JORDAN LAKE WATER SUPPLY STORAGE ALLOCATION ROUND FOUR

TOWNS OF CARY, APEX AND MORRISVILLE, AND WAKE COUNTY

FINAL APPLICATION

NOVEMBER 12, 2014

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EXECUTIVE SUMMARY

JANUARY 7, 2015

This final Application for a Round Four Allocation of Jordan Lake Water Supply Storage is on behalf of the Town of Cary and the Town of Apex; the documentation supports allocations to meet the water supply needs of Cary, Apex, Morrisville and RTP South (the Wake County portion of Research Triangle Park) through 2045.

Jordan Lake Allocations

Cary, Apex, and Morrisville, and Wake County currently hold individual Level I allocations from the Jordan Lake water supply storage pool totaling 39%: 32% (Cary/Apex), 3.5% (Morrisville) and 3.5% (Wake County on behalf of RTP South). Wake County has requested that its 3.5% allocation be transferred to the Town of Cary. The Town of Morrisville is requesting to retain its 3.5% allocation. This Application provides supporting information for the requests from both Wake County and Morrisville.

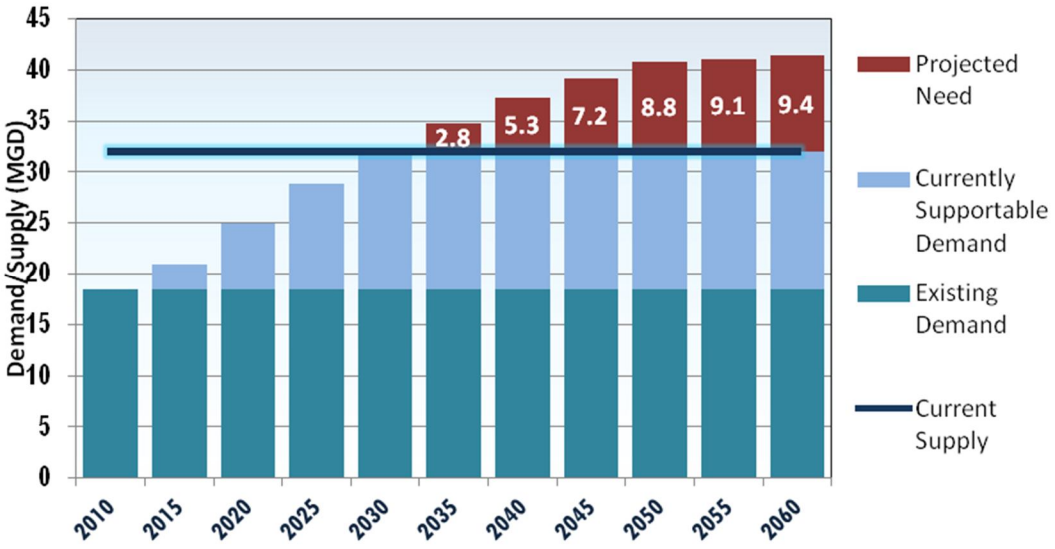
The Town of Cary and Town of Apex jointly request an increase in total allocation to 39.2% to meet the water supply needs of Cary and Apex through 2045 – which is a **Round 4 increase in Level I allocation of 7.2%**. With the Wake County allocation transfer this would result in a total Round Four Cary/Apex allocation of 42.7%. The Level I Jordan Lake water supply storage allocations reflected in this application, totaling 46.2%, meet the needs of Cary, Apex, Morrisville and RTP South.

Water Supply Needs

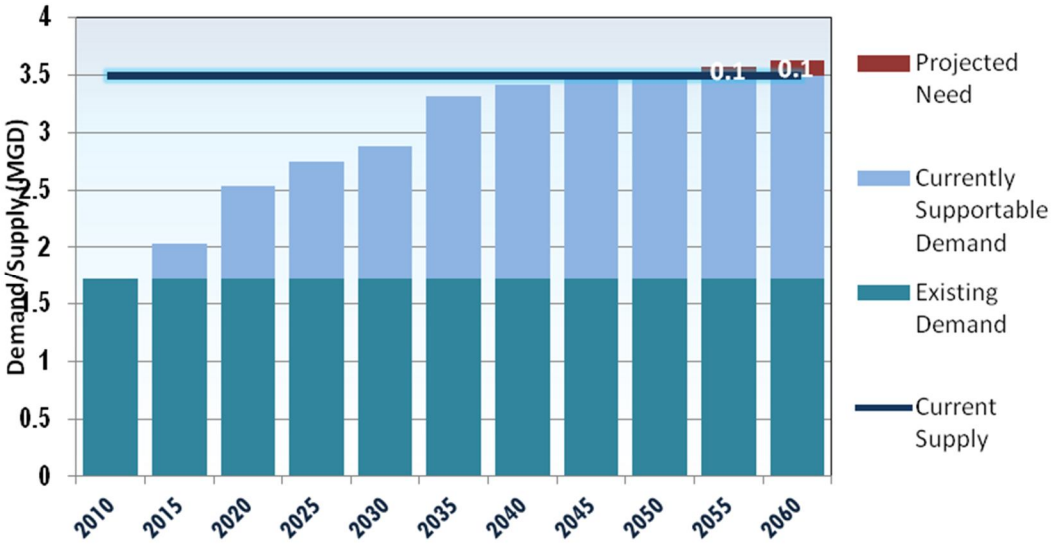
Town of Cary staff worked with staff of Apex, Morrisville, and Wake County to develop a Long Range Water Resources Plan (LRWRP). The LRWRP includes best management practices addressing supply side management, demand side management and reclaimed water use. The specific recommendations are already part of or planned for utility operations.

Our combined service area population is projected to almost double from 182,000 to 360,000 by 2060. The following water demands and supply needs are consistent with the LRWRP.

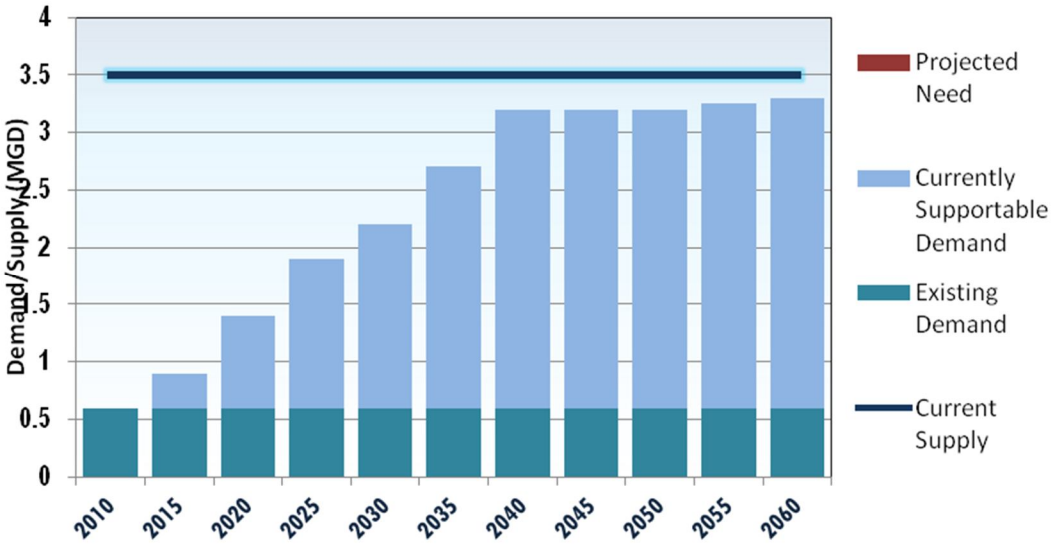
Cary & Apex Demand and Need



Morrisville Demand and Need



RTP South Demand and Need



Water Supply Alternatives

The Towns of Cary, Apex and Morrisville, and RTP South all rely upon Jordan Lake as their sole source of raw water supply. A Jordan Lake water supply storage allocation for the Towns of Cary and Apex, Town of Morrisville, and RTP South would have the least cost and fewest negative impacts among all water supply alternatives. The selected alternative is consistent with the LRWRP.

Water Supply Alternatives Analysis

Classification	Jordan Lake Allocation, Round 4	Jordan Lake Allocation, Future	Increased Jordan Lake Water Supply Pool	Cape Fear River @Harnett County	Crabtree Creek & Triangle Quarry
Rd. 4 Allocation Request (% of storage)	**7.2**	**0.0**	**0.0**	**0.0**	**0.0**
Total Supply (MGD)	**9.5**	**9.5**	**9.5**	**9.5**	**9.5**
Environmental Impacts	Same As	Same As	More Than	More Than	More Than
Water Quality Classification	WS IV B NSW CA	WS IV B NSW CA	WS IV CA	C NSW	WS III B CA
Timeliness	Timely	Timely	Timely	Timely	Timely
Regional Partnerships	Yes, JLP	Yes	Yes	Yes	Yes
Technical Complexity	Not Complex	Not Complex	Complex	Very Complex	Complex
Institutional Complexity	Not Complex	Complex	Complex	Very Complex	Very Complex
Political Complexity	Not Complex	Not Complex	Complex	Very Complex	Very Complex
Public Benefits	None	None	None	Few	None
Consistency with local plans	Yes	Yes	Yes	Yes	Yes
Total Cost ($ millions)	**52.3**	**55**	**174.3**	**62.7**	**178**
Unit Cost ($ millions/MGD)	**5.5**	**5.8**	**18.3**	**6.6**	**18.8**
Selected Alternative	✔				

Regional Partnerships

This Application is consistent with the Triangle Regional Water Supply Plan (TRWSP) developed by the Jordan Lake Partnership (JLP), 13 local governments and water systems (Apex, Cary, Hillsborough, Holly Springs, Morrisville, Pittsboro, Durham, Raleigh, Sanford, Chatham County, Orange County, Wake County, and the Orange Water and Sewer Authority) planning collaboratively for the sustainable water supply future of the Triangle Region. The JLP's TRWSP presents a plan for meeting the water supply needs for the Triangle Region through 2060 **without compromising the water supply needs of downstream communities**. The TRWSP does not result in over-allocation of the Jordan Lake water supply storage pool.

The Towns of Cary and Apex would continue to access their Jordan Lake water supply storage allocation through their jointly owned Cary/Apex Water Treatment Facility. The Towns would continue to meet the potable water needs of the entire Cary, Apex, Morrisville and RTP South service area. Cary and Apex would also continue to provide access to the Jordan Lake water supply storage allocations of Chatham County, the City of Durham, and the Orange Water and Sewer Authority.

INTRODUCTION

The Towns of Cary and Apex jointly hold a Level I Jordan Lake water supply storage allocation of 32%. The Town of Morrisville holds a Level I allocation of 3.5%. Wake County holds a Level I allocation of 3.5% on behalf of the Research Triangle Foundation for the Wake County portion of Research Triangle Park (RTP South).

The Towns of Cary and Apex jointly own a 40 million-gallon–per-day (mgd) water treatment facility (CAWTF) with the source of water supply from Jordan Lake. The Town of Cary provides potable water to customers in the Towns of Cary and Morrisville, RTP South, and the Raleigh-Durham (RDU) International Airport. The Town of Apex provides water to customers in the Town and its planning jurisdiction.

The Cary/Apex Raw Water Pump Station (CARWPS) provides the only access to Jordan Lake water supply storage. In addition to Cary and Apex, Chatham County obtains raw water, daily, from the CARWPS, and treats and delivers that water to customers in its jurisdiction. The City of Durham and the Orange Water and Sewer Authority access their Jordan Lake allocations, as needed, by obtaining treated water from the CAWTF through their interconnections with Cary.

