment for the Towns of Apex, Cary, Morrisville, and the Wake County portion of Research Triangle Park (RTP South), and Holly Springs will not use a regional water WRF for wastewater treatment.

While the use of technical factors is important for comparing the quantifiable features and characteristics of the 12 alternative sites, the Project Partners have also considered service factors as part of the WRF site selection process to ensure that the selected sites are financially, technically and environmentally feasible with regard to service area demands and needs – in addition to having favorable technical features and characteristics. Service factors considered for Phase II of the WRF site selection process include the location of (a) the service area demands, (b) the wastewater treatment service needs, and (c) the wastewater discharge.

Given that Holly Springs will not use the regional WRF for wastewater treatment, all potential WRF sites located south of US 1, as well as Site 16, were deemed less favorable due to service factor considerations. Although detailed cost estimates were not prepared during Phase II of the WRF site selection process, it has since been concluded that project costs would increase due to the increased distance that raw wastewater and treated effluent would have to be conveyed to accommodate sites located south of US 1 and Site 16. In addition, the longer pipeline lengths will increase the environmental and community impacts associated with additional pipeline construction.

Service factor considerations also eliminated Site 3 and Site 6 from further consideration because the cost to deliver raw wastewater from the Town of Apex service area to Site 3 and Site 6 would increase program costs beyond the costs expected for other possible sites (Site 9, 11/12 and 14). In addition, the number of impacted property owners and residents requiring relocation at Site 3 and Site 6 was deemed to be unacceptable.

Based on the consideration of technical factors and service factors, the Partners identified three sites for additional study. The three sites selected were Sites 8, 11/12 and 14 (Figures 4-6, 4-7, and 4-8). The Partners elected to evaluate Site 8, which was not one of the original 12 shortlisted sites, because of its close proximity to Site 9, which was one of the sites selected for detailed evaluation. Site 8 was also being considered as a possible site for the Beaver Creek PS. By selecting Site 8 for final study, the

Partners could determine if cost-savings for the Project could be realized by locating the Western Wake WRF at the proposed site for the Beaver Creek PS, thereby potentially eliminating the need – and costs – for the Beaver Creek PS.

4.4.3 Phase III WRF Site Selection Process

Phase III (November 2004) was conducted using the site-specific information and data collected during Phase II to prepare facility site plans and conduct engineering analyses for three alternative sites. During Phase III, the facility site plans and engineering analyses were based on the implementation of the recommended Modified Option 10D as the preferred wastewater management solution.

The site-specific facility site plans and engineering analyses were used to prepare capital cost estimates for each site. Once the capital cost estimates were complete, a weighted-score was calculated for each of the three sites based on the factors shown in Table 4-7. Each site was ranked based on its weighted score and a preferred site for field investigations was selected. Environmental considerations were not included as a criterion since detailed site layouts were prepared with the facilities placed outside of wetlands, gamelands and stream buffers and no other environmental considerations were identified on these three sites. Further information is found in PER TM 05 (Appendix B).

Based on the data collected and engineering analyses conducted, scores were calculated for each evaluation factor using the methodology conducted for Phase II of the WRF site selection process. The Project Cost factor, though very important in terms of its effects on rate payers in each municipality, was given a lower weight (0.5) because the cost estimates were similar for the three sites based on planning level estimates. The present worth cost for the alternative WRF sites is presented in Table 4-8. The weighting factors used, the combined site scores, and the site rankings are shown in Table 4-7.

TABLE 4-7
WRF Site Weighting Factors, Weighted Scores, and Ranks

Factor	Weighting Factor	Site 8	Site 11/12	Site 14
No. of Property Owners	1.5	3.50	7.50	1.50
Existing Land Use	1.5	3.50	7.50	1.50
Adjacent Land Use	1.0	1.00	2.07	5.00
County Location	1.0	1.00	5.00	1.00
Project Cost	0.5	2.25	2.5	0.5
Expansion Potential	1.0	5.00	1.00	1.00
Combined Score		**16.25**	**25.57**	**10.50**
RANK		**2**	**3**	**1**

See PER TM 05 for further information (Appendix B)

TABLE 4-8
Present Worth Costs for Alternative WRF Sites in Millions of Dollars (2005 Dollars)

	Raw Wastewater Conveyance	New and Existing WRFs	Treated Effluent Conveyance	Interbasin Transfer Facilities
Site 8	$53	$389	$65	$16
Site 11/12	$55	$389	$64	$16
Site 14	$63	$389	$48	$16

Costs are based on desktop analyses completed during Phase II project planning for comparison purposes.

