Executive Summary

This report is the 2018 update to the Long Range Water Resources Plan (LRWRP) for the Towns of Cary, Apex and Morrisville and Wake County. This LRWRP serves as a working strategy for the Towns to actively manage a flexible portfolio of water resources options. Strategies and options in the 2013 LRWRP were re-appraised for their ability to meet updated projections of future water and wastewater demands to identify and recommend the best path forward to meet these growing and changing needs.

The Towns of Cary and Apex continue to partner in the management of water and wastewater infrastructure and water supply to meet the growing and changing demands of their customers. They remain active members of the Triangle Water Supply Partnership. Since 2000, the Towns have taken actions on the recommendations provided in the initial Long Range Water Supply Plan (CH2M, 2000) and the Integrated Water Resources Management Plan (CH2M, 2007) including regular updates to the LRWRP and detailed demand projects. The Towns have also implemented major infrastructure and regulatory recommendations highlighted in the Water Resources Portfolio, ranging from the start of a reclaimed water program to the addition of water supply allocation and treatment capacity as well as wastewater treatment capacity and securing additional flexibility for interbasin transfer (IBT). These updates were prepared in alignment with the Town of Cary's land use planning updates and the *Imagine Cary* Community Plan (Town of Cary, 2017). These actions, implemented at the right times, allow the Towns to meet customers' water needs, support long-term planning goals and continue to make this area a premier place to live, work and play in North Carolina.

This LRWRP Update continues to provide the Towns with a guide for development of a reliable, flexible water supply and management solutions that are financially responsible, maintain quality of service provided to customers, and support the commitment to protecting health and being good stewards of the natural environment.

This LRWRP updates the strategic view presented in the 2013 LRWRP using data from 2013 through 2016 and extends the planning period from 2060 to 2065. Since the 2010 water use analysis used in the 2013 LRWRP, the Town has replaced its water meter system with an advanced metering infrastructure (AMI) system, Aquastar. Aquastar provides the Town with water meter reading data on hourly and daily bases, compared to the previous process, which provided only monthly billing data. The increased frequency of the meter readings provides for a more accurate representation of consumption patterns, compared to monthly billing data. The finer resolution of consumption data provides the ability to complete more robust comparative analyses with other daily data, such as the Cary/Apex Water Treatment Facility (WTF) production data, daily wastewater flow monitoring data, and weather data.

Water Resources Supply and Infrastructure

Since the 2013 LRWRP was issued, the Towns of Cary and Apex have worked to expand water supply allocation and infrastructure capacity to meet customer demands in their service areas and plan for growth. The Towns of Cary and Apex jointly own and share treatment capacity at the Cary/Apex WTF and the Western Wake Regional Water Reclamation Facility (WWRWRF) and share an IBT certificate.

The Town of Cary's service area also includes the Town of Morrisville, the Wake County portion of Research Triangle Park (RTP South), Raleigh-Durham International Airport (RDU), and the portion of Cary that lies within Chatham County (Figure ES-1).

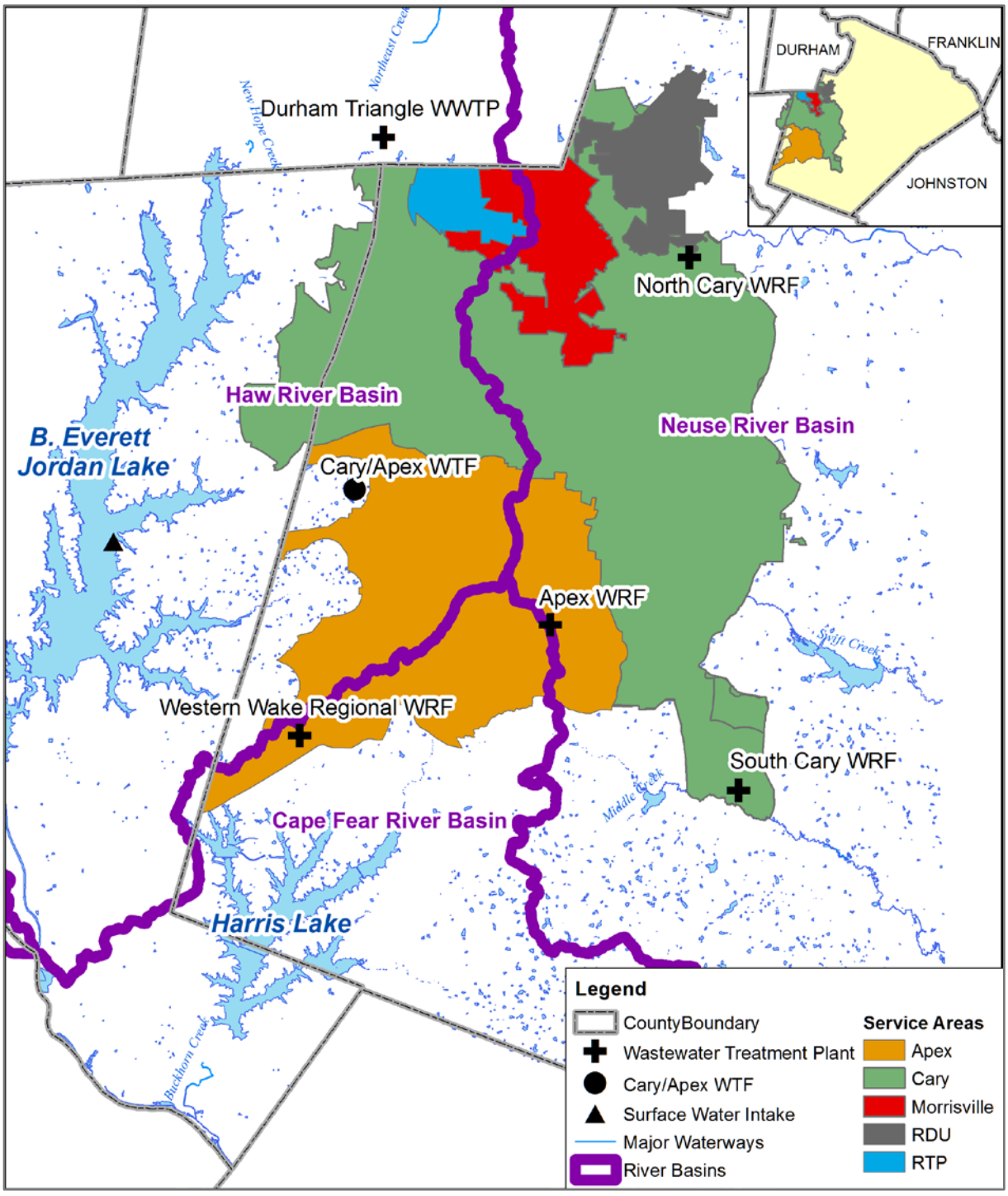

Figure ES-1. Service Areas for the Towns of Cary and Apex
Long Range Water Resources Plan Update

Since 2013, the Towns have completed the following actions:

- Received additional water supply from Jordan Lake Round 4 allocation
- Completed expansion of Cary/Apex WTF expansion to 56 million gallons per day (MGD) permitted maximum day capacity
- Installed AMI in the Town of Cary
- Completed construction of the jointly owned WWRWRF with a permitted capacity of 18 MGD
- Received IBT Certificate modification to 31 MGD for transfers from the Haw River basin to the Neuse River basin and 2 MGD for transfers from the Haw River basin to the Cape Fear River basin. These are regulated on a maximum month average day (MMAD) basis.