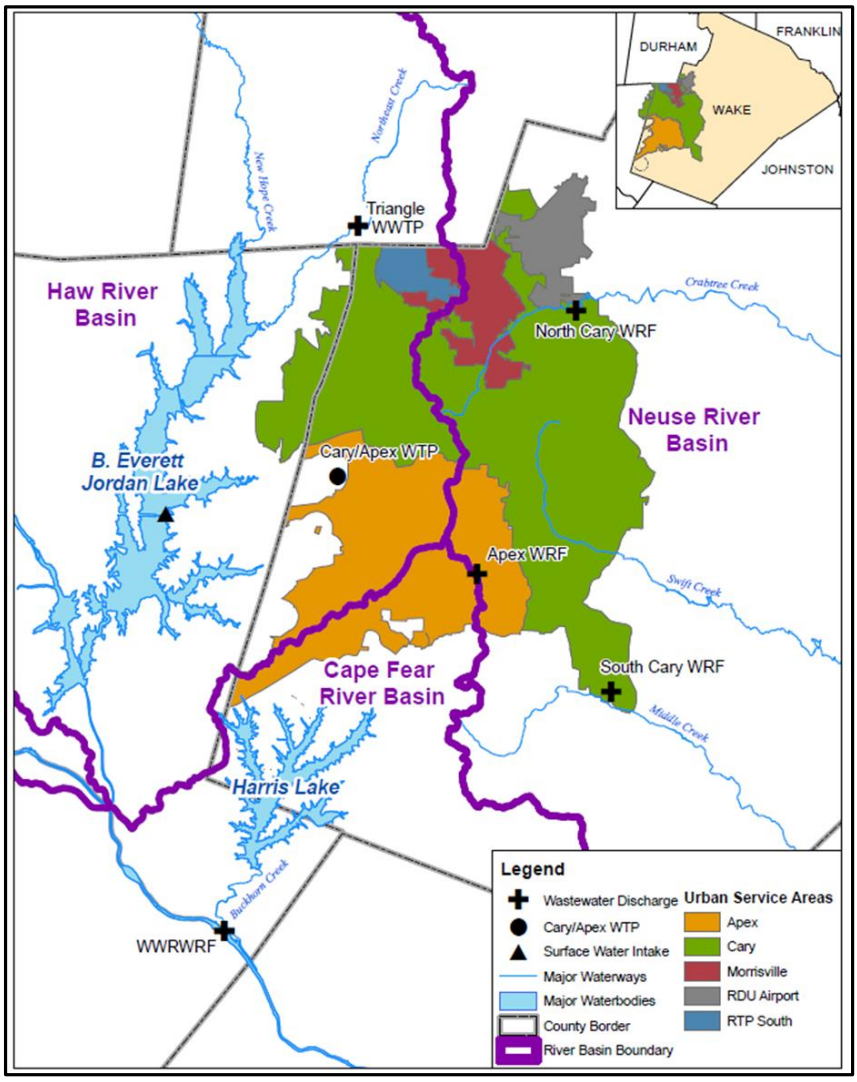
The Towns of Cary and Apex have a long history of developing plans to effectively manage their water resources and to ensure safe and reliable water supply for the communities they serve. Since 2000, the Towns have taken actions on the recommendations provided in the Long Range Water Supply Plan (CH2M HILL, 2000) and the Integrated Water Resources Management Plan (CH2M HILL, 2007). In the spirit of continuing to value the importance of long range water resources planning, starting in 2010 the Towns of Apex, Cary, and Morrisville, and Wake County worked through a structured two-phase process to develop a Long Range Water Resources Plan (LRWRP). The LRWRP was completed in January 2013 and serves as the basis for this Round 4 Jordan Lake water supply storage allocation request.

In addition to planning for each Town's service area, the Towns and Wake County are part of the Jordan Lake Partnership (JLP) which is a regional partnership of 13 local governments proactively planning for the region's water resources needs. The JLP recently completed the Triangle Regional Water Supply Plan (TRWSP) to collaboratively plan for sustainable and secure water supplies for the Region. This allocation request is on behalf of the Towns of Cary, Apex and Morrisville, and Wake County for RTP South, and is consistent with the TRWSP.

SECTION I. WATER DEMAND FORECAST

The baseline water demand and wastewater flow forecasts developed for the Long Range Water Resources Plan are representative of each Town's current programs and policies, including current conservation programs, and assume they continue into the future absent of any influence of major technology or regulatory changes. The service areas for the Towns of Cary and Apex are shown in Figure I.1. Demand projections are provided for the Towns of Cary and Apex, the Town of Morrisville, and the Wake County portion of Research Triangle Park (RTP South).

Figure I.1 – Map of Service Areas



User Sectors

User sectors for the Towns and RTP South are defined as follows in presenting demand projections for this allocation request.

Table I.1. Water Use Sectors

Use Sector	Use Sub-sector	Description
Residential		Includes potable water use for single family and multi family dwellings for Cary, Apex and Morrisville
	Single Family Residential	Includes potable water use for single family dwellings for Cary and Morrisville
	Multi Family Residential	Includes potable water use for multi family dwellings (e.g., apartments and condominiums) for Cary and Morrisville
Commercial		Includes potable water use for retail stores, business offices, hotels, hospitals, restaurants, golf courses, etc. for Cary, Apex, Morrisville and RTP South. RDU potable use is also included in this sector.
Industrial		Includes potable water use for manufacturing facilities, processing facilities, warehouses, etc. for Cary, Apex, Morrisville and RTP South. RDU potable use is also included in this sector.
Institutional		Includes potable water use for parks, government facilities, schools, utility pumping stations, etc. for Cary, Apex and Morrisville
Bulk Sales		Includes potable water sales for construction activities through hydrant meters for Cary
Non-Revenue	Distribution System Process	Water used in distribution system flushing and other distribution system operations for Cary, Apex, Morrisville, and RTP South
	Water Treatment Process	Water used in treatment processes (Cary/Apex Water Treatment Facility), such as filter backwashing, that is not sent to the distribution system
	Other Non-Revenue	Potable water sent to the distribution system that is not captured by metered use or used in system processes, e.g., customer metering inaccuracies, fire flows, system leakage, etc. for Cary, Apex, Morrisville and RTP South

Note that Bulk Sales as a water use sector differs from contractual bulk water sales to another water supply system. Also note that Water Treatment Process water is discharged to Jordan Lake.

Demand Projections

While the demand projection methodology used for the Towns of Cary and Morrisville in the LRWRP is based on parcel level information, it is consistent with the following population projection.

Table I.2 - Population projections for service area

Service Area	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
Apex	37,700	41,400	53,100	62,900	74,400	87,400	100,500	104,900	109,200	110,700	112,200
Cary	126,500	139,400	154,100	170,000	183,800	196,900	204,800	213,200	221,500	221,500	221,500
Morrisville	18,400	20,400	22,300	23,200	24,300	25,300	25,800	26,100	26,400	26,700	26,900
TOTAL	182,600	201,200	229,500	256,100	282,500	309,600	331,100	344,200	357,100	358,900	360,600

The demand projections for the Towns of Cary and Apex, the Town of Morrisville and RTP South are as follows. Demand projections are further detailed in the attached Excel workbook.

Table I.3 – Average Day Raw Water Demand (MGD), Cary & Apex

Sector	Subsector	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
Residential	Residential	10.30	11.60	14.00	15.90	17.60	19.30	20.80	21.80	22.80	22.85	22.90
Commercial	Commercial	3.40	4.40	5.10	5.80	6.40	6.80	7.10	7.40	7.70	7.80	7.90
Industrial	Industrial	0.20	0.30	0.30	0.60	0.70	0.90	1.10	1.15	1.20	1.20	1.20
Institutional	Institutional	0.30	0.30	0.40	0.40	0.50	0.50	0.60	0.60	0.60	0.60	0.60
Bulk Sales	Bulk Sales	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
System Process	Distribution Process	0.23	0.33	0.34	0.45	0.50	0.50	0.50	0.55	0.60	0.60	0.60
System Process	WTP Process	3.20	3.00	3.60	4.20	4.60	5.10	5.40	5.65	5.90	5.95	6.00
Non-Revenue	Other Non-Revenue	0.80	1.00	1.20	1.40	1.50	1.60	1.80	1.90	2.00	2.00	2.00
TOTAL		18.40	20.90	25.00	28.80	31.90	34.80	37.30	39.15	40.80	41.10	41.40

NOTE: WTP Process water is discharged to Jordan Lake.

Figure I.2 – Average Day Raw Water Demand by Sector, Cary & Apex

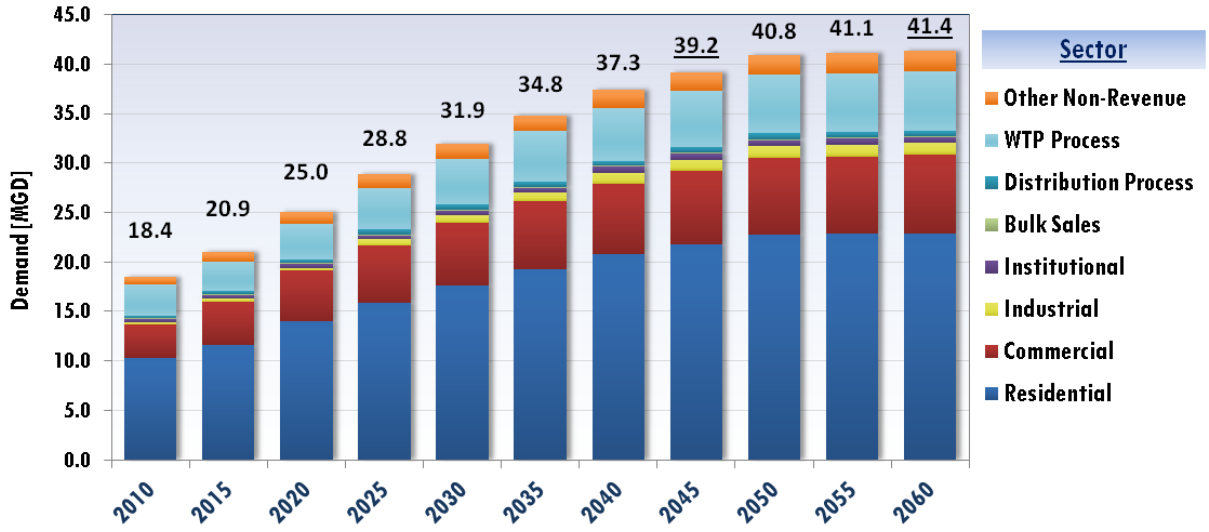


Table I.4 – Average Day Raw Water Demand (MGD), Morrisville

Sector	Subsector	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
Residential	Single Family Res.	0.60	0.70	0.80	1.00	1.00	1.10	1.10	1.15	1.20	1.25	1.30
Residential	Multi Family Res.	0.30	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40	0.40
Commercial	Commercial	0.40	0.50	0.80	0.80	0.90	1.00	1.10	1.10	1.10	1.10	1.10
Industrial	Industrial	0.01	0.02	0.03	0.04	0.06	0.10	0.10	0.10	0.10	0.10	0.10
Institutional	Institutional	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.03
System Process	Distribution Process	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.10
System Process	WTP Process	0.30	0.30	0.40	0.40	0.40	0.50	0.50	0.50	0.50	0.50	0.50
Non-Revenue	Other Non-Revenue	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
TOTAL		1.72	2.03	2.54	2.75	2.88	3.32	3.42	3.47	3.52	3.58	3.63

NOTE: WTP Process water is discharged to Jordan Lake.