4.4.4 Recommendation

The results of the WRF site evaluation showed that Site 14 has potential for expansion, the lowest total project cost, the least number of on-site property owners and residents, and has the lowest (most favorable) score of the three sites. Based on these investigations, Site 14 is the recommended site for the Western Wake WRF.

4.4.5 Investigation of Additional Site 30

The original site selection process was completed during calendar year 2004 for the 29 sites described above. In August 2005, the elected officials from the Town of Apex identified an additional Site 30 for review and analysis. This site was reviewed using screening analyses similar to the other sites. Based on the analyses completed, the local governments and NCDENR affirm that Site 14 remains the preferred site for the

project (letter included in Appendix I). NCDENR's preference for Site 14 over Site 30 was based on fewer environmental impacts, particularly those to gamelands.

4.5 TRANSMISSION LINE ALIGNMENTS

Several pipeline alignments were evaluated based on environmental impacts, pipeline length, hydraulic characteristics, topography, private property impacts, utility conflicts, constructability, and community impacts during construction. Some of these alignments were eliminated from consideration based on environmental concerns and other considerations, and these eliminated routes are further discussed in Section 4.5.1. TMs 2 and 27 of the PER (Appendix B) provides more detail on the routes considered.

4.5.1 Alternative Pipeline Alignments

Four alternative pipeline alignments from the West Cary Pump Station to the proposed WRF site, and two alternative pipeline alignments from the proposed WRF site to the Cape Fear River were evaluated for various environmental impacts and cost. This resulted in a total of eight alignments from the West Cary Pump Station to the Cape Fear River. These alignments are described below and illustrated on Figures 4-9A and 4-9B. Shared alignment routes are illustrated in red on the Figures; alternative routes are shown in brown and purple on the Figures.

4.5.1.1 Raw Wastewater Alignments

Each route that was considered travels west from the West Cary pump station along Green Level Road and then travels south along Wimberly Road. All alignments then travel cross country to Reedy Branch where they travel by gravity and then south to the Beaver Creek Pump Station. From the Beaver Creek Pump Station, there are two alternatives which are labeled as **segments A** and **B** on Figure 4-9A. Segment A crosses Beaver Creek along Richardson Road while segment B follows Progress Energy right-of-way (ROW) to the east and bypasses USACE property. These segments meet up at the intersection of Richardson Road and the Progress Energy ROW and follow ROW to Humie Olive Road. At Humie Olive Road, there are two alternative **segments**, **1** and **2**, as labeled on Figure 4-9. Segment 1 follows Humie Olive Road and New Hill Olive Chapel Road to the WRF site. Segment 2 follows Progress Energy ROW to the WRF site.

4.5.1.2 Raw Wastewater Alignments Considered but Eliminated

The Partners considered the American Tobacco Trail (ATT) ROW as a pipeline alternative (Figure 4-10). This alternative was removed from further consideration for the following reasons:

- Greater impact to environmental resources including gamelands, parkland, federal lands, streams and wetlands
- The potential future use of the ATT as a commuter train rail; NCDOT will not allow the pipeline within the ROW if there are other alternatives as this could impact this potential future use

The Partners also considered leaving the West Cary pump station and traveling east along Green Level Road (Figure 4-10). The route then travels south along the Progress Energy proposed ROW and then either travels across land (Progress Energy alignment) or along Kelly Road to Olive Chapel Road. These routes were eliminated because field observations at road crossings identified high quality wetlands that included beaver dams that would result in higher environmental impacts or costs to avoid the wetlands. In addition, the route marked as the Roadway ROW route had higher costs associated with it than other alternatives.

4.5.1.3 Effluent Pipeline Alignment Alternatives

The effluent pipeline alternatives also share much of the same alignment. The only alternatives evaluated further are labeled as **segments a** and **b** on Figure 4-9B. The Partners elected to present a portion of segment a as a corridor to allow greater flexibility during final design. This corridor segment is generally defined as the area located between Old US 1 and the Dixie Pipeline right-of-way. For segment a, the effluent pipeline leaves the WRF site on the west side and follows along the defined corridor a transition point for the Dixie Pipeline, and then along the Dixie Pipeline ROW to Christian Chapel Church Road. Segment b leaves the WRF site on the south side and follows new US 1 to the Dixie Pipeline ROW to Christian Chapel Church Road.