The Towns each also manage their own infrastructure:

- Town of Cary infrastructure
  - North Cary and South Cary WRFs (permitted at 12.0 MGD and 12.8 MGD, respectively)
  - A reclaimed water distribution system currently serviced with reclaimed water from Durham County, the North Cary Water Reclamation Facility (NCWRF), and the South Cary Water Reclamation Facility (SCWRF)
- Town of Apex infrastructure
  - Apex WRF (permitted at 3.6 MGD)
  - While the Town holds a reclaimed water distribution permit, it does not currently have reclaimed water infrastructure in place

The Towns maintain water interconnections with the City of Durham, City of Raleigh, and the Town of Holly Springs. In addition, they have an agreement that allows mutual aid with adjacent municipalities through their direct connections. The Town of Cary also maintains a wastewater interconnection with Durham County. These connections provide resiliency and flexibility for emergencies and operational maintenance needs.

Changing Land Uses and Development Patterns

The Towns are currently experiencing different types of growth and development. With less available land, the Town of Cary has less capacity for development than the Town of Apex. This dynamic is driving an increase in redevelopment and mixed-use development in Cary, leading to densification. Population projections are listed in Table ES-1. The Town's planning efforts as documented in the *Imagine Cary* Community Plan also include a focus on revitalizing areas and promoting the Town center (Town of Cary, 2017). The Town's planning efforts and projects are captured in the parcel-based land use information used in the CommunityViz model (Triangle J COG, 2018) and used in this evaluation.

The Town of Apex is experiencing a high rate of residential growth, which is driving up demands. For this analysis, a per capita usage projection and a range of population projections were used in the forecasting. Results are not spatial as they are for the Town of Cary's service area.

Table ES-1. Historical and Projected Population for the Town of Cary Service Area
Includes the Towns of Cary and Morrisville

Town	2001	2007	2013	2015	2016	2045	2065
Cary	99,798	122,643	144,982	153,867	157,259	196,761	210,772
Morrisville	8,973	15,393	21,696	23,682	24,456	29,963	31,782

Notes:
Historical population provided by Town of Cary as reported in CH2M (2017).
Population in 2045 was developed using persons per household values of 2.78 (SFR) and 2.22 (MFR) for Town of Cary and 2.70 (SFR) and 2.18 (MFR) for Town of Morrisville and expected 2045 development from the CommunityViz model.
Population at full capacity is assumed for the purposes of this evaluation to occur in the year 2065.
Population at full capacity is taken from the CommunityViz model as an additive value to the 2015 population (Triangle J COG, 2018).

Identifying the Needs of the Future

Projections through 2065 provide a basis on which to evaluate the ability of the Towns' water supply and infrastructure capacity to meet existing and future demands. The effort in this 2018 LRWRP began with an analysis of customer water usage and water system patterns using the most recent five years of the Town of Cary's comprehensive collection of system data and customer billing information. The Town of Apex also provided future planning information which is included in Appendix B. The next step was to develop an updated forecast of future water demand and wastewater flows to reassess the strategies in the Water Resources Portfolio provided in the 2013 LRWRP. New from 2013, reclaimed water projections are a part of the forecast.

This LRWRP includes the following projections to 2065:

- Water demands, including raw water and finished water
- Wastewater flows
- Reclaimed water demands
- Interbasin transfer
- Required discharge

In 2017, CH2M HILL North Carolina, Inc. (CH2M) updated the Town's water use analysis; this serves as the basis for many of the water use statistics used in this forecast, including updated unit water demand factors (CH2M, 2017). Key years for the forecast are the following:

- 2016—baseline year
- 2025—selected to represent when current plans approved but not yet built will be online
- 2045—selected to align with regional planning efforts
- 2065—selected to represent reaching the Town's full capacity for development

The Town included a major assumption in its demand projections in the 2013 LRWRP: by 2040 the Towns would start to reach their buildout capacity for development, with buildout reached between 2050 and 2060. The Town updated this assumption in 2018, with the new date of 2065 representing buildout capacity for development. This represents a more linear growth curve than was predicted in 2013. When reviewing the demand projections from 2013 and 2018, average day finished water demand for the Towns (inclusive of Morrisville, RTP South, RDU, and the service areas of Cary and Apex) at full capacity is a little more than 40 MGD. The 2018 LRWRP expectation for growth is similar to the 2013 LRWRP; however, buildout will be reached at a later timestep than was projected in 2013.

To capture the uncertainty inherently present in the long-range planning process, in this 2018 LRWRP Update CH2M used a probabilistic forecasting methodology similar to that used for the 2013 LRWRP.

This uncertainty is useful in understanding the potential risk in water supply and treatment capacity development decisions. The Towns benefit from implementing actions at the right times and this approach supports the Towns' goals for efficient use of financial resources and minimizing impacts to rate payers. Figure ES-2 displays the annual average day raw water demand forecast for the Towns of Cary and Apex. Depictions of the 5th, 25th, 50th, 75th, and 95th percentile forecasts represent the estimate of probability of occurrence of the identified level of demand and below. The 2013 LRWRP baseline forecast is included for comparison. To account for uncertainty and to support planning efforts to maintain a reliable water supply and infrastructure capacity for water and wastewater treatment, CH2M recommends that the Towns use the 75th percentile of the 2018 probabilistic forecast for infrastructure planning purposes. CH2M identified the future water/wastewater facility capacity needs discussed in the following paragraphs using this probability level from the forecast.