Figure I.3 – Average Day Raw Water Demand by Sector, Morrisville

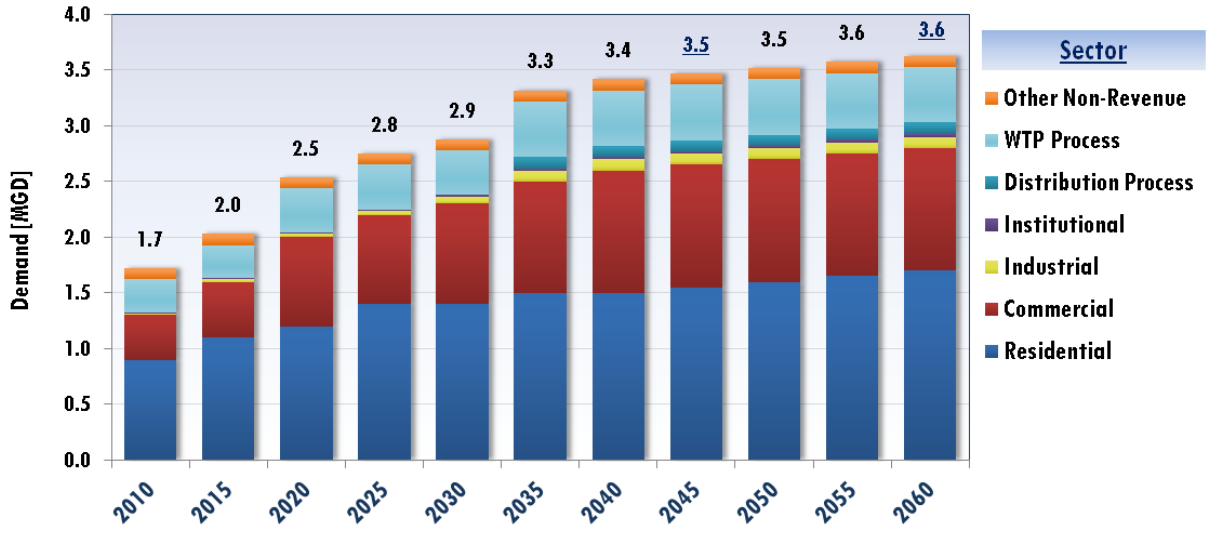
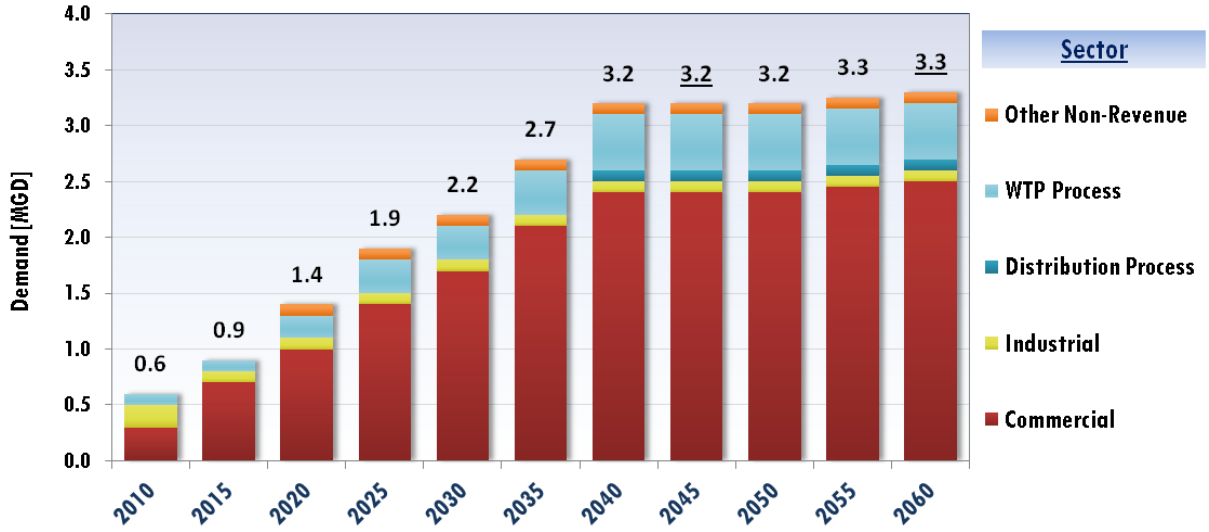


Table I.5 – Average Day Raw Water Demand (MGD), RTP South

Sector	Subsector	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
Residential	Single Family Res.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Residential	Multi Family Res.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Commercial	Commercial	0.30	0.70	1.00	1.40	1.70	2.10	2.40	2.40	2.40	2.45	2.50
Industrial	Industrial	0.20	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Institutional	Institutional	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
System Process	Distribution Process	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.10	0.10	0.10	0.10
System Process	WTP Process	0.10	0.10	0.20	0.30	0.30	0.40	0.50	0.50	0.50	0.50	0.50
Non-Revenue	Other Non-Revenue	0.00	0.00	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
TOTAL		0.60	0.90	1.40	1.90	2.20	2.70	3.20	3.20	3.20	3.25	3.30

NOTE: WTP Process water is discharged to Jordan Lake.

Figure I.4 – Average Day Raw Water Demand by Sector, RTP South



Demand Projection Methodology

Demand projection methods differed between Apex, Cary and Morrisville, and RTP South, based on information available.

Apex

Population Estimates

Apex developed its population estimates based on planning projections through 2030, and a land use analysis to determine population thereafter. CH2M Hill prepared several technical memoranda detailing the population projections. The basic population methodology is laid out in "Final Technical Memorandum: Town of Apex Population and Water Demand Projections" (CH2M Hill, 2008). CH2M Hill acquired total population projections by Traffic Analysis Zone

(TAZ) for the Town of Apex from the Capital Area Metropolitan Planning Organization (CAMPO). These projections included the years 2007, 2010, 2015, 2020, and 2030. The total population projections were then adjusted to match the population estimates provided by the Town's Planning Department while maintaining the spatial distribution of the population data within each TAZ. The water demand estimates were developed for the Apex water service area, which is defined as the combination of the: Town's corporate limits, extraterritorial jurisdiction (ETJ) and urban service area (USA). Neither the Town of Apex nor CAMPO had data available for the years 2030 through 2050. CH2M Hill needed to determine the maximum population that the entire water service area could sustain based on the build-out conditions of the Town's 2025 Land Use Plan GIS data layer.

The 2030-2050 demands were determined through a parcel-based land capacity analysis. The land capacity analysis estimates the expected build-out population in Apex by taking into account existing land use from the Wake County parcel database, future land use from the Town's Land Use Plan, development density from the Town of Apex Comprehensive Plan, and persons per household assumption from US Census Bureau data for Apex. This analysis was later extended by CH2M Hill to 2060 in "Technical Memorandum Addendum No. 2: Town of Apex Population and Water Demand Projections through 2060, Modified Growth Scenario" (CH2M Hill, 2010a). The land capacity analysis established the maximum population in the current corporate limits, ETJ, and USA. Under the chosen "Modified Growth Scenario," the combined population of the corporate limits and ETJ reaches its build-out population of 101,570 in 2050. The USA population does not reach build-out, and grows by four percent per year from 2015 to 2060. The populations of the Corporate Limits/ETJ and USA areas were summed to obtain the total population estimate.

Water Demand Projection

The Town of Apex projected sector usage by quantifying the size of each sector and multiplying by a water use rate. Four use sectors were defined for the purposes of this analysis. The residential and institutional sector sizes were defined on a population basis. The commercial sector's size was quantified on the basis of commercial land area developed. Projections of the rate of increase of developed commercial land area were tied to the rate of increase in the CAMPO projections of employment by TAZ area. The industrial demand sector size was quantified by the acreage of developed industrial parcels.

Once sector size was projected for all of the use sectors, they were multiplied by a use rate to calculate water demand. The use rates remained constant for all forecast periods. The residential and commercial use factors were determined using the average 2004-2010 billing data, population estimates, land use data and commercial account estimates for the same time period. The industrial and institutional unit factors were determined from 2007 data. The use rates used in the projections include:

- Residential (RES): 60.0 gpd per capita
- Institutional (INS): 1.88 gpd per capita
- Commercial (COM): 602 gpd per acre COM development
- Industrial (IND): 221 gpd per acre IND development

Using these rates multiplied by the sector size, the water demand projections by sector were calculated. After these demands were calculated, the projected usage in the non-revenue categories of demand was projected.

For the purposes of these projections, the Town of Apex divided non-revenue into two categories. Most of the non-revenue use fell into a general other non-revenue category capturing all non-revenue uses of finished water. This includes leakage, pipe breaks, firefighting, and system flushing. For all forecast years, Apex calculated the other non-revenue usage as 9% of finished water demand. This category did not include water treatment plant system process usage. The system process use definition was limited to Apex's portion of system process usage to operate the Cary/Apex water treatment plant, in other words WTP Process only. For WTP system process projections, Apex used a factor equal to 0.17 times finished water production. This is equivalent to the factor used in projecting WTP Process for Cary since they jointly operate the Cary/Apex Water treatment plant. This was added to finished water production to obtain total projected average daily (raw) water demand.

Cary & Morrisville

The Town of Cary has been reviewing population, water usage patterns and water demand projections annually since 2000 as a part of its ongoing water supply and infrastructure planning efforts, as well as engagement in the Jordan Lake Partnership. These efforts are most recently captured in the Town of Cary Water Use Analysis (CH2M Hill, 2010b) and the Long Range Water Resources Plan (CH2M Hill, 2012).

Projected water demands were developed for existing and future conditions based on parcel-level land use information and water meter billing data. The total future system finished water demand is comprised of the existing demand, projected future demand, future non-revenue water, operational requirements and bulk water sales (i.e., potable water sales for construction activities through hydrant meters). Water demands were disaggregated by jurisdiction (Cary, Morrisville and RTP South), river basin (Cape Fear, Haw, and Neuse) and customer classification (single family residential, multi-family residential, commercial, industrial, and institutional). The projections were developed for the Town's water system service area, which is defined as the combination of the Towns of Cary and Morrisville urban service areas, RDU Airport and the Wake County portion of RTP (RTP South). Demand projections for RTP South were provided by Wake County.

The billing data for 2001 through 2010 were assumed to be the baseline characteristic for existing and future customers for all use types. The 2001 through 2010 time period was analyzed because it includes the most recent data trends, as well as the occurrence of normal and outside of normal weather patterns in these years and the impact of an extended economic recession. Using these data captures the potential future trend of oscillating patterns

of extreme and normal weather, as well as the implementation of conservation measures by the Town to manage demand during times of environmentally induced water shortages.

The unit-based water demand projections were developed and applied based on the projected future development data. The following sections provide a summary of the projection steps.

Step 1: Unit Demand Factors

Water demand unit factors form the base for the development of essentially any demand projections. These factors are typically applied to water uses on an annual average basis and can be determined on a per capita, per account, or per acre basis. Tables 1 and 2 (CH2M Hill, 2012) display the water demand unit factors for Cary and Morrisville, respectively, as identified from analyses detailed in the Town of Cary Water Use Analysis TM (CH2M Hill, 2010b).

TABLE 1
Town of Cary Water Demand Unit Factors

Customer Classification and Abbreviation	Water Demand Unit Factor [a]	Data Source
Single Family Residential (SFR)	218 gpd/unit [b]	Town of Cary Water Use Analysis (CH2M HILL, 2010)
Multi-Family Residential (MFR)	116 gpd/unit	Town of Cary Water Use Analysis (CH2M HILL, 2010)
Industrial/Commercial/ Institutional (ICI)	0.1 gpd/square foot of building	Town of Cary Engineering Department
Commercial (COM)	1,142 gpd/acre	Town of Cary Water Use Analysis (CH2M HILL, 2010)
Industrial (IND)	376 gpd/acre	Town of Cary Water Use Analysis (CH2M HILL, 2010)
Institutional (INS)	214 gpd/acre	Town of Cary Water Use Analysis (CH2M HILL, 2010)
Parks (PKS)	25 gpd/acre	Determined for the LRWRP from existing Town park facility meter and parcel data.
Open Space (OS)	0 gpd/acre	No open space demand factors

[a] Water demand unit factors include both domestic and outdoor usage.
[b] Based on 2.78 people per unit (2010 Census), this would be equivalent to 78 gpcd.

TABLE 2
Town of Morrisville Water Demand Unit Factors

Customer Classification and Abbreviation	Water Demand Unit Factor [a]	Data Source
Single Family Residential (SFR)	218 gpd/unit [b]	Town of Cary Water Use Analysis (CH2M HILL, 2010)
Multi-Family Residential (MFR)	130 gpd/unit	Town of Cary Water Use Analysis (CH2M HILL, 2010)
Industrial/Commercial/ Institutional (ICI)	0.1 gpd/square foot of building	Town of Cary Engineering Department

Commercial (COM)	771 gpd/acre	Town of Cary Water Use Analysis (CH2M HILL, 2010)
Industrial (IND)	312 gpd/acre	Town of Cary Water Use Analysis (CH2M HILL, 2010)
Institutional (INS)	153 gpd/acre	Town of Cary Water Use Analysis (CH2M HILL, 2010)
Parks (PKS)	25 gpd/acre	Determined for the LRWRP from existing Town park facility meter and parcel data.
Open Space (OS)	0 gpd/acre	No open space demand factors

[a] *Water demand unit factors include both domestic and outdoor usage.*
[b] *Based on 2.70 people per unit (2010 Census), this would be equivalent to 81 gpcd.*

The ICI square foot unit demand factor of 0.1 gpd/square foot of building space is a value that has historically been used by the Town's Engineering Department for capacity determinations. This value was validated as appropriate to continue to be used for water demand projections based on a review of non-residential water meter and building square footage data, from the Wake County parcel database. The review yielded a range of potential square foot unit demand factors with 0.10 gpd/square foot being a reasonable estimate of unit consumption for non-residential facilities.

A number of assumptions were used to develop the SFR unit demand factor presented in Tables 1 and 2, and these assumptions form the basis for the projected future SFR water demand and wastewater flows. These assumptions were developed during analyses completed for the Town of Cary Water Use Analysis TM and are as follows:

- SFR usage patterns for existing accounts for homes constructed after the year 2000 will continue into the future:
    - Outdoor unit demands for homes without an in-ground irrigation system = 16 percent of unit demand.
    - Irrigation unit demands for home with an in-ground irrigation system = 54 percent of unit demand.
- Thirty-five percent of new homes will have in-ground irrigation systems, a continuation of the trend for homes constructed after 2005.
- The profile of new homes by square footage will be similar to that of homes constructed after 2005:
    - <2,000 square feet – 16 percent
    - 2,001 – 3,000 square feet – 34 percent
    - 3,001 – 4,000 square feet – 35 percent
    - >4,001 square feet – 16 percent
- The current level of water efficiency for fixtures within homes constructed after 2005 will continue into the future.