4.5.2 **Alternatives Analysis**

Table 4-9 summarizes the environmental impacts of the eight transmission line routes from the West Cary Pump Station to the Cape Fear River. As stated above, each route starts along Wimberly Road and then has a combination of alternatives (one example is Wimberly.A.1.a which includes the Wimberly Road section, the common segments, the

alternative segment A, the alternative segment 1, and the effluent alternative segment a). For the effluent line segment a that includes a corridor as the route leaves the WRF, a representative route described in PER TM 27 was used to estimate impacts since using the entire corridor would overestimate environmental impacts. The analysis also includes impacts from the pipelines that would be needed to serve the Town of Apex; the Apex alignments are common to all alternatives evaluated in this document and are shown in Figure 4-9A in lighter red. The Apex alignments were included in the analysis since some options considered but eliminated resulted in different infrastructure for Apex which would have biased the environmental impacts. In addition, the Apex infrastructure will be constructed during Phase 1 of the project and are directly related to the project.

TABLE 4-9
Environmental Impacts of Transmission Line Alternatives

Environmental Resources	Wimberly A*.1.a	Wimberly A*.2.a	Wimberly A*.1.b	Wimberly A*.2.b	Wimberly B.1.a	Wimberly B.2.a	Wimberly B.1.b	Wimberly B.2.b
Total Acres	155.9	152.9	155.4	152.4	160.2	157.2	159.7	156.7
# of Parcels Crossed	196	169	194	167	202	175	200	173
Topography								
Topography	No permanent changes	No permanent changes	No permanent changes	No permanent changes	No permanent changes	No permanent changes	No permanent changes	No permanent changes
FEMA Floodplain Acres	6.7	6.6	8.2	8.1	9.5	9.4	11.0	10.9
Soils								
Prime Farmland Acres	38.3	36.6	36.9	35.2	40.3	38.6	38.9	37.2
Hydric Soil Acres	27.4	27.9	29.1	29.6	32.3	32.8	34.0	34.5
Landuse	See addt'l table	See addt'l table	See addt'l table	See addt'l table	See addt'l table	See addt'l table	See addt'l table	See addt'l table
Complies with current zoning	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Wetlands								
Hydric Soil Acres	27.4	27.9	29.1	29.6	32.3	32.8	34.0	34.5
NWI Total Acres	18.5	18.4	19.3	19.2	19.6	19.4	20.4	20.3
L1UBHh	0.0	0.0	0.3	0.3	0.0	0.0	0.3	0.3
PUBHh	0.7	0.2	0.7	0.2	0.8	0.3	0.8	0.3
PFO1A	2.6	2.6	2.4	2.4	2.6	2.6	2.4	2.4
PFO1/4A	8.3	8.7	8.7	9.2	9.2	9.7	9.7	10.1
PFO1C	6.9	6.9	6.9	6.9	6.9	6.9	6.9	6.9
PSS1Gh	0.0	0.0	0.2	0.2	0.0	0.0	0.2	0.2
Public Lands and Parks								
Federal Lands** (acres)	2.7	2.7	2.7	2.7	3.0	3.0	3.0	3.0
Parks/ATT (acres)	2.9	2.9	2.9	2.9	4.5	4.5	4.5	4.5
Historic and Archaeological Resources								
No. of Historic Districts (500 ft on either side)	1	1	1	1	1	1	1	1
No. of Historic Structure (500 ft on either side)	1	1	1	1	1	1	1	1

TABLE 4-9
Environmental Impacts of Transmission Line Alternatives

Environmental Resources	Wimberly A*.1.a	Wimberly A*.2.a	Wimberly A*.1.b	Wimberly A*.2.b	Wimberly B.1.a	Wimberly B.2.a	Wimberly B.1.b	Wimberly B.2.b
Archaeological Resources	None Known	None Known	None Known	None Known	None Known	None Known	None Known	None Known
Air Quality	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar
Noise	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar
Surface Water Resources								
Total No. of Stream Crossing	45	51	45	52	50	57	51	58
Groundwater Resources	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar
Forest Resources (acres)	142.5	142.3	142.0	141.8	146.2	146.0	145.7	145.5
Fish								
Perennial Stream Crossings (#)	29	31	29	31	33	35	33	35
Intermittent Stream Crossings (#)	15	20	16	21	17	22	18	23
Wildlife and Natural Vegetation								
No. of RTE's within 500 feet on either side (note: all occurrences are RCW which are considered destroyed)	1	1	1	1	1	1	1	1
Gameland (Acres)	47.4	44.5	54.6	51.7	50.3	47.4	57.5	54.6
Forest Acres Impacted	142.5	142.3	142.0	141.8	146.2	146.6	145.7	145.5
Toxic Substances								
Distance to Hazardous Waste Site (ft)	4770	4770	4770	4770	4770	4770	4770	4770
Geology	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar

TABLE 4-9
Environmental Impacts of Transmission Line Alternatives

Environmental Resources	Wimberly A*.1.a	Wimberly A*.2.a	Wimberly A*.1.b	Wimberly A*.2.b	Wimberly B.1.a	Wimberly B.2.a	Wimberly B.1.b	Wimberly B.2.b
Aesthetics	Higher impact along ATT	Higher impact along ATT	Higher impact along ATT	Higher impact along ATT	Higher impact along ATT	Higher impact along ATT	Higher impact along ATT	Higher impact along ATT
Traffic	Low	Low	Low	Low	Low	Low	Low	Low
Navigation	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Recreation								
Parks/ATT (Acres)	2.9	2.9	2.9	2.9	4.5	4.5	4.5	4.5
Gamelands (Acres)	47.4	44.5	54.6	51.7	50.3	47.4	57.5	54.6
Water Supply & Conservation	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar
Energy Needs	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar
Safety	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar
Food & Fiber Production	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mineral Needs	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Consideration of Property Ownership								
Number of parcels crossed	196	169	194	167	202	175	200	173
Conservation	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar
Economics	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar	All options similar
Shore Erosion	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Cost								
Construction and O&M	$149,830,200	$147,552,500	$149,840,900	$147,563,200	$147,906,600	$145,517,600	$147,917,300	$145,528,300
Mitigation	$831,200	$914,100	$846,200	$942,200	$939,800	$1,035,800	$967,900	$1,063,900

* Segment A impacts assumes that trenchless technology will be used for pipeline installation along a 1,000ft section along Richardson Road along land owned by USACE

** The area listed will be required for the easement requested from the USACE; permanent impacts would be reduced by 1.8 acres due to use of trenchless technology

The following data sources, limitations, and assumptions apply to the environmental impacts estimates:

- Unless otherwise noted, ArcView data available from the Center for Geographic Information and Analysis (CGIA, 2004) were used to estimate impacts
- Wake County's hydrology data layer was used to estimate stream impacts within Wake County
- Soils data and floodplain data were not available electronically for Chatham County; thus impacts to prime farmland, hydric soils, and floodplains may be underestimated for the effluent alignments
- Streams were assumed to exist at all crossings since field verification could not occur on private property
- Perennial streams were assumed to occur where streams were located in hydric soils or in a wetland as identified through available national wetlands inventory (NWI) data
- Trenchless technology will be used to minimize stream impacts; more information is provided in Section 6. For this table, it was assumed that trenchless technology was impractical for most stream crossings so impacts are likely overestimated. However, due to discussions with USACE it is assumed that trenchless technology will be used for a 1,000 foot section along Richardson Road to avoid impacts to USACE owned land (Segment A only). Similarly, impacts to wetlands and federal lands will likely be reduced through the use of trenchless technology
- The assumed easement width is based on the size of the pipe: a pipe from 18" to 48" requires an easement width of 40 feet and pipes greater than 48" require an easement width of 50 feet (Fisher, 2005). Where two adjacent pipes are required, a space of ten feet between the pipes was assumed. Therefore, if there was a need for a 36" and a 24" pipe, the pipes would each have 20 feet from the pipe centerline to the outside edge of the easement. There would be an additional 12.5 feet between the pipes (10 feet of space between pipes and then the distance from the pipe centerline to the edge of the pipe). The total easement width would be 52.5 feet wide. This number was then rounded up to 54 feet since even widths provided easier spatial analysis of existing conditions, and the increase in easement widths ensured that no conditions were underestimated.

To better evaluate the various alternatives, the impacts of the individual decision points are outlined in Table 4-10 (i.e. raw wastewater segment A and B are compared and 1 and 2 are compared).