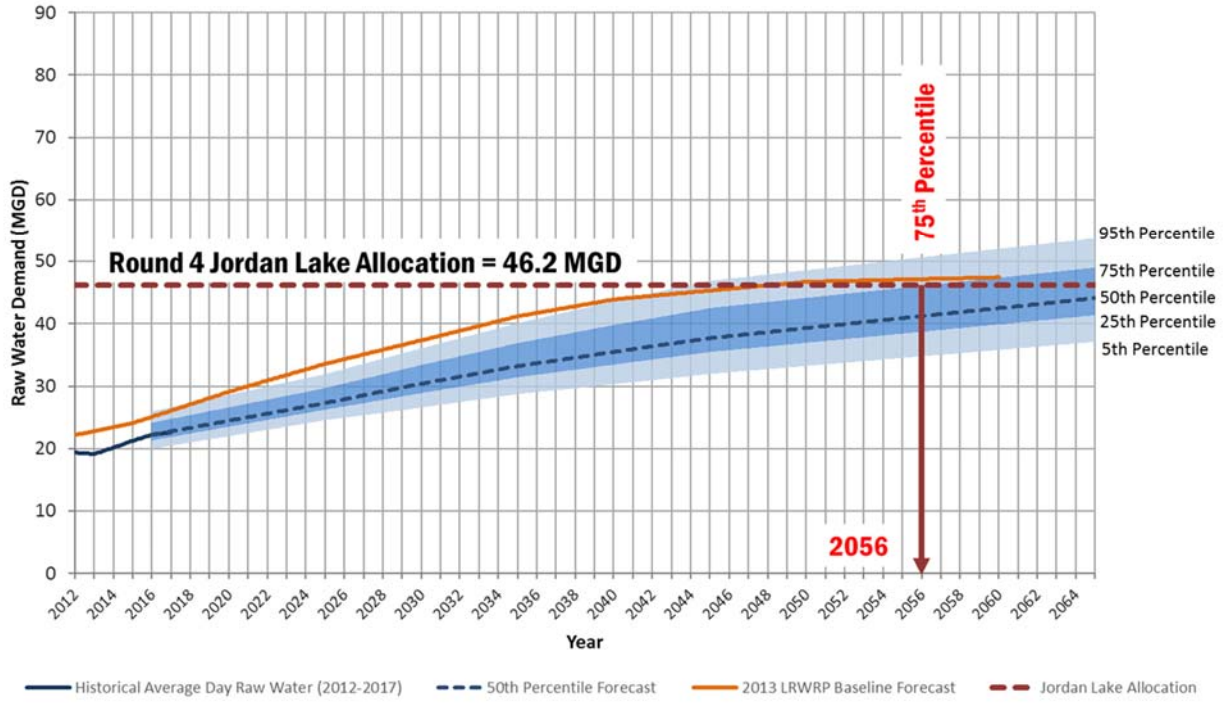

Figure ES-2. Annual Average Day Raw Water Demand Gap
Includes the Towns of Cary, Morrisville, and Apex; RTP South; and RDU

The Towns may see the need to act to extend their Jordan Lake allocation farther into the future. One way to accomplish this could be by treatment efficiency improvements at the Cary/Apex WTF. Other ways to achieve efficiencies include demand management. The Town of Apex's rate of growth should be monitored closely against its portion of the Jordan Lake allocation so that plans can be implemented to extend the total allocation.

The maximum day finished water demand forecast is presented in Figure ES-3. The Towns' demands are expected to reach and exceed the total treatment capacity at the Cary/Apex WTF in the mid-2040s. Additional finished water capacity will be needed. This finished water demand could be met by further expanding the WTF, purchasing finished water from neighboring communities with whom the Towns have interconnections, or implementing other Water Resources Portfolio options provided in this LRWRP Update.

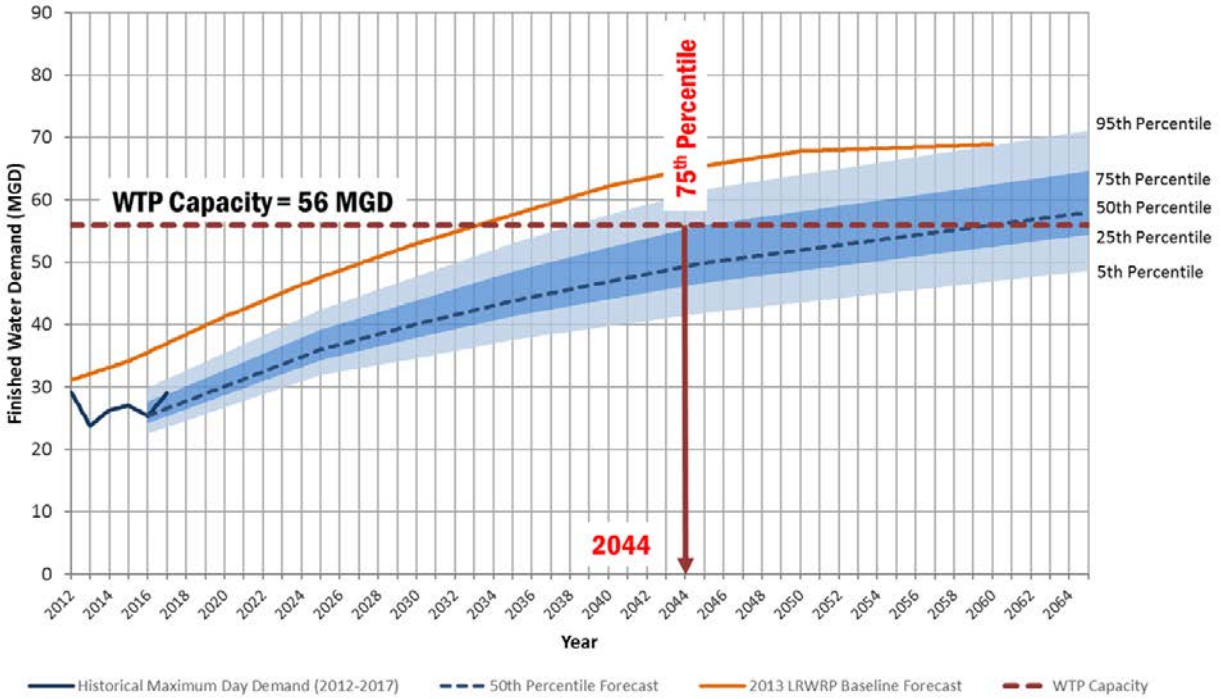

Figure ES-3. Maximum Day Finished Water Demand Projections
Includes the Towns of Cary, Morrisville, and Apex; RTP South; and RDU

Four water reclamation facilities within the Towns' service areas treat a portion of these water demands. By 2065, approximately 44.7 MGD of wastewater treatment capacity is needed, and the total current permitted capacity is 47.9 MGD. CH2M also evaluated future capacity needs by facility. The Town of Cary has an implementation strategy to obtain additional capacity at the NCWRF, raising its maximum month capacity to 13.5 MGD. If this strategy is implemented, the Town of Cary is expected to have sufficient wastewater capacity to meet its total needs with the two WRFs and its portion of capacity at the WWRWRF.

The Town of Apex WRF has a treatment capacity of 3.6 MGD; this amount is expected to be sufficient to meet future Neuse River Basin needs. However, the majority of growth in the Town of Apex is expected to occur in the Cape Fear River basin. The Town of Apex is likely to exceed its portion of capacity at the WWRWRF and the Beaver Creek Pump Station, which pumps to the WWRWRF. This gap in Apex's WWRWRF capacity allocation is expected to be over 3 MGD and is predicted to occur within the planning period to 2065 (Table ES-2). The Town of Apex is monitoring its growth and collaborating with the Town of Cary regarding the timing of additional capacity needs.

Table ES-2. 75th Percentile Wastewater Flow Projections by Water Reclamation Facility, 2016 to 2065, MGD, Maximum Month Average Day

Includes the Towns of Cary, Morrisville, and Apex; RTP South; and RDU

Jurisdiction	Permitted Discharge	2016 Actual	2025	2030	2035	2040	2045	2065	2065 Gap[1]
NCWRF	**12.0**	7.3	8.2	9.0	9.7	10.2	10.6	12.4	0.4
SCWRF	**12.8**	6.5	6.8	7.5	8.1	8.5	8.9	11.3	-
Apex WRF	**3.6**	0.9	1.4	1.5	1.6	1.7	1.7	1.7	-
WWRWRF Total	**18.0**	6.3	10.4	12.2	13.9	15.4	17.0	19.3	1.3
WWRWRF—Cary	**11.88**	3.8	5.7	6.4	7.0	7.5	8.1	10.0	-
WWRWRF—Apex	**6.12**	2.5	4.7	5.8	6.9	7.9	8.9	9.3	3.2
Total Flow	**47.9**	**21.0**	**26.8**	**30.2**	**33.3**	**35.8**	**38.2**	**44.7**	**-**

Notes:
[1]The 2065 Gap value is calculated as the difference between the 2065 projection and the current WRF permitted discharge value.