Step 2: Non-Revenue Water

The *non-revenue water* represents the portion of the water produced that is not billed. This typically includes meter errors; water lost to system leaks, hydrant flushing, and fire flows.

Once water production and water sales have been determined for the system, the percent of non-revenue water can be estimated as:

$$U = 100 \times (Q_p - Q_s)/Q_p$$

Where U is non-revenue water percentage, Q_p is the total water production and purchases, and Q_s is the total water sales.

A constant percentage for the system was assumed based on Town data for the average estimated percentage of non-revenue water factor for the time period of 2001 through 2010; these values are shown in Table 3 (CH2M Hill, 2012). For the Town of Cary, the non-revenue water during this time period was estimated to be 7 percent. Analyses completed by Town staff to disaggregate non-revenue water that is attributed to operational usage (e.g., pipeline flushing) versus leaks, failing water meters or water theft revealed that approximately 2 percent of the total water supply was used for the Town's operational purposes. This percentage was used to project operational demands into the future, and 5 percent was used to project non-revenue demands into the future.

TABLE 3
Town of Cary Water System Non-Revenue Water Summary, January 2001 through December 2010 (in mgd)

Year	Total Water Supply	Total Water Sold	Non-Revenue Water	Non-Revenue Water (% of Total Supply)
2001	12.0	11.2	0.8	6%
2002	12.8	11.9	0.9	7%
2003	11.5	11.2	0.3	3%
2004	12.3	11.4	0.8	7%
2005	12.8	12.4	0.4	3%
2006	12.9	11.9	1.0	7%
2007	15.4	13.9	1.5	10%
2008	13.9	12.8	1.1	8%
2009	13.2	12.3	0.8	6%
2010	14.2	13.4	0.8	6%

Note: Numbers may not sum due to rounding.
Note: mgd = million gallons per day

Step 3: Water Treatment Plant System Process Water

The water treatment plant (WTP) system process water is returned almost directly to Jordan Lake by discharge to an unnamed tributary of White Oak Creek. WTP system process water requirements include the amount of water needed for in-facility needs such as filter backwashing. The ratio of raw water requirement to produce one gallon of finished water is an appropriate measure of the WTP system's need to produce potable water. The ratio used to estimate the required raw water demand to produce finished water is 1.17 to 1.00. This ratio means that the Cary/Apex WTP requires 1.17 gallons of raw water to produce one gallon of finished water, based on current processes at the WTP. This ratio was selected as reasonable

for use based on a review of the long and short-term trends in the annual ratios, which exhibited limited variance from the mean.

Table 4 (CH2M Hill, 2012) contains the historic Cary/Apex WTP raw water demand to finished water produced ratios from 1998 through 2010.

TABLE 4
Cary/Apex WTP Raw Water Demand to Finished Water Produced Ratio

Year	Average Day Raw Water Demand (mgd)	Average Day Finished Water Produced (mgd)	Raw Water: Finished Water (1 Gallon) Ratio
1998	10.75	9.81	1.10
1999	9.20	8.09	1.14
2000	7.30	6.42	1.14
2001	9.71	7.17	1.35
2002	17.41	14.59	1.19
2003	15.93	13.86	1.15
2004	17.04	14.82	1.15
2005	18.43	15.60	1.18
2006	17.60	15.54	1.13
2007	20.28	18.39	1.10
2008	19.28	16.57	1.16
2009	19.54	16.08	1.21
2010	20.94	17.12	1.22
	13-year Average Raw Water to Finished Water Ratio (1998-2010)		**1.16**
	5-year Average Raw Water to Finished Water Ratio (2006-2010)		**1.17**

Step 4: Calculating Average Day Water Demand Projections

The future year water demand was calculated by adding the base year (2010) water demand for existing customers by customer class to the future year water demand. Each parcel was assigned a water service connection category which identified parcels with an existing water service connection (i.e., existing water demand) or that will have a connection in the future. The four primary general water service connection categories are: Existing, Developing, Developing Permitted, and Vacant. Individual parcels assigned to these categories were further assigned to a sub-category. The water service connection categories and sub-categories were used to define how the parcel would develop and contribute to the future demands.

To attribute demands to an individual customer type each parcel was assigned a generalized customer type classification which included single family residential, multi-family residential, commercial, industrial, institutional, parks or open space. For existing accounts the generalized use type was assigned based on the 2010 billing data. For the LRWRP projections, the Developing and Developing Permitted parcels were classified based on the information

provided by the Town for each permitted or planned development. The vacant parcels within the Town of Cary and Town of Morrisville were classified based each Town's respective future land use plan. Built without Service parcels were classified using each Town's respective land use planning data paired with the NC Department of Revenue codes contained in the Wake County parcel data to fill any data gaps and verify land use codes.

The rate at which a parcel would develop in the future varies based on its water service connection category. The Town of Cary's Engineering and Planning Departments and the Town of Morrisville's Planning Department were consulted in assigning the build-out rates. The composite build-out rate for all water service connections is consistent with other planning estimates.

The future demands were calculated using different methods dependent upon the water service connection category for an individual parcel. The overall method is as follows:

- Existing meter demands: The 2010 water meter billing data provided by the Town of Cary were assumed to be the base year characteristic for existing water customers of all use classifications. The total annual consumption by individual account was used to determine the average annual day demand for each account. This demand is defined as the base water demand. This consumption pattern was assumed to remain constant in future years. This meter data excludes those meters identified to connect to the Town's reclaimed water system.
- Future parcel demands: The development capacity of single family lots, multi-family units, or non-residential (commercial, industrial, institutional) square footage or acreage by parcel was determined based on submitted site plans or the future land use plan. The future development potential of a parcel was then used as the basis for the demand calculation. Demands were calculated by multiplying the development numbers (lots, units, square footage or acreage) by the appropriate unit demand factors (from Tables 1 and 2), and the rate of demand accumulation through the planning period. Irrigation demand at future Town park facilities was determined on a site specific basis. These park facilities include Thomas Brooks Park, USA Baseball Complex, expansion of Mills Park, the addition of athletic fields at Panther Creek high school, the future Roberts Rd. Park and a future unnamed park facility that will border the American Tobacco Trail.

<u>RTP South</u>

The Research Triangle Foundation (RTF) serves as the property management agency for Research Triangle Park (RTP). Wake County serves as the governmental jurisdiction for the portion of RTP within Wake County (RTP South). RTP South obtains its water supply and wastewater services from the Town of Cary through an interlocal agreement that includes Wake County and RTF.

RTP South currently has ten (10) existing or planned tenants and nine (9) vacant parcels. Questionnaires were sent by Wake County to each of the existing tenants to determine the projected employee counts for the years 2040 and 2060. Those projected employee counts

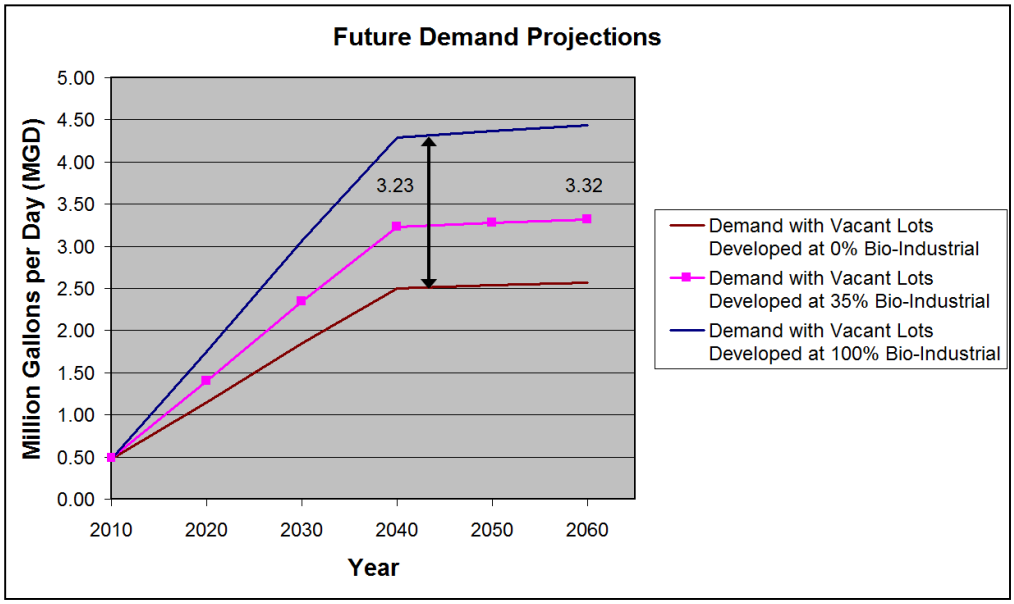
were utilized by Wake County in estimating the projected water demands in RTP South. The questionnaires also included information related to the tenants' plans to use reclaimed water at their facilities. A project to supply RTP South with reclaimed water for irrigation and other uses has been operational since 2012.

RTP South is a defined area with a limited number of lots. The area's future growth is therefore limited to the existing parcels. Since Cisco's arrival in 1994, all but nine (9) of the existing parcels have been developed. Since more than half of the lots have been developed in approximately 17 years, it is estimated that the remaining vacant parcels in RTP South will be developed within the next 29 years, or by the year 2040.

Currently, approximately 35% of the existing built-upon acreage in RTP South is occupied by bio-industrial tenants that consume, proportionally, a larger amount of water than other tenants. The other 65% of RTP South is occupied by commercial office facilities. Predicting the nature of future tenants is always speculative. The most aggressive water demand projections would assume that 100% of the remaining vacant land would develop with bio-industrial facilities. The least aggressive – and one might argue tenuous – demand projections would assume that 0% of the vacant land would be developed for bio-industrial.

For the purposes of this projection, it is assumed that the vacant sites will develop in a manner similar to historic development patterns. Therefore, it is assumed that 35% (119 acres) of the remaining 339 acres will be developed for bio-technology companies, with the remaining 65% (220 acres) being developed for commercial tenants. The range of possible water demand projections is demonstrated in Figure 26 (TJCOG, 2012). The selected demand curve is for 35% bio-industrial development

FIGURE 1. WAKE COUNTY – RTP SOUTH FUTURE DEMAND PROJECTIONS



Historically, the existing commercial tenants in RTP South have an average of 20 employees per acre and an average water demand of 19 gpd per employee. Commercial tenants are projected to develop to 47 employees per acre by 2040 and 48 employees per acre by 2060. These

employee densities were calculated using the previously mentioned questionnaire. For future demand projections, each employee is projected to use 25 gpd per NCAC T15A:18C.0409, which is not dissimilar from historical use.

Currently, the existing bio-industrial tenants are developed at 10 employees per acre. The average water demand is 20 gpd per employee. In the future, bio-industrial tenants are projected to develop to 20 employees per acre by 2040 and 29 employees per acre by 2060. These employee densities were calculated using the previously mentioned questionnaire. Each employee is projected to use 25 gpd per NCAC T15A:18C.0409, which again is consistent with historical use.

In addition to the water demands expected due to employee use, the bio-industrial tenants will also have process water use. A process water rate of 0.6 gpd/ft^2 of projected building square footage was utilized. This rate is equivalent to the permitted process use per square foot of the existing bio-industrial tenants in RTP South. The existing building square footage in RTP South represents 19% of their respective lot acreage, as several sites contain multi-level buildings. For projections, the building square footage for future bio-industrial facilities is projected to be 20% of their lot coverage.

There are currently no institutional demands in RTP South. No future institutional development is expected to occur within RTP South. For this reason, no projection of institutional demand has been included.

Non-revenue water for RTP South consists of RTP South's share of the process water loss (filter backwashing, sampling, etc.) at the Town of Cary's water treatment plant, and other non-revenue losses such as flushing of the distribution system and small leaks and deficiencies in the system.

All projections for 2020, 2030 and 2050 were determined by interpolating between the 2010 estimates and the 2040 and 2060 calculated projections. Additionally, it was assumed that all irrigation needs will be met using reclaimed water.

References

CH2M Hill, 2012. Long Range Water Resources Plan: Town of Cary, Morrisville and RTP South Baseline Water Demand and Wastewater Flow Projections.

CH2M Hill, 2011. Long Range Water Resources Plan: Town of Apex Baseline Water Demand and Wastewater Flow Projections.

CH2M Hill, 2010a. Town of Apex Population and Water Demand Projections through 2060, Modified Growth Assumption Scenario TM.

CH2M Hill, 2010b. Town of Cary Water Use Analysis TM.