4.5.2.1 Raw Wastewater Segments A and B

For all of the impacts evaluated, Segment A is environmentally preferable to or similar to Segment B as illustrated in Table 4-10. Trenchless technology is being considered for Segment A for 1,000 feet along the USACE owned land. This will further reduce the impacts along Segment A (Table 4-10). Thus, Segment A is the preferred alternative.

4.5.2.2 Raw Wastewater Segments 1 and 2

For most of the impacts evaluated, Segment 1 is environmentally preferable to or similar to Segment 2 as illustrated in Table 4-10. The only exception to this was in the number of parcels crossed. Following Progress Energy's alignment (segment 2) will impact fewer property owners. However, the property owners along Progress Energy land were already impacted when the powerline ROW was constructed. In addition, since the majority of land associated with segment 1 is adjacent to a road, the land will largely return to its original use once construction is completed if the property owner desires.

4.5.2.3 Effluent Segments a and b

Segment a was selected as the preferred alternative because conversations with NCDOT indicated that it does not allow pipelines to be installed within fully controlled-access roads, including US1. Thus, segment b was eliminated from consideration. Following US1 also results in a higher number of stream crossings and wetlands impacts. In particular, the streams and wetlands on the southwest side of the WRF site will be impacted. Hardwood areas were noted during the wetlands delineation that could potentially be impacted if US 1 was the selected alternative.

4.5.3 **Recommendation**

Based on the review and analysis of the features, benefits, advantages and disadvantages of each alternative alignment, it is recommended that the Project Partners pursue the Wimberly Road Alignment with segments A.1.a, which offers the following benefits:

- Reduced environmental impacts, including the lowest number of stream crossings and hydric soils

TABLE 4-10
Environmental Impacts of Transmission Line Segments

Environmental Resource	Segment A*	Segment B	Segment 1	Segment 2
Total Acres	5.3 (5.3)	7.5	17.7	14.7
# of Parcels Crossed	6 (6)	8	40	13
Topography				
Topography	No permanent changes	No permanent changes	No permanent changes	No permanent changes
FEMA Floodplain Acres	1.6 (0)	2.8	0.4	0.2
Soils				
Prime Farmland Acres	3.8 (2.2)	4.2	8.1	6.4
Hydric Soils Acres	1.6 (0)	4.9	0.74	1.2
Landuse				
Complies with current zoning	N/A	N/A	N/A	N/A
Wetlands				
Hydric Soils Acres	1.6 (0)	4.9	0.7	1.2
NWI Acres (Total)	0.84 (.02)	1.1	1.2	1.1
PUBHh		0.1	0.6	0.1
PFO1/4A	0.84 (.02)	1.0	0.5	1.0
Public Lands and Parks				
Federal Lands (acres)	1.1 (0)	0.3	0.0	0.0
Parks/ATT (acres)	0.38 (0)	1.6	0.0	0.0
Historic and Archaeological Resources				
No. of Historic Districts within 500 ft	0 (0)	0	1	1
No. Historic Structures within 500 ft	0 (0)	0	0	0
Archaeological Resources	None known	None known	None known	None known
Air Quality	Options similar	Options similar	Options similar	Options similar
Noise	Options similar	Options similar	Options similar	Options similar
Surface Water Resources				
No. Stream Crossings	1 (0)	6	4	11
Groundwater Resources	Options similar	Options similar	Options similar	Options similar
Forest Resources (acres)	4.8 (2.8)	6.5	13.8	13.6
Fish				
Perennial Stream Crossing (#)	1 (0)	4	1	3
Intermittent Stream Crossings (#)	0 (0)	2	3	8
Wildlife and Natural Veg.				
RTE's	0 (0)	0	0	0
Gameland (Acres)	1.5 (0)	2.9	0	0
Forest Acres impacted	4.8 (2.8)	6.5	13.8	13.6
Toxic Substances				
Distance to Hazardous Waste Site (ft)	18,500 (18,500)	16,800	15,250	15,250

*It is assumed that a 1,000ft section of this segment will be installed using trenchless technology. This will result in a reduction of impacts to several resources. The number in parenthesis is the amount of impact for this segment using trenchless technology.