In addition to water demand and wastewater flow projections, the Towns also monitor IBT and required discharge to the Cape Fear River. The 2015 IBT certificate allows Cary and Apex to transfer up to 31 MGD to the Neuse River basin and up to 2 MGD to the Cape Fear River basin from Jordan Lake (in the Haw River source basin) on a MMAD basis. Figure ES-1 shows the river basin boundaries as defined in North Carolina's IBT regulations. This represents the amount of water that can be consumed within the Cape Fear River and Neuse River receiving basins without being returned to the Haw River source basin. Obtaining this increased IBT flexibility was one of the recommendations outlined in the 2013 LRWRP and provides the Towns with more flexibility as development and redevelopment occur throughout the Towns' service areas.

Transfers to the Neuse River basin from Town of Cary demands are expected to grow approximately 50 percent during the planning period. Transfers driven by growth in the Town of Apex to the Neuse River basin are expected to grow approximately 25 percent and to the Cape Fear River basin are expected to increase seven-fold. Projections for the Neuse River basin IBT are shown in Figure ES-4. The Towns' transfers are expected to remain below the maximums listed in the IBT certificate, so compliance throughout the planning period is expected. However, the Town of Apex's high rate of predicted growth leads to more uncertainty around the forecasted transfer to the Cape Fear River. Figure ES-5 shows this forecast. Only Apex has part of its service area in the portion of the Cape Fear River basin below the Haw River confluence. Growth there could lead to the need for the Towns to revisit this transfer amount.

As part of their IBT certificate, the Towns are required to discharge a portion of their wastewater effluent to the Cape Fear and Haw River basins. This requirement is defined using a calculation comprised of average annual day finished water usage in the Neuse River basin and wastewater discharge to the Cape Fear River basin. This is currently achieved by the discharge of the WWRWRF but can also be met by other means, such as wastewater sent to Durham County. For the purposes of this LRWRP Update evaluation, the projected average annual discharge from the WWRWRF was used in the calculation.

To calculate future required discharge, CH2M captured the uncertainty associated with the location and rate of development and redevelopment by using the 25th, 50th, and 75th percentiles of the forecast. In all scenarios, the projected wastewater flow from the WWRWRF into the Cape Fear River is greater than the calculated minimum discharge requirement by more than 4 MGD at the end of the planning period.

Therefore, the Towns are expected to remain in compliance with this minimum required discharge throughout the planning period.

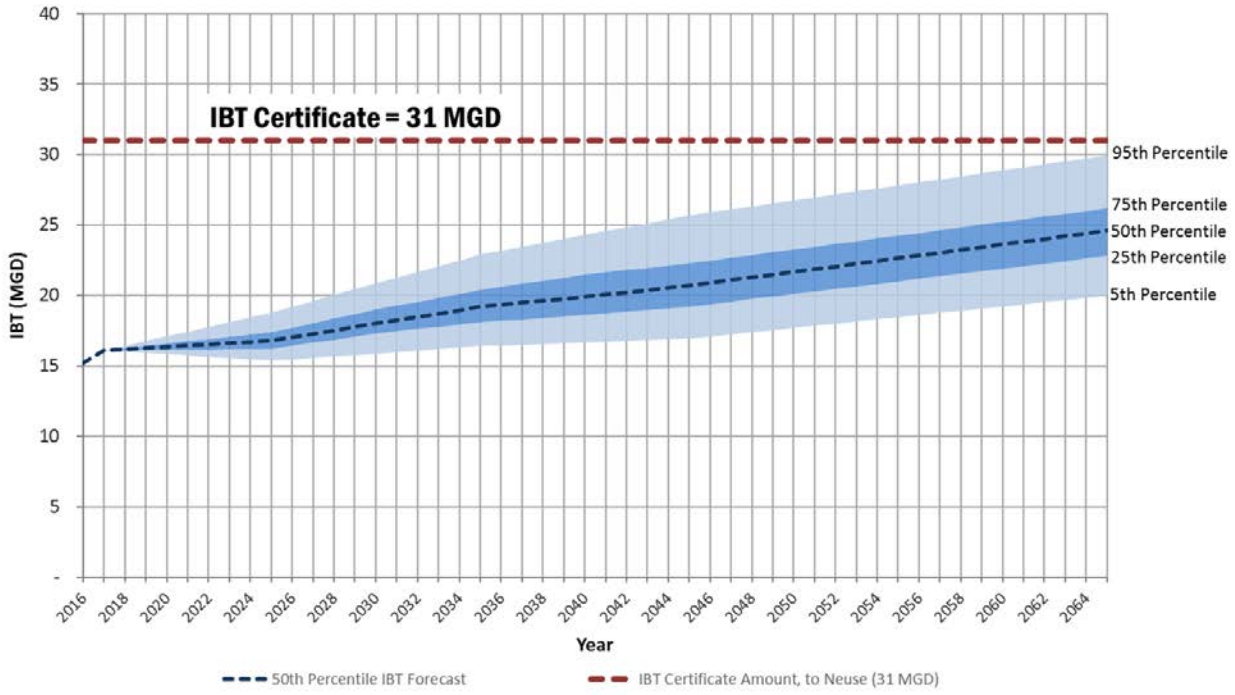

Figure ES-4. Interbasin Transfer to the Neuse River Basin Projections, Maximum Month Average Day
Includes the Towns of Cary, Morrisville, and Apex; RTP South; and RDU