CH2M Hill, 2008. Final Technical Memorandum: Town of Apex Population and Water Demand Projections.

Triangle J Council of Governments (TJCOG), 2012. Triangle Regional Water Supply Plan: Volume I – Regional Needs Assessment.

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SECTION II. CONSERVATION AND DEMAND MANAGEMENT

Cary and Apex have their own jurisdictions, their own service areas, and operate separate distribution systems. Similarly, their conservation programs differ.

Apex

The Town of Apex is committed to continuing its efforts to ensure efficient water use, limited non-revenue water, and rigorous water accounting. Most of the Town's residential homes (and corresponding water lines and meters) have been built since 2000 and include water efficient fixtures, helping to achieve low residential water use rates. The Town's water utility staff performs an annual water audit, tracking bulk water sales, non-metered construction water, metered non-billed water and in-house use for activities like street sweeping and water quality flushing. Through this process, Apex is able to account for 97% of its water use and just 3% is unaccounted for. Throughout its distribution system, finished water provided by the joint Cary-Apex Water Treatment Plan is used efficiently and non-revenue water is held to just 7.8% of its raw water demand, excluding water treatment plant process water. The Town of Apex was a core participant in developing regionally-consistent year-round water efficiency and water conservation measures following the 2007-2008 drought, and was one of the first towns to adopt those measures. The Town is committed to continuing to use water efficiently in the future and conducting annual water audits to track water use.

Cary, Morrisville, RTP South

The Town of Cary's service area includes the Town of Morrisville and RTP South. The Town of Cary owns and operates the utility infrastructure within Morrisville. By interlocal agreement, customers within RTP South enjoy the same rights and responsibilities for water service as do the Town's other utility customers. Therefore, Morrisville and RTP South are included in this section.

Conservation Program Overview

The Town of Cary has one of the longest-standing water conservation programs in the State of North Carolina (starting in 1995), one of the most comprehensive and proactive programs in the Southeast, and is well recognized across the country. The Town's water conservation program is led by a Water Resources Outreach Supervisor who supervises a full-time Water Resources Specialist and a half-time Water Resources Communications Specialist. Two Water Conservation Technicians also implement the Water Conservation Program through field education and, when needed, enforcement, with priorities set by the Water Resources Outreach Supervisor. The program is overseen by the Town's Water Resources Manager.

The Town set forth goals for the conservation program within Town Policy Statement 111:

- Support the high quality of life in Cary by providing safe and reliable water service while reducing wasteful uses of water; reducing costs of infrastructure; and conserving a limited natural resource.
- Delay capital projects for the expansion of water supply facilities or the development of new sources.

The Town's water conservation program focuses on two primary areas to meet these goals: (1) reducing per capita water consumption and (2) managing peak day water demands. The program has accomplished its goals through a combination of three strategies:

- Education
- Financial incentives
- Regulations

The combination of these three strategies has fostered the Town's culture of conservation, encouraging customers to use water wisely by installing efficient technologies and by practicing water wise behaviors. The Town regularly evaluates its conservation program and occasionally changes the elements that implement its conservation strategies, based on the Town's goals and strategies, and the effectiveness of the program elements. Table 1 (CH2M Hill, 2012a) summarizes elements of Cary's Water Conservation Program in place at that time, including target water use classes.

TABLE 1
Cary Water Conservation Program Elements

Conservation Program Elements	Target Use Class
Education and Public Information	
Public Education/Beat the Peak Campaign	All
Fix a Leak Week Campaign	Residential
Block Leader Program	Residential
Residential Water and Irrigation Audits	Residential
Website	All
Festival Booths	All
Financial Incentives	
Tiered Rate Structure	All
Water Budgets (linked with tiered rates)	Commercial (some Residential)
High Efficiency Toilet (HET) Rebate	All
Rain Barrel	Residential
Rain Barrels for Sale at Cost	
Build Your Own Rain Barrels for Sale at Cost	
Give-aways (showerheads, kitchen and bathroom aerators, shower timers, rain gauges)	Residential

TABLE 1
Cary Water Conservation Program Elements

Conservation Program Elements	Target Use Class
Regulations and Policies	
Water Waste Ordinance	All
Rain Sensor Ordinance	All-Outdoor
Alternate Day Watering Ordinance	All-Outdoor
New Development	
Land Development Ordinance	Commercial-Outdoor
Irrigation Plan Review	All -Outdoor
Requirement for Separate Irrigation Meters	All-Outdoor

Reclaimed Water Program

In 2001, the Town of Cary became the first municipality in North Carolina to provide reclaimed water to homes and businesses for irrigation and cooling. The Town is permitted to divert up to 5 mgd of treated effluent to its reclaimed water system. In 2010, the Town provided approximately 0.3 mgd on an annual average day basis and in excess of 1 mgd on a seasonal peak day to over 600 customers.

The Town's Policy Statement No. 132 (PS 132), adopted in 2001 and most recently updated in March 2013 after completion of the Long Range Water Resources Plan (LRWRP), defines the reclaimed water services areas (Figure 1, page 19) and provides guidance on the effective utilization of reclaimed water. The goals of PS 132 and the Town's reclaimed water program are the reduction of non-essential use of potable water and to prevent peak potable water demands from accelerating the need for expansion of the CAWTP. Following are key points contained in PS 132:

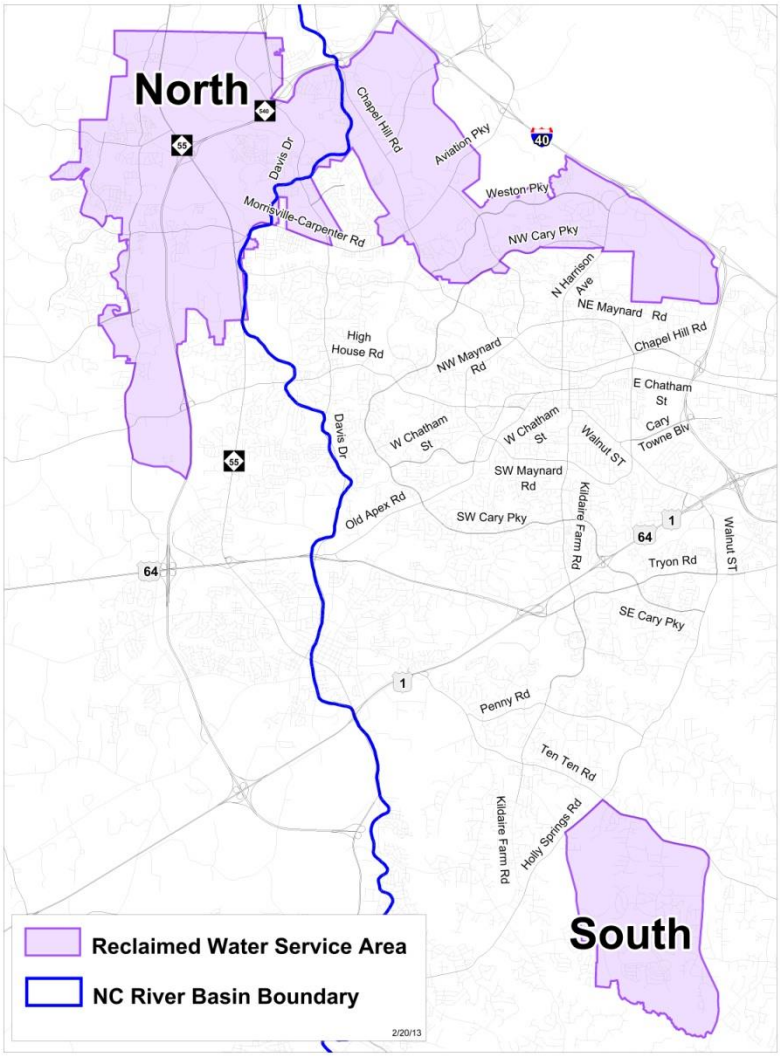
- Residents and businesses are to utilize to the maximum extent possible reclaimed water for secondary plumbing usage; including irrigation, cooling towers and other potential uses ("secondary water use facilities") as determined by the Town Manager, within the Town's designated reclaimed water service area.
- Developers are responsible for the full cost of installation reclaimed water facilities within their own properties.
- If reclaimed water is not available to a property for use when the site is ready for development, all on-site reclaimed water infrastructure shall be constructed and designed for permanent conversion to use reclaimed water when reclaimed water supply becomes available.

The Town's reclaimed water system currently consists of:

North Cary Reclaimed Water Service Area: Reclaimed water from the North Cary Water Reclamation Facility (WRF) serves commercial facilities for irrigation and cooling needs, as well as lawn irrigation for single-family homes. Reclaimed water from Durham County's Triangle

WWTP serves facilities in the Wake County portion of Research Triangle Park (RTP South) for irrigation and cooling needs, and in 2015 will serve additional residential and commercial facilities along Green Level Church Road extending from RTP to Thomas Brooks Park. Eventually the two systems will be connected, serving parts of Morrisville along the pipeline route, and supplied with reclaimed water from the North Cary WRF.

Figure 1
Reclaimed Water Service Areas



- South Cary Reclaimed Water Service Area: Reclaimed water from the South Cary WRF serves the irrigation needs for nearby schools and a recreational complex and is currently expanding its system to supply lawn irrigation for residential customers.
- Bulk Reclaimed Water: Both of the Town's WRFs allow approved contractors and Town employees to fill non-potable water tanks for use in irrigation, road construction, dust

control, sewer flushing, and street cleaning. Recently completed, the Western Wake Regional WRF will also provide bulk reclaimed water.

Water Loss Reduction Program

The Town of Cary conducts annual water audits using the AWWA Water Loss Control Committee Water Audit Software v4.2. Unaccounted for water loss is consistently < 10%, ranging between 2% and 6% for the past five fiscal years.

All of the Town's potable and reclaimed water connections are metered. The Town requires contractor tank trucks to use a bulk water meter when withdrawing water from hydrants, and, for approved uses, encourages them to use bulk reclaimed water instead of potable water.

The Town recently replaced all of the 63,000+ manual read meters to electronic read meters with a new fixed base network system (advanced meter infrastructure or AMI) and refers to this as Aquastar. As a result of the Aquastar project, 98% of the meters in the Town's service area are less than three years old.

The large meters at the Cary Apex WTF (30" and 42") are tested and calibrated every six months. Large electronic flow meters in the distribution system are calibrated quarterly. Large mechanical meters are typically not calibrated, but are tested during system-wide flow studies to determine their accuracy.

100% of the Town's distribution system is mapped using GIS. All development projects that include installation of public water infrastructure are reviewed and permitted by the Town's Water Resources Department (WR) and inspected during construction by WR. WR receives as-built drawings for archiving, and updates the Town's GIS data upon receipt of the as-builts.

The Town's goal is to exercise all valves ≥ 30" two times per year and all valves < 30" once every two years. The Town is in the process of locating all valves by GPS.

Overall Customer Water Use Efficiency

The LRWRP assessed the overall water use efficiency of the Town's customers and reviewed unit consumption data, by customer type, from 1995 through 2011. Since the inception of the Water Conservation Program in 1996, the Town has used and updated a database to track water consumption per unit for all residential and non-residential customer classes. In addition to actual consumption, the database also normalizes consumption to remove the influence of weather, estimating the annual unit consumption values had there been normal weather conditions, defined as the long-term average (20 and 30-year average). Figure 2 on page 21 (CH2M Hill, 2012a) presents the **residential** (combined single family and multi-family) gallons per capita per day (gpcd) from 1996, the first full year after the inception of the water conservation program, through 2011. Figure 3 on page 22 (CH2M Hill, 2012a) presents the **overall** (combined residential and non-residential) gallons per day per account (gpd/account).

Reviewing total monthly water use by customer class (single family residential, multi-family residential, commercial, industrial, and institutional) from January 1996 through December 2011 reveals that the overall single family residential customer class' daily consumption has decreased significantly over this 16-year period. The weather-adjusted data indicate that the

single family residential customer class per capita consumption has decreased approximately 24 percent since 1996 (1996 was used as the baseline year for comparisons to be consistent with previous Town reports). This is compared to the weather-adjusted overall gpcd (combined residential and non-residential consumption) reduction of approximately 20 percent during the same period. It is important to note that this overall decrease in water use is by no means consistent on a yearly basis with some years showing increases in per capita consumption when compared with previous years. These fluctuations underscore the importance of the Town's commitment to long-term water resources management through its dynamic water conservation program.