- Less adverse impacts to Project schedule
- Reduced capital, operations and maintenance costs for pumping station and pipelines
- The use of existing road ROW for reduction in land use conversion and increased pipeline accessibility for scheduled maintenance

Under the recommended alternative, wastewater flows from Cary, Morrisville, and RTP South will enter into the regional wastewater system at the West Cary Pump Station. Wastewater flow from the West Cary Pump Station will be pumped to the Beaver Creek Pump Station via a wastewater conveyance system that will include a force-main segment which will discharge to a gravity sewer segment, which in turn will discharge to the Beaver Creek Pump Station. Apex will enter the regional wastewater system at two points along the alignment of the gravity sewer segment. The two points of entry for Apex will be along Reedy Branch and Beaver Creek as shown in Figure 4-9A.

4.6 ALTERNATIVE PUMP STATION LOCATIONS

Two alternative locations were considered for the Beaver Creek PS for the preferred transmission line alignment. One location is along Olive Chapel Road near the ATT and the other location is along Richardson Road near the Little Beaver Creek crossing (Figure 4-9A). The Richardson Road location was selected as the preferred location for the Beaver Creek PS, and the impacts associated with this location are described in Section 6. A summary of impacts for the Olive Chapel Road location is presented in Table 4-11.

TABLE 4-11
Environmental Impacts for the Beaver Creek PS at the Olive Chapel Road Location

Soil Impacts

Soil Type	Description	Acres	Percent of site	Hydric	PFL	Forest Land Productivity		
						Common Trees	**Site Index**	**Trees to Manage**
Au	Augusta fine sandy loam	1.8	41.7%	B	P2	American sycamore Loblolly pine Southern red oak Sweetgum White oak	90 90 80 90 80	American sycamore, Cherrybark oak, Loblolly pine, Sweetgum, Yellow-popular
CrC2	Creedmoor sandy loam, 6 to 10 percent slopes, eroded	2.4	56.2%	No	S1	Loblolly pine Shortleaf pine Yellow-poplar	87 66 97	Loblolly pine, Shortleaf pine
CrB2	Creedmoor sandy loam, 2 to 6 percent slopes, eroded	0.1	2.1%	No	P1	Loblolly pine Shortleaf pine Yellow-popular	87 66 97	Loblolly pine, Shortleaf pine
Total		4.2	100%					

Land Cover Impacts

Description	Acres	Percent of site
Bottomland Forest/Hardwood Swamps	0.2	4.0%
Managed Herbaceous Cover	1.1	25.2%
Mixed Hardwoods/Conifers	0.2	5.5%
Southern Yellow Pine	2.7	65.0%
Total	4.2	

NWI Wetland Impacts

Type	Description	Acres	Percent of site
PFO 1/4A	Augusta fine sandy loam	0.02	0.5%

Sources: CGIA, 2004 and USDA, 2006

Generally the Olive Chapel Road location had greater environmental impacts for wetlands and forests. Also the Olive Chapel Road location would impact 3 land owners while the Richardson Road location would impact one landowner. While there would be no direct impacts to the ATT from either location, the Olive Chapel Road location would likely place pump station elements within 300 feet of the trail. In addition, the Wake County Open Space Plan indicates that the County may be planning a park near the Olive Chapel Road location. To connect to the Olive Chapel Road PS, the Beaver Creek gravity sewer would need to be longer than if it connected to the Richardson Road PS. The gravity sewer entering the Olive Chapel Road PS would be shorter than the gravity sewer needed to enter the Richardson Road PS, but large segments of the gravity sewer entering would not be tunneled thus possibly increasing impacts due to installation of the pipeline. For these reasons and others, the Richardson Road location was determined to be preferred for the current pipeline alignments (impacts associated with these options are further discussed in TMs 02, 03, and 04 in Appendix B).

4.7 ALTERNATIVE WASTEWATER DISCHARGE OPTIONS

The purpose of this section is to present information regarding the two alternative wastewater discharge options available for the proposed Project. The two alternative wastewater discharge options include:

- Bank discharge
- In-stream diffuser

On May 24, 2004, the Project Partners submitted to DWQ a request for speculative effluent limits for a discharge to the Cape Fear River below Buckhorn Dam. On December 15, 2004 DWQ issued a Speculative Effluent Limits letter which defined annual mass limits based on 6 mg/L total nitrogen and 2 mg/L total phosphorus for a discharge to the Cape Fear River. In the Speculative Effluent Limits letter, DWQ staff indicated that if a bank discharge was to be provided for the proposed Project, then a dye study would be required as part of the preliminary engineering effort. Alternatively, DWQ staff indicated that to avoid the dye study, the Project Partners could propose the construction of an in-stream diffuser, which would require mixing zone models as part of the final design effort. The Speculative Effluent Limits letter is included in Appendix D.