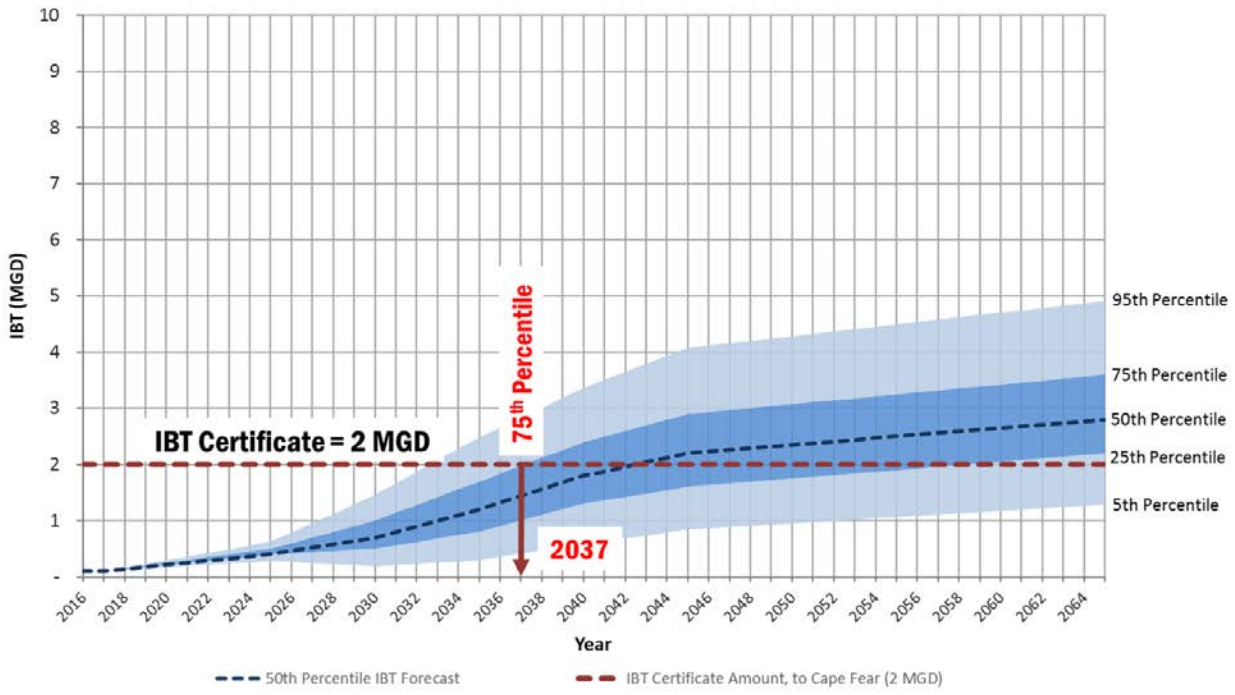

Figure ES-5. Interbasin Transfer to the Cape Fear River Basin Projections, Maximum Month Average Day
Includes the Towns of Cary, Morrisville, and Apex; RTP South; and RDU

The Planning Process

The planning process used for the 2018 LRWRP Update and outlined in Figure ES-6 is similar to that conducted for the 2013 LRWRP. In this update, CH2M reviewed, revalidated, and updated the 2013 short list of water resources portfolio strategies to reflect current needs as defined by the forecast of future demands.

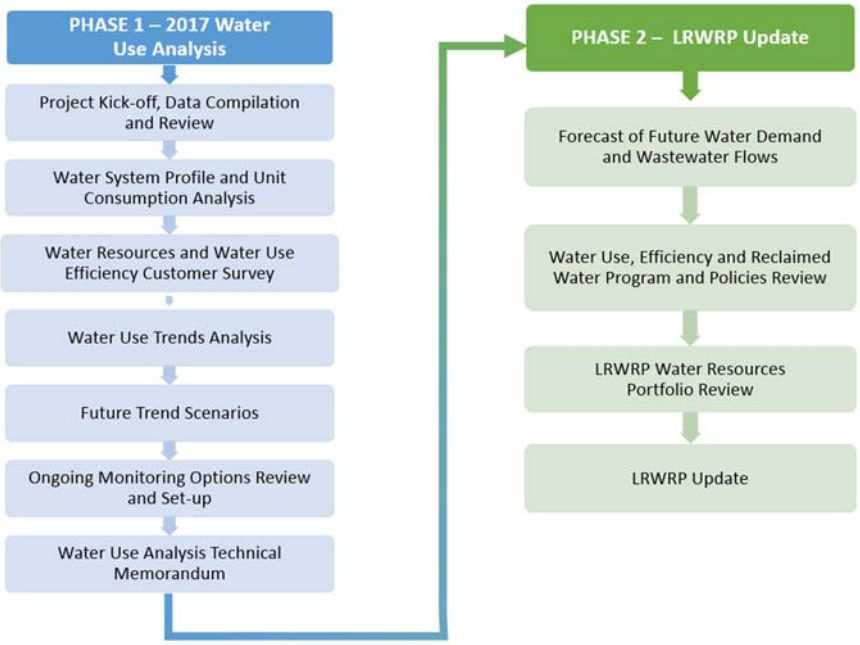

Figure ES-6. The LRWRP Update Planning Process

Includes the Towns of Cary, Morrisville, and Apex; RTP South; and RDU

The customer survey was also repeated to assess changing customer behaviors, understanding of the Town of Cary's conservation program and goals, and preferred methods of communication for conservation messages. CH2M and the Town then incorporated these responses into an updated water conservation strategy (Appendix C). The Town's water conservation program and expected future water efficiency gains were incorporated into the 2018 LRWRP Update.

The Water Resources Portfolio

The Town developed a Water Resources Portfolio, a diverse set of strategy and source options to meet and manage water supply needs into the future under a variety of uncertainties. Source, infrastructure, and adaptive management solutions are included.

The 2013 LRWRP included a portfolio of water supply sources including interconnections, management tools, and resource recovery options. The portfolio was updated in 2018 into the following options:

- Strategy 1—Increase Water Supply via Jordan Lake Allocation
- Strategy 2—Increase Water Supply and/or Storage by Other Means
  - Strategy 2A—Increase Jordan Lake Water Supply Pool
  - Strategy 2B—Water Supply from Crabtree Creek with Storage in Existing Triangle Quarry
  - Strategy 2C—Water Supply from the Cape Fear River Watershed
  - Strategy 2D—Water Supply Development from Source Outside the Triangle
- Strategy 3—Purchase of Capacity via Triangle Regional Agreements
- Strategy 4—Integrated Master Planning and Strategic Utility Resource Utilization
- Strategy 5—Best Management Practices
  - Strategy 5A—Supply Side Management—Optimize Internal Operations
  - Strategy 5B—Demand Side Management—Manage Customer Demands for Improved Efficiency
  - Strategy 5C—Reclaimed Water

These strategies are summarized in Table ES-3 with details regarding treatment capacity requirements, implementation requirements, regulatory considerations, policy implications, key uncertainties, and benefits.

Implementation Plan

CH2M and the Town formulated an updated set of recommendations from the refreshed list of Water Resources Portfolio strategies. A combination of these strategies is most likely to reliably meet future demands. After considering the implemented actions recommended in the 2013 LRWRP, CH2M prepared an updated 2018 list of projected gaps in water supply and facility capacity and formulated near-term recommendations to meet finished water needs, as listed in Table ES-4. The Towns can implement these recommendations, allowing the Towns to meet demands in the short-term while delaying the potential need for large infrastructure investments until near the end of the planning period. These projects do not take decades to develop; instead each recommendation can be done in a few years, providing the Towns with flexibility to make investments and act at the right times. By monitoring demands and updating them when needed, such as when the Town of Apex's land use plan is completed, the Towns can implement recommendations in the short-term while keeping other, larger scale recommendations available for implementation if long range planning updates suggest they may be necessary. A full summary of each Water Resources Portfolio strategy is included in Table ES-3.

Gaps and recommendations to meet expected wastewater capacity needs are listed in Table ES-5. The timing of implementation will likely be driven by the Town of Apex's growing demands, as depicted in Figures ES-7 and ES-8. Capacity is likely needed at the jointly-owned Beaver Creek pump station and WWRWRF. The Town of Apex's pace of growth and corresponding wastewater flows are the likely drivers in the timing of these needs. To better understand these flows, additional flow monitoring and collection system modeling is necessary. The Towns would also benefit from development and use of a joint model that would help facilitate discussions regarding a path forward for the capacity agreements and any expansion(s) needed at these facilities. The Town of Cary's NCWRF will also likely reach its 12.0 MGD capacity during the planning period; the re-rating recommended for this facility, increasing its capacity to 13.5 MGD, will likely be sufficient to meet future flows.