It is challenging to explicitly link the influence of the Town's water conservation program on these decreasing unit consumption trends (inclusive of adjustment for weather). Other factors that also influence water consumption include the economy, severe droughts in 2001-2002 and 2007-2008, changes in housing stock, changing regulations (outside of the Town's control), and the influence of local as well as global perspectives on water resources and sustainability. However, Cary considers its Water Conservation Program to be one of the driving factors in the sustained decrease in unit water use since 1996. In addition, the conservation program has been in place as greater numbers of residential irrigation systems have been installed; the increased prevalence of these systems have the potential to drive peak season water demands above the historical peaks, but this situation has not been shown by the data.

Figure 2
Annual Average Combined Residential Water Use in Gallons per Capita per Day (GPCD), 1995 through 2011
Town of Cary Customers Only

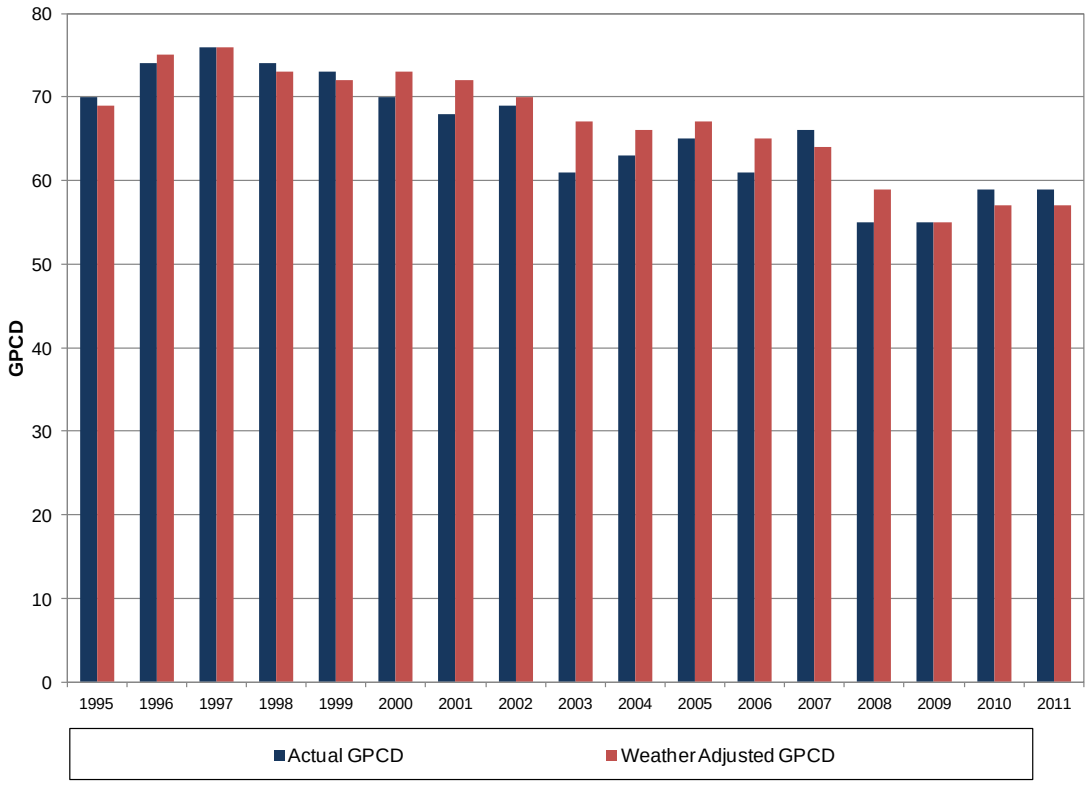
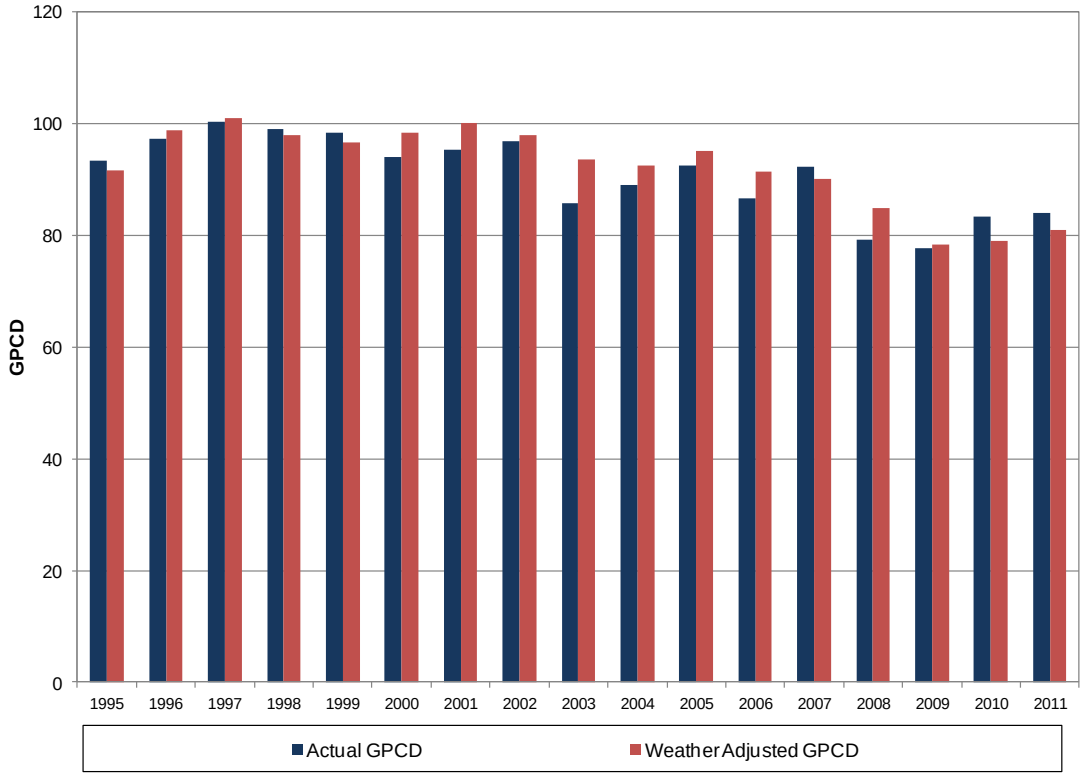


Figure 3
Annual Average Overall Water Use in Gallons per Capita per Day (GPCD), 1995 through 2011
Town of Cary Customers Only



Customer Water Consumption Trends

The Town has completed a significant amount of work to understand and track the consumption trends of its customers. Detailed analyses were completed by the Town during the development of the 2010 Water Use Analysis report (CH2M HILL, 2010). This report presents a vast amount of consumption profile data which provides a strong foundation for evaluating conservation programs in the Town. The 2010 analyses include evaluations of water use by different customer classes to provide a more detailed understanding of how, when and where water is used and the trends in water use for the different customer classes.

Residential (single and multi-family) water use has continued to make up a majority of the Town's water use profile – approximately 65 percent of total consumption. Single family residential irrigation demands have been estimated to range from 10 to 28 percent of the annual average daily demand from 2001 through 2009 (CH2M HILL, 2010), and comprise up to 50 percent, or greater, of the total residential demand on the annual maximum day. Significant trends in single family residential consumption or factors that can and will impact consumption in the future, as identified in the Water Use Analysis report (CH2M HILL, 2010) include:

- Homes built after 2000 tend to be larger in size (with greater tax values), have more bathrooms, more water consuming fixtures, smaller lots and a higher prevalence of automatic inground irrigation systems than older homes.
- Newer homes tend to use approximately 20 percent more water on an average daily basis than older homes. Although newer homes have a greater number of bathrooms and water consuming fixtures, their indoor consumption volumes do not appear to be driving total consumption. Irrigation demands are likely driving the increased consumption level for new homes.
- Homes with inground irrigation systems use a significantly higher amount of water than those without. Total annual average daily demand for homes with an inground irrigation system, constructed after 2000, is approximately 30 percent irrigation. During the peak irrigation season, the daily water consumption of these homes can be comprised of more than 50 percent irrigation.

The trends identified above are not much different than those being identified in national studies completed by AquaCraft (Mayer, 2011), Maddaus Water Management (Maddaus, 2011) and the AWWA Research Foundation (AWWARF, 2010).

The Maddaus (2011) work presents some additional trends of interest for the future which are partly the result of the recent economic recession, and which could impact residential consumption profiles. Residential indoor profiles have historically been decreasing or flat due to improved fixture efficiency, reduced household sizes and conservation efforts. However, the recession-driven trends demonstrate an increased prevalence of teleworking, increased unemployment, household consolidation (increase in person per household), reduced vacations, and a shift in demographics for new homes (elderly vs. new families). A few of these trends are contrary to the declining trend in household size identified in a recent AWWARF (2010) study which identified a decreasing trend in household water consumption, in part linked to decreasing household size. The water consumption dataset used for that AWWARF study included data through 2006-2007, which was the time period before the full impact of the economic recession, which started in 2007, was realized.

All of the identified trends, Town-specific and national, will influence the future consumption profile of the Town and shape its future water supply needs. Cary's water conservation program has been and will continue to be an important part of managing the influence of these trends on the Town's water system.

Future Water Demands

Town of Cary staff worked with staff of Apex, Morrisville, and Wake County through a structured, two-phase process to develop a Long Range Water Resources Plan (LRWRP). The LRWRP takes a strategic long view – through 2060 – to prepare us to meet the Town's water resources challenges in a dynamic and holistic way, through development of a Water Resources Portfolio. The Portfolio provides a mix of practical strategies that we can apply to meet our water resources responsibilities by implementing the right actions at the right time.

In addition to infrastructure and regulatory solutions, the Water Resources Portfolio contains best management practices addressing supply side management, demand side management and reclaimed water use. Supply side management includes continuation of existing operational programs like optimizing the distribution system operation, performing annual system water audits, and leak detection. The specific recommendations are already part of or planned for utility operations, and increase the flexibility and resiliency of our water system management.

Demand side management and reclaimed water have the potential for a significant impact on water use which could vary greatly depending on Town policies and customer choices. Because of the uncertainty associated with these practices, we cannot depend on them to reduce potable water demand, but the LRWRP quantifies how they could – in combination – increase the reliability and/or extend the life of our water supply (Figure 5, page 25) and treatment plant (Figure 6, page 26). For example, Figure 5 shows that by continuing implementation of reclaimed water and demand-side management, we can decrease the probability that our raw water demand will exceed our current 39-mgd allocation in 2032 from 50 percent to only 25 percent – thereby increasing the reliability of our water supply. Similarly, Figure 6 illustrates that these strategies could decrease the probability that our treated water demand will exceed the expanded CAWTF 56-mgd capacity in 2032 from 50 percent to only 25 percent – possibly delaying the need for the next expansion.

Figures 5 and 6 (CH2M HILL and Brown and Caldwell, 2013) are based on reclaimed water Scenario 4 (discussed on pages 27-28), and on overall potential demand side management water use reductions from current conservation programs, future federal efficiency requirements, and enhancements to the Towns' conservation programs.