Based on guidance provided by DWQ staff on December 15, 2004, the Project Partners have proposed the construction of an in-stream diffuser for the proposed Project. The preliminary engineering analysis for the in-stream diffuser is presented in the Preliminary Engineering Report Technical Memorandum No. 28. Subsequent to this decision, DWQ indicated that both a bank discharge and diffuser should be evaluated as part of the final design if detailed studies completed during final design indicate that a bank discharge is feasible. However, the Project Partners will defer the final selection of the preferred wastewater discharge option until final design when more detailed field studies have been completed, the mixing models have been developed and the results reviewed with DWQ, which will issue the final permits for the wastewater discharge. Recognizing that the selection of the final wastewater discharge option will be deferred until final design, a qualitative evaluation of environmental impacts for the bank discharge option and the in-stream diffuser option are presented in this environmental impact statement. The qualitative comparison of environmental impacts are presented in Table 4-12.

The Project Partners believe that while the in-stream diffuser provides more efficient and effective mixing and dilution for the treated effluent (which is beneficial for surface water quality), it may be necessary to consider the construction of a bank discharge because of reduced environmental impacts for other environmental criteria presented in Table 4-12. However, based on field investigations conducted for the Project, the constructability of a bank discharge will require careful consideration given that the discharge location is predominantly a wide, gently sloping flood plain area and there is no clearly defined bank along the edge of the Cape Fear River. Again, final selection of the wastewater discharge option will be made during the course of final design at which time the constructability of a bank discharge can be reviewed and considered in coordination with the environmental impacts for both alternative options. The qualitative comparison of environmental impacts for both options are presented in Table 4-12.

TABLE 4-12

Qualitative Comparison of Environmental Impacts of a Bank Discharge Option versus In-Stream Diffuser Option

Environmental Evaluation Criteria	Bank Discharge	In-stream Diffuser
Man-made Environment		
Land Use	**Similar impacts**	**Similar impacts**
Cultural Resources	**Similar impacts**	**Similar impacts**
Natural Environment		
Topography	**Less impacts.** Project extends only to water's edge of Cape Fear River.	**Greater impacts.** Alternative extends into mainstem of Cape Fear River
Soils	**Less impacts.** Project extends only to water's edge of Cape Fear River.	**Greater impacts.** Alternative extends into mainstem of Cape Fear River
Prime or Unique Farmland	**Similar impacts**	**Similar impacts**
Water Resources	**Similar impacts.** Project complies with requirements of IBT	**Similar impacts.** Project complies with requirements of IBT
Groundwater	**Similar impacts**	**Similar impacts**
Surface Water **(1)**	**Greater impacts.** Less efficient mixing and dilution of effluent in mainstem of Cape Fear River.	**Less impacts.** Greater efficiency for mixing and dilution of effluent in mainstem of Cape Fear River.
Air Quality	**Similar impacts**	**Similar impacts**
Noise Levels	**Similar impacts**	**Similar impacts**
Vegetation Resources	**Less impacts.** Reduced construction required to deliver effluent to mainstem of Cape Fear River	**Greater impacts.** Increased construction required to deliver effluent to mainstem of Cape Fear River
Wetlands	**Less impacts.** Reduced construction required to deliver effluent to mainstem of Cape Fear River	**Greater impacts.** Increased construction required to deliver effluent to mainstem of Cape Fear River
Terrestrial Wildlife Resources	**Similar impacts.** Project requires construction to water's edge	**Similar impacts.** Project requires construction to water's edge
Aquatic Wildlife Resources	**Less impacts.** Reduced obstructions located in main stem of Cape Fear River	**Greater impacts.** Increased obstructions located in mainstem of Cape Fear River
Natural and Scenic Resources	**Less impacts.** Reduced obstructions located in main stem of Cape Fear River	**Greater impacts.** Increased obstructions located in mainstem of Cape Fear River
Toxic Substances	**Greater impacts.** Less efficient mixing and dilution of effluent in mainstem of Cape Fear River.	**Less impacts.** Greater efficiency for mixing and dilution of effluent in mainstem of Cape Fear River.

Note: **(1)** *Mixing zone models will be developed during final design to quantify the dilution rate differential between the bank discharge and the in-stream diffuser.*

4.8 REFERENCES

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