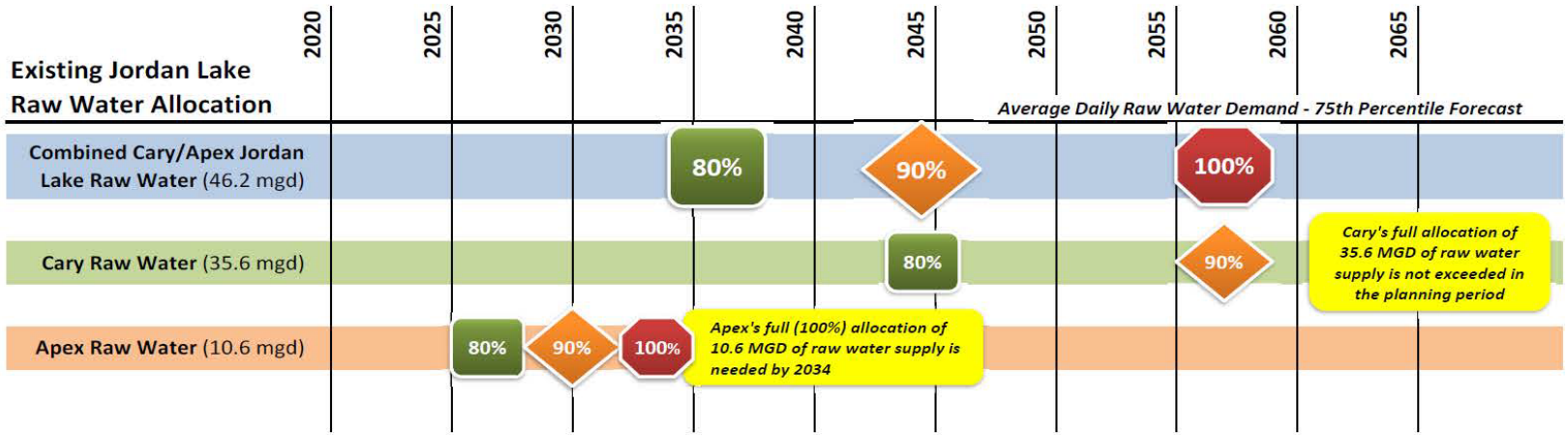

Figure ES-7. Timeline for Need for Additional Raw Water Supply

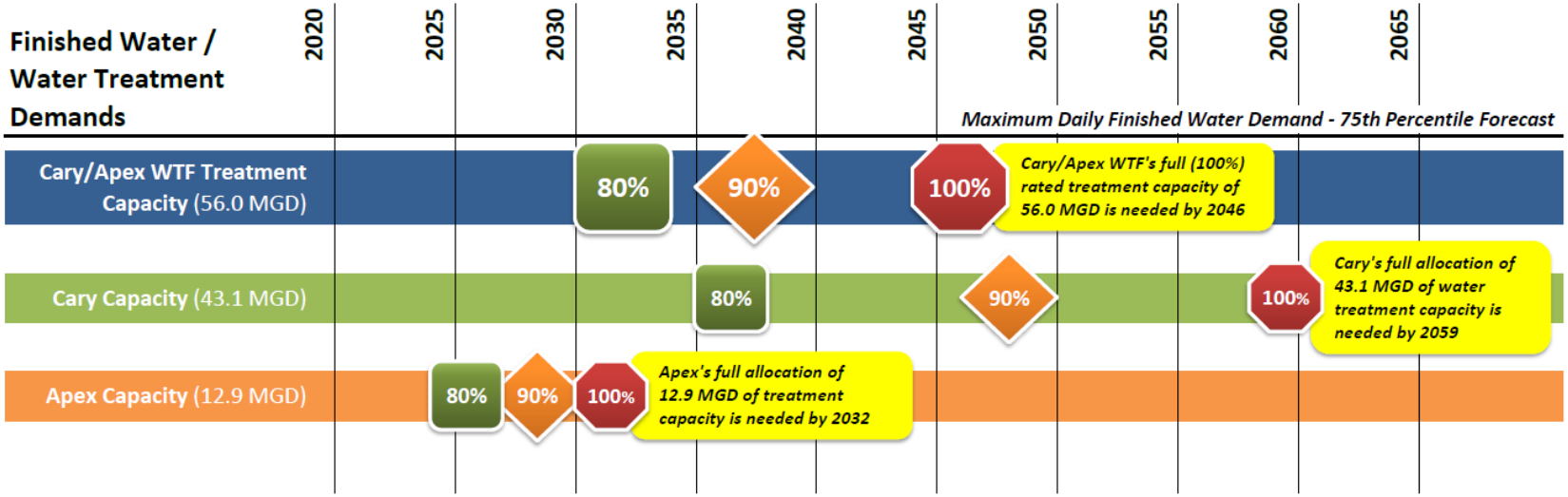

Figure ES-8. Timeline for Need for Additional Finished Water Capacity

Table ES-4. Summary of Water Resources Portfolio Recommended Actions
Includes the Towns of Cary, Morrisville, and Apex; RTP South; and RDU

Gap Identified	Recommendation	Benefits	Drivers
Raw Water Supply	5A: Supply Side Management via Cary/Apex WTF Optimization	Optimizes and extends Jordan Lake Allocation Project can be implemented quickly when needed	Timing of implementation driven by Apex's growing demands
Finished Water Capacity	3: Purchase of Capacity via Triangle Regional Agreements	Uses existing interconnections to supplement daily supply if agreement(s) can be reached Agreements can be reached prior to timing of actual need Can be used to bridge the gap in daily demands until towards near end of planning period; assess need for future expansion or additional source later	Timing of implementation driven by Apex's growing demands

Table ES-5. Summary of Wastewater Treatment Recommended Actions
Includes the Towns of Cary, Morrisville, and Apex; RTP South; and RDU

Gap Identified	Recommendation	Benefits	Drivers
Capacity at Beaver Creek Pump Station	Flow monitoring and modeling to better understand flows from Cary and Apex Adjust Interlocal Agreement following detailed analysis	Improved understanding of flows Supports capacity needs throughout planning period	Timing of solution driven by Apex's growing demands
Capacity at Western Wake Regional WRF	Conduct analysis following completion of Beaver Creek Pump Station review Short-term: Plan to adjust Interlocal Agreement following detailed analysis Long-term: Plan for expansion to meet future capacity needs	Improved understanding of flows Actions may meet Apex's needs in short-term Short-term actions may support delay of longer-term capacity needs, deferring larger capital investments	Timing of solution driven by Apex's growing demands
Capacity at North Cary WRF	Complete re-rating of facility from 12 MGD to 13.5 MGD	Re-rating approach is less expensive and faster than an expansion Supports needs until near end of planning period; assess need for future expansion then	Flows can be monitored, and a trigger used to determine when Cary needs to take action