Figure 5. Annual Average Daily Raw Water Demand, Towns of Apex, Cary, and Morrisville, RDU Airport, and RTP South, 2002 through 2060 – With the Incorporation of Enhanced Demand Management Programs and Reclaimed Water Program

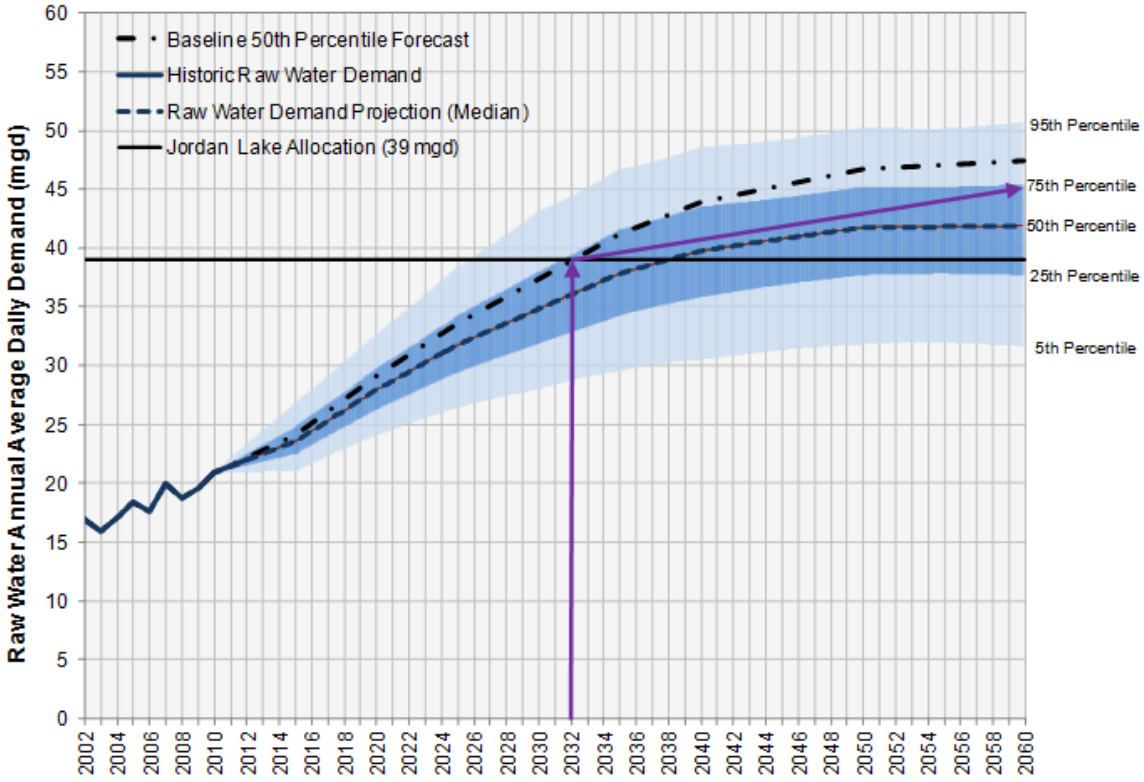
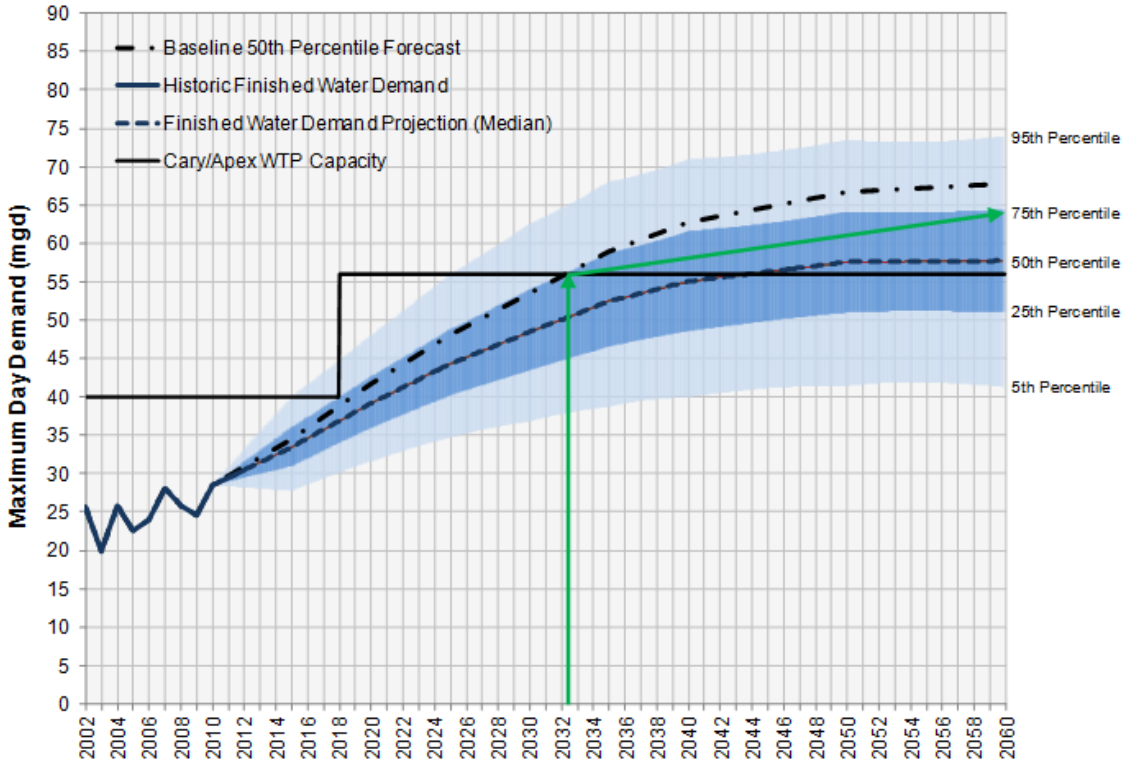


Figure 6. Maximum Day Finished Water Demand, Towns of Apex, Cary, and Morrisville, RDU Airport, and RTP South, 2002 through 2060 – With the Incorporation of Enhanced Demand Management Programs and Reclaimed Water Program



Demand Side Management

Demand side management includes both price-based (rate structure) and alternative (non-price-based) demand side management. The LRWRP includes an evaluation of Cary's current water conservation program (Appendix M, Town of Cary Water Conservation Program Evaluation and Future Considerations), incorporating a statistically valid survey of single family residential customers in Cary and Morrisville to assess water use awareness and values. On average, customers indicated that they were satisfied with the Town's conservation program. There was a general consensus that efficient water use is crucial to the Town's future water supply and the strongest motivation for conserving water is because it's "the right thing to do." Other key drivers to conserve water included compliance with water use ordinances and saving money.

Regulations as a strategy for conservation were viewed favorably and tiered water rates to encourage conservation are acceptable. Nearly 85% of respondents have a role (all or part) in maintaining their landscape indicating a potential opportunity for encouraging conservation. The preferred means of receiving information was limited to 4-5 methods including the BUD newsletter, postcards from the utility, Cary's e-mail list service and Cary's website.

Our nationally-recognized conservation program has always consisted of three main strategies: education and public information, financial incentives, and regulations. Over the years, the

initiatives within these strategies have changed based upon program analysis from each of the long range plans, new technology, and community needs. The three-pronged approach provides a variety of opportunities for customers to understand their role in helping us manage our water resources for the long-term benefit of our community.

Currently, the primary initiatives of the education and public information component include the annual “Beat the Peak” and “Fix a Leak Week” campaigns, the Block Leader Program, and Residential Water and Irrigation Audits. Staff supports educators with teaching materials, but no longer teaches lessons in the schools. With information on our Web pages and regular Bud articles, as well as personal contact with citizens at Lazy Daze and Earth Day festivals, staff provides individuals, neighborhoods and the community at large with information to help them use water wisely. With the recent completion of its advanced water meter infrastructure, known in Cary as Aquastar, many of Cary's educational initiatives will focus on the benefits of this tool for all customer types.

Financial incentives have included the Tiered Rate Structure, High Efficiency Toilet (HET) Rebate program, Rain Barrel Sales, Turf Buy Back program, and water efficient tool giveaways. As with the public information initiatives, financial incentives will continue to change over time based upon participation and quantifiable results. For example, program evaluations have resulted in elimination of the Toilet Flapper Rebate program, elimination of the Turf Buy Back program, reduction of the HET rebate from $150 to $100, and then elimination of the HET rebate program.

The water conservation regulations – Water Waste Ordinance, Rain Sensor Ordinance, Alternate Day Watering Ordinance, Land Development Ordinance, Irrigation System Design Requirements, and the Separate Irrigation Meter Requirement – provide clear expectations, and have changed as irrigation technology has improved watering efficiency.

The Town’s well-established Water Conservation Program has been and will continue to be an integral part of Cary's water resources management. The LRWRP includes many suggestions for further evaluations and considerations for advancing the water conservation program that focus on efficient irrigation/peak day management and a broader framework for water resources communications strategies.

Reclaimed Water System

The Strategic Reclaimed Water System Plan (SRWSP) developed for the LRWRP (Appendices L1 and L2) was closely coordinated with the Reclaimed Water Master Plan update still in progress. Four reclaimed water scenarios were evaluated representing different future service areas and total reclaimed water demand, ranging from serving only the areas adjacent to the current built or funded reclaimed water infrastructure, to serving the entire town.

Scenario 4 was selected for future planning because it balances the extent of the reclaimed water service area and reclaimed water demand with the reclaimed water supply available. This changed the reclaimed water service area adopted in 2010 to include an area of the Town of Morrisville. The policy continues to prohibit use of potable water for new irrigation systems when reclaimed water is available. In the long term, depending on the rate of development and

customer choices regarding water use, this scenario could include use of toilet flushing in new non-residential buildings and/or retrofit of existing residential irrigation systems to use reclaimed water. The selected scenario allows for the most cost-effective use of reclaimed water in the short term, with flexibility for continued system and policy development in the long term.

References

American Water Works Association Research Foundation (AWWARF), 2010. North American Water Usage Trends Since 1992. Report No. 4031.

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CH2M HILL, 2010. Town of Cary Water Use Analysis TM.

Maddaus Water Management (MWM), 2011. “Why do new homes use more water than existing homes even during the recession?” Presentation at the Water Smart Innovation Conference. October 6, 2011.

Mayer, Peter and Al Dietemann, 2011. “Assessing Changes in Single Family Water Use”. Water Research Foundation webcast. December 6, 2011.

SECTION III. CURRENT WATER SUPPLY

Available Supply

The Towns of Cary, Apex and Morrisville, and RTP South all rely upon Jordan Lake as their sole source of raw water supply. The Towns of Cary and Apex jointly hold a Level I Jordan Lake water supply storage allocation of 32%. The Town of Morrisville holds a Level I allocation of 3.5%. Wake County holds a Level I allocation of 3.5% on behalf of the Research Triangle Foundation for the Wake County portion of Research Triangle Park (RTP South).

Figure III.1 – Map of Water Supply Sources and Treatment Plants

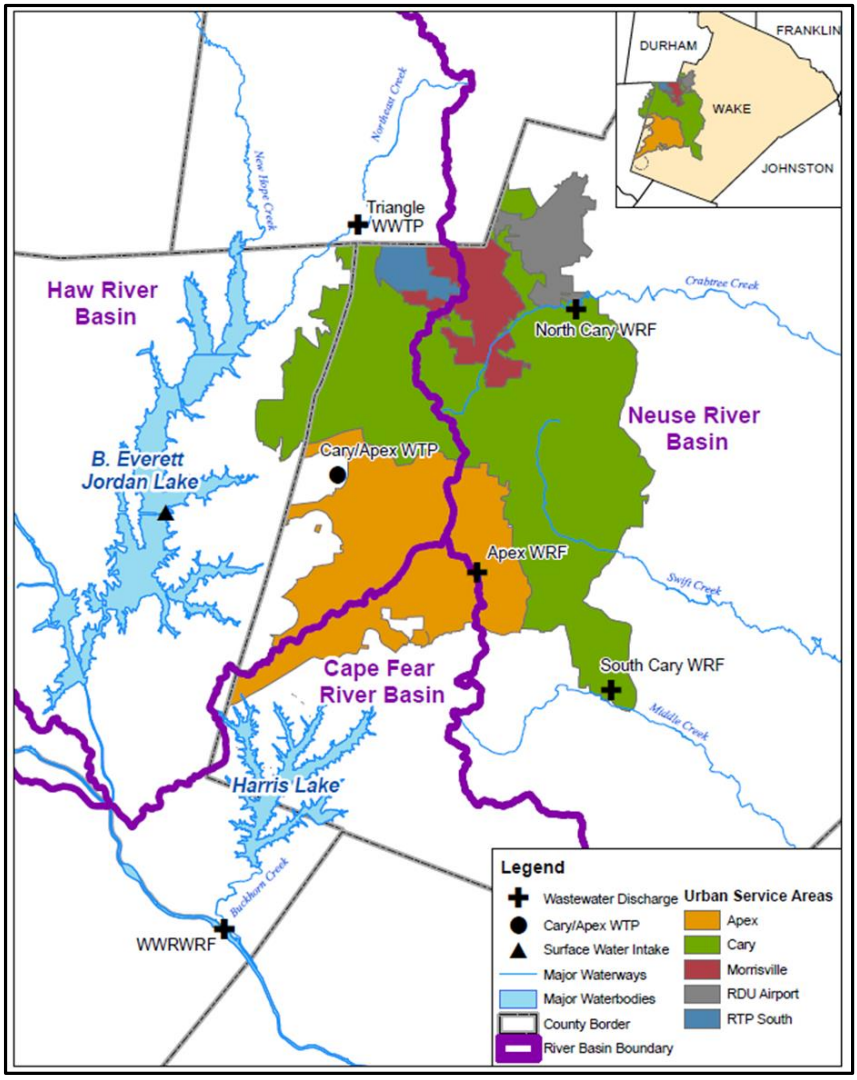


Table III.1 – Available Supply

Source	PWSID	SW or GW	Basin	WQ Classification	Available Supply (MGD)
Jordan Lake Allocation - Cary/Apex	03-92-020 / 03-92-045	SW	Haw (2-1)	WS IV B NSW CA	32.0
Jordan Lake Allocation - Morrisville	03-92-020	SW	Haw (2-1)	WS IV B NSW CA	3.5
Jordan Lake Allocation - Wake/RTP South	03-92-020	SW	Haw (2-1)	WS IV B NSW CA	3.5
TOTAL					39.0

Mutual Aid

The Towns of Cary and Apex operate the two water distribution systems that supply Cary, Apex, Morrisville and RTP South. The Towns have interconnected their distribution systems with neighboring jurisdictions and developed mutual aid agreements to increase system reliability and resilience.