Table ES-3. Strategies for Meeting Water Supply Needs

	Strategy 1 Increase Water Supply Via Jordan Lake Allocation	Strategy 2A Increase Water Supply and/or Storage by Other Means: Increase Jordan Lake Water Supply Pool (216 Study or reallocation of sediment pool)	Strategy 2B Increase Water Supply and/or Storage by Other Means: Water Supply from Crabtree Creek, Storage in Triangle Quarry, and new WTP	Strategy 2C Increase Water Supply and/or Storage by Other Means: Water Supply from Cape Fear River Watershed	Strategy 2D Increase Water Supply and/or Storage by Other Means: Water Supply Development from Source Outside the Triangle	Strategy 3 Purchase of Capacity via Triangle Regional Agreements	Strategy 4 Integrated Master Planning and Strategic Utility Resource Utilization	Strategy 5A Best Management Practices: Supply Side Management – Optimize Internal Operations	Strategy 5B Best Management Practices: Demand Side Management – Manage Customer Demands for Improved Efficiency	Strategy 5C Best Management Practices: Reclaimed Water
Objective	Increase the average day raw water supply to the CAWTF through obtaining additional allocation from the existing water supply of Jordan Lake, located in the Haw River Basin. The increase would also include an expansion of the WTF to meet future finished water needs.	Increase the average day raw water supply accessible from the conservation pool of Jordan Lake to the CAWTF. Options include re-evaluating the safe yield of the conservation pool or reallocating storage from sediment or flood control storage to the conservation pool, which would increase water supply storage.	Increase the water supply for the Towns by "skimming" high flows from Crabtree Creek and storing the water in the existing Wake Stone Corporation Triangle Quarry.	Increase the water supply for the Towns from a new water supply intake on the Cape Fear River downstream of Jordan Lake and to treat the water at either a new WTF or at the existing CAWTF. Another source within the Cape Fear River watershed could be Harris Lake.	Increase the Towns' average day raw water supply by accessing a water supply outside the Triangle region. This would likely be implemented in partnership with another utility and would also involve another water treatment facility.	Increase average day finished water supply through long-term water purchase agreements with other regional utilities, and then to access the purchased water through existing or new interconnections.	Integrate community planning, water resources management, utility planning, and sustainable development. Unifying these planning efforts will promote development practices that support the Towns' commitment to responsible growth and the wise use of water.	Increase the available average day raw water supply to the CAWTF through capital and operational improvements at the treatment plant. This strategy reduces and/or recycles process water that is currently sent to waste (i.e. "lost") and therefore, if implemented, would capture some portion of the raw water supply that is currently unavailable for treatment and distribution.	Influence customers to use water wisely – resulting in reduced water demand - through policies. Demand-side management approaches are increasingly relied upon for water resource management and complement more traditional supply side management measures. A combination of price-based and alternative (non-price-based) demand side management policies could be most beneficial.	Offset potable water system demands through the beneficial utilization of reclaimed water. This potential is explored in the Town of Cary's Strategic Reclaimed Water System Plan objectives and policies and is linked with Strategy 4.
Potential Raw Water Supply Need, identified as approx. 5 MGD ADD for Apex	Possibly the full need of 5 MGD could be allocated under Round 5 for Apex	Possibly the full need of 5 MGD for Apex could be allocated under the 46.2% total current allocation	Safe yield and timing are key uncertainties; possibility that the full 5 MGD would not be available; additional distribution system infrastructure needed	5 MGD possible; could work in partnership with another utility	5 MGD possible; could work in partnership with another utility	Sufficient finished water supply to be provided through interconnections or through partnering on an expansion project; the total water supply required could be provided through agreements phased with multiple utilities	Integrated system modeling would provide better understanding of system loss and improve forecasting.	Could achieve a maximum process waste recovery potential of 7.8 MGD, sufficient to meet the projected need.	Up to 1.5 MGD of savings expected by 2065 and included in forecast. Additional benefits could be achieved by strengthening program.	Offsets finished water demand by additional reclaimed water demand 0.5-1.2 MGD ADD, 3.0 MGD MDD by 2065
Treatment Capacity Needs identified need of up to 10 MGD MDD	Expansion of CAWTF to meet Cary and Apex needs	Expansion of CAWTF to meet Cary and Apex needs	Obtain Triangle quarry; new WTF needed to meet Cary and Apex needs; may not be available before 2035	Potential for new WTF; could work in partnership with another utility	Potential for new WTP needed; could work in partnership with another utility	Potential for new WTF if raw water is purchased or share of another WTP's capacity	No additional capacity achieved	No direct increase in treatment capacity; potential for raw water supply capacity augmentation through optimized operations only at CAWTF	No additional capacity achieved; would offset some demand	No additional capacity achieved; would offset some demand
Implementation Requirements	Jordan Lake allocation process; Cape Fear River Basin Hydrologic model and safe yield study; Cape Fear River Basin Water Supply Plan	Updated Hydrologic Model; updated USACE Section 216 study; evaluation of raising pool with current dam structure	Water quality study (Crabtree Creek and quarry); Treatability study; Water blending study; design, permit, and construct infrastructure	Treatability study; Finished water blending study; Preliminary Engineering Report for intake, pipeline route; approval from other entities for construction of infrastructure within their jurisdictions; design, permit, and construct infrastructure	Treatability study; Finished water blending study; Preliminary Engineering Report for intake or reservoir improvements, pipeline route; approval from other entities for construction of infrastructure within their jurisdictions; design, permit, and construct infrastructure	Triangle Regional Water Supply Plan; Phase 2 Interconnect Study for Triangle Regional Partnership (TRP); booster pumps or pressure regulating valves, and bi-directional metering; approval from entities for construction of infrastructure	Master planning and modeling efforts linked directly with water resources planning/ management; use Strategy 4 information and the LRWRP as resource in upcoming land use planning projects	Necessary to conduct a study to better understand SuperPulsator blowdown volume and percent solids under current operation; assessment of existing Recycle Pump Station	Rate study; program/method for incorporating AMI customer data into email messaging and communication plan; messaging should include the broad perspective of water resources management and include new demand management programs developed; Cary to implement Conservation Program recommendations	Capital projects to extend transmission lines; Cary to maximize customer base through expansion of system as described in master planning

Table ES-3. Strategies for Meeting Water Supply Needs

	Strategy 1 Increase Water Supply Via Jordan Lake Allocation	Strategy 2A Increase Water Supply and/or Storage by Other Means: Increase Jordan Lake Water Supply Pool (216 Study or reallocation of sediment pool)	Strategy 2B Increase Water Supply and/or Storage by Other Means: Water Supply from Crabtree Creek, Storage in Triangle Quarry, and new WTP	Strategy 2C Increase Water Supply and/or Storage by Other Means: Water Supply from Cape Fear River Watershed	Strategy 2D Increase Water Supply and/or Storage by Other Means: Water Supply Development from Source Outside the Triangle	Strategy 3 Purchase of Capacity via Triangle Regional Agreements	Strategy 4 Integrated Master Planning and Strategic Utility Resource Utilization	Strategy 5A Best Management Practices: Supply Side Management – Optimize Internal Operations	Strategy 5B Best Management Practices: Demand Side Management – Manage Customer Demands for Improved Efficiency	Strategy 5C Best Management Practices: Reclaimed Water
Regulatory Considerations	Jordan Lake allocation process; may require IBT process (Cape Fear transfer); SEPA process (for WTP expansion); Secondary and Cumulative Impact Master Management Plan (SCIMMP) updates; Authorization to Construct	USACE Section 216 process could require EA or EIS; Jordan Lake allocation process; may require IBT process; SEPA process (for WTP expansion); SCIMMP updates; Authorization to Construct	Reclassification of Crabtree Creek and quarry; SEPA process; Crabtree Creek passing flow requirements, 401/404 Permit; SCIMMP updates, Authorization to Construct	Potential Jordan Lake allocation; SEPA process; SCIMMP updates; 401/404 Permit; Authorization to Construct	Potential need for allocation process and/or USACE Section 216 process; Could require EA or EIS; IBT process; SEPA process; SCIMMP updates; 401/404 Permit; Authorization to Construct	May require IBT process; permitting for infrastructure	No new regulations required; however, some changes to the Unified Development Ordinance can be considered	Approval of PWSS for residuals process water enhancements	None identified	Continued compliance with 15A North Carolina Administrative Code (NCAC).02U for reclaimed water use
Policy Implications	None likely	None likely	Other jurisdictions may need to update policies to reflect water supply watershed requirements	Interlocal agreements would be required; May require programs to mitigate downstream water resources issues	Interlocal agreements would be required between municipal partners	Interlocal agreements for finished water purchases will be required	Policies to direct future growth to locations of available water supply and infrastructure, including reclaimed water; Apex to review the potential benefit and feasibility of a reclaimed water policy	Potential interlocal agreement to expand Cary hydraulic modeling to include integration of Apex system	Affordability; revenue stability with decreased consumption per connection; ability to implement recommended actions	Connection/development requirements and costs; capital costs of expanding the reclaimed water system; customer service adjustments to address issues unique to reclaimed water
Key Uncertainties	Round 5 allocation from Jordan Lake to be received; ability of reservoir to meet total regional water demands; level of stakeholder involvement and issues	Federal funding for Section 216 study (cost share); Section 216 study requirements and outcome; Ability of reservoir to meet total regional water demands; Level of stakeholder involvement and issues; weather variability	Availability of quarry and timeframe of availability are not definite; cost of quarry could be much greater than assessed tax value; source water availability could be impacted by passing flow requirements; water quality of Crabtree Creek and quarry; reclassification of Crabtree Creek watershed and quarry; limited safe yield due to system variability; distribution system requirements from a new treatment facility	May require a Jordan Lake allocation or at minimum coordination with Triangle Water Supply Partnership; regional water demands and the potential impact it may have on Cape Fear River water supply potential; availability of flow from the Cape Fear River and requirements for instream flow studies; Duke Energy water needs and availability of Harris Lake as an option; water quality in Harris Lake; Indirect potable reuse; construction and permitting costs and timeline associated with a new water source	Likely the most expensive strategy; federal funding for Section 216 study (federal portion); Section 216 study requirements; study outcome; likely would require a utility partner due to cost; timing of partner's needs; pumping costs to service area	May require a Jordan Lake allocation; Single agreement may not be able to provide entire additional water supply needs; permanent water supply allocation from regional utility is uncertain without capacity purchase or participation in joint water supply capacity project; timing of agreements and availability of water; other entities are also currently reviewing their own water supply options; water blending issues; pressure differentials across system; capacity limitations of interconnects with other utilities; IBT certificate modifications; new distribution system infrastructure and current system improvements	Societal trends driving the development market; Policies can be changed by governing bodies; timing and level of new growth will affect potential for benefits	Potential changes to PWSS requirements; would require action on another strategy to completely meet future demands; the actual amount of process waste currently generated is relative to its sources; impact of recycle on blended water quality; increase in operational complexity; potential impacts on downstream water quality; potential degradation in future raw water quality may impact feasibility of process waste recovery; limit on types of polymers that may be used	Actual price elasticity of water demand based on price may not reflect calculated savings because factors other than price influence water use; participation levels in conservation programs may be different than planned participation; rate structures need to be easily understood and accepted by the customer; revenue implications; policies can be changed by governing bodies; Apex program initiation; billing software needs to be capable of calculating billing alternative rate structures	The level and timing of new growth will affect demand for reclaimed water public and commercial concerns related to water quality; practicality and cost of seasonally supplying reclaimed water; cost for developer installed or Cary installed infrastructure

Table ES-3. Strategies for Meeting Water Supply Needs

	Strategy 1 **Increase Water Supply Via Jordan Lake Allocation**	Strategy 2A **Increase Water Supply and/or Storage by Other Means: Increase Jordan Lake Water Supply Pool (216 Study or reallocation of sediment pool)**	Strategy 2B **Increase Water Supply and/or Storage by Other Means: Water Supply from Crabtree Creek, Storage in Triangle Quarry, and new WTP**	Strategy 2C **Increase Water Supply and/or Storage by Other Means: Water Supply from Cape Fear River Watershed**	Strategy 2D **Increase Water Supply and/or Storage by Other Means: Water Supply Development from Source Outside the Triangle**	Strategy 3 **Purchase of Capacity via Triangle Regional Agreements**	Strategy 4 **Integrated Master Planning and Strategic Utility Resource Utilization**	Strategy 5A **Best Management Practices: Supply Side Management – Optimize Internal Operations**	Strategy 5B **Best Management Practices: Demand Side Management – Manage Customer Demands for Improved Efficiency**	Strategy 5C **Best Management Practices: Reclaimed Water**
Benefits	Continue to leverage the work of the Triangle Water Supply Partnership; Jordan Lake is currently one of the most reliable water supplies in the region; utilizes a single water supply source and maximizes investment in the CAWTF and associated distribution infrastructure, resulting in a straightforward implementation	Continue to leverage the work of the Triangle Water Supply Partnership Jordan Lake is currently one of the most reliable water supplies in the region; downstream users support for a Section 216 study; utilizes a single water supply source and maximizes investment in the CAWTF and associated distribution infrastructure, resulting in a straightforward implementation	Water supply diversification; potential for increased operational flexibility and the management of finished water supplies for planned WTF maintenance activities or unplanned outages; finished water supply directly to Cary's central pressure zone areas furthest from the CAWTF; helps minimize future IBT; quarry site is close to the Cary service area	Water supply diversification; potential for increased operational flexibility and the management of finished water supplies for planned WTF maintenance activities or unplanned outages; potential for reduction in IBT	Water supply diversification and resiliency to water quality changes and weather variability; potential for increased operational flexibility and the management of finished water supplies for planned WTP maintenance activities or unplanned outages	Water supply diversification; potential for increased operational flexibility and the management of finished water supplies for planned WTP maintenance activities or unplanned outages; operational benefit if interconnections are created in areas within the distribution system that have potential for water quality or pressure issues; could help to minimize IBT	Reduction of demands defers need for infrastructure investments and interlocal agreements; could help minimize IBT	Potential to extend available raw water supply; achieve increased operational flexibility and the management of finished water supplies for planned WTF maintenance activities or unplanned outages	Reduction of demands defers need for infrastructure investments and interlocal agreements; could help minimize IBT	Reduction of demands defers need for infrastructure investments and interlocal agreements; Rates for reclaimed water versus potable water to both encourage its use and generate sufficient revenue; could help to minimize IBT

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