Table III.2 – Mutual Aid and Interconnections

Supplier	PWSID	Contract Amount (MGD)	Begin Year	End Year	Regular or Emergency	Pipe Size (in.)
City of Durham	03-32-010	0.0	2009	2028	Emergency	16
Orange Water & Sewer Authority	03-68-010	0.0	2010	2029	Emergency	0
City of Raleigh	03-92-010	0.0	2012	2032	Emergency	24
Harnett County	03-43-045	0.0		Recurring	Emergency	16
Town of Holly Springs	03-93-050	0.0		Recurring	Emergency	16
TOTAL						

The Jordan Lake Partnership contracted with Hazen & Sawyer to study existing and potential potable water connections among the water utilities serving:

Town of Apex
Town of Cary
Chatham County
City of Durham
Town of Hillsborough
Town of Holly Springs
Town of Morrisville
Orange County
OWASA
Town of Pittsboro
City of Raleigh
City of Sanford
Wake County

The first phase of the Jordan Lake Potable Water Interconnection Study was a report documenting existing and proposed interconnections between members of the Jordan Lake Regional Water Supply Partnership and adjoining water systems. The report also identified several new interconnections that potentially could increase transfer capacities and reduce vulnerabilities.

The second phase of the Jordan Lake Potable Water Interconnection Study was launched in June 2014 and involves combining distribution system models for the various water systems and determining existing and potential water transfer capacities under a variety of scenarios.

References

CH2M HILL and Brown and Caldwell, 2013. Long Range Water Resources Plan. Prepared for Towns of Cary, Apex and Morrisville, and Wake County.

Hazen and Sawyer, 2011. Jordan Lake Potable Water Interconnection Study. Prepared for Jordan Lake Partnership.

SECTION IV. FUTURE WATER SUPPLY NEEDS

The future water supply needs for the Towns of Cary, Apex and Morrisville, and RTP South are a function of their respective demand projections and currently available supplies, as presented in Sections I and III. This section presents the water supply needs for the Towns of Cary and Apex, the Town of Morrisville, and RTP South. This information is also provided in the attached Excel workbook.

Table IV.1 – Raw Water Supply Need (MGD), Cary & Apex

	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
Demand	18.4	20.9	25.0	28.8	31.9	34.8	37.3	39.2	40.8	41.1	41.4
Supply	32	32	32	32	32	32	32	32	32	32	32
Demand % of Supply	*58%*	*65%*	*78%*	*90%*	*100%*	***109%***	***117%***	***122%***	***128%***	***128%***	***129%***
Need	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**2.8**	**5.3**	**7.2**	**8.8**	**9.1**	**9.4**

Figure IV.1 – Demand and Need, Cary & Apex

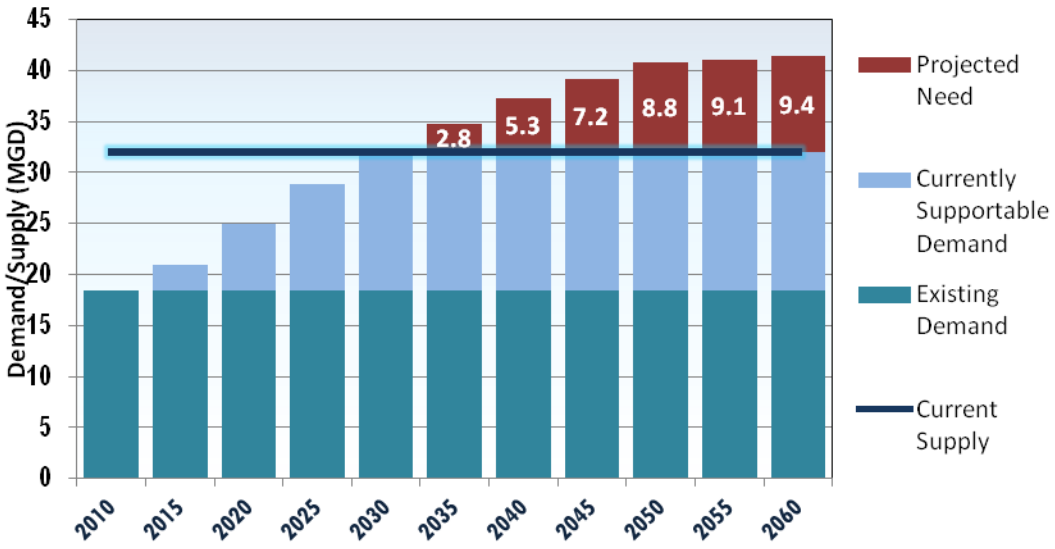


Table IV.2 – Raw Water Supply Need (MGD), Morrisville

	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
Demand	1.7	2.0	2.5	2.8	2.9	3.3	3.4	3.5	3.5	3.6	3.6
Supply	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Demand % of Supply	*49%*	*58%*	*73%*	*79%*	*82%*	*95%*	*98%*	*99%*	***101%***	***102%***	***104%***
Need	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.1**	**0.1**

Figure IV.2 – Demand and Need, Morrisville

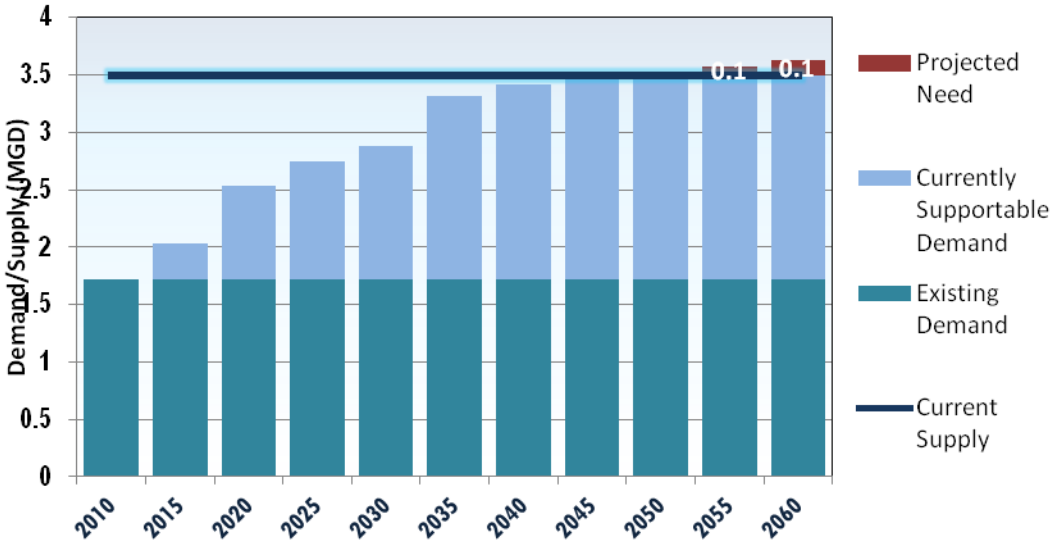
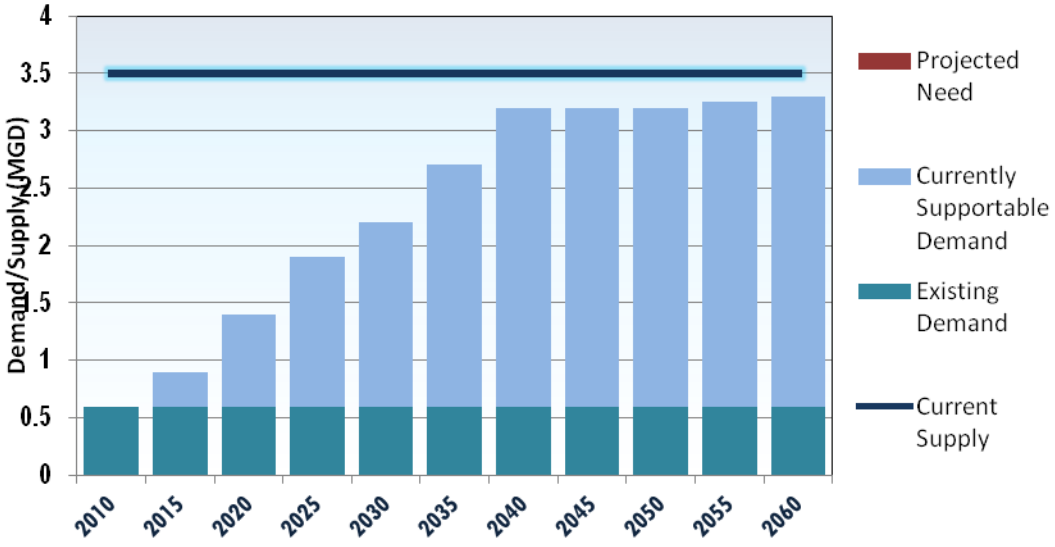


Table IV.3 – Raw Water Supply Need (MGD), RTP South

	2010	2015	2020	2025	2030	2035	2040	2045	2050	2055	2060
Demand	0.6	0.9	1.4	1.9	2.2	2.7	3.2	3.2	3.2	3.3	3.3
Supply	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Demand % of Supply	*17%*	*26%*	*40%*	*54%*	*63%*	*77%*	*91%*	*91%*	*91%*	*93%*	*94%*
Need	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Figure IV.3 – Demand and Need, RTP South



SECTION V. ALTERNATIVE WATER SUPPLY OPTIONS

The Towns' (Cary, Apex, and Morrisville) and County's (Wake) vision for the future framed the selection of a number of water resources strategies that support the project purpose and objectives. These strategies will increase the resiliency of the Towns, as well as the region, in responding to changing conditions into the future. These strategies comprise the Water Resources Portfolio and provide the Towns with the flexibility to:

- Continue to effectively manage water supply.
- Ensure that water resources are used most efficiently.
- Implement strategies over time as they become needed; as well as maintain the viability of a water supply strategy until it is no longer needed.
- Enable adaptation to changes in the future that are relatively uncertain, such as:
  - Economic and business trends and their impact on growth and land use patterns
  - Environmental regulations and requirements
  - Regional partnerships
  - Shifting societal trends

The Water Resources Portfolio contains infrastructure solutions as well as adaptive management strategies. The portfolio includes flexible timeframes for implementation of each strategy which do not preclude the implementation of other strategies concurrently or in the future. The two strategies included in the Portfolio pertaining to water supply are:

- Strategy 1 – Increase Water Supply via Jordan Lake Allocation
- Strategy 2 – Increase Water Supply and/or Storage by Other Means
  - 2A: Increase Jordan Lake Water Supply Pool
  - 2B: Water Supply from Crabtree Creek with Storage in Existing Triangle Quarry
  - 2C: Water Supply from Cape Fear River
  - 2D: Water Supply from Kerr Lake

The Water Resources Portfolio is described in the Long Range Water Resources Plan, Section 4. The water supply alternatives in the Water Resources Portfolio were included in the JLP's RWSP and evaluated in the regional context. The review of water supply alternatives in this section assumes a total supply necessary to meet the collective needs of Cary, Apex, Morrisville, and RTP South.

Source Options

The water supply source options for Cary, Apex, Morrisville and RTP South are summarized as follows.

Jordan Lake Allocation – Obtain an additional water supply storage allocation in Round 4 to meet 2045 projected demands.

Increased Jordan Lake Water Supply Pool – A study would need to be completed by the USACE to reallocate water from the sediment or flood control storage pools to the conservation pool.

For the Towns to access additional water supply from the increased Jordan Lake water supply pool, Jordan Lake water supply allocations would have to be approved by the EMC under the normal process.

Cape Fear River – Raw water would be pumped from the Cape Fear River in the reach between Jordan Lake Dam and the Town of Lillington. Water would be withdrawn using either a reservoir intake within the Buckhorn Dam impoundment or a run-of-river intake. Water would be treated either at a new WTP, between the intake location and the connection to the Towns' current distribution systems, or at the existing Cary/Apex WTP.

Crabtree Creek and Triangle Quarry – Raw water would be pumped from Crabtree Creek, stored in an existing Wake Stone Corporation Triangle Quarry, treated at a new WTP located nearby, and distributed through the existing water system.

Kerr Lake – Raw water supply would be withdrawn from Kerr Lake on the North Carolina-Virginia line. Raw water would be conveyed to either Raleigh or Durham via pipeline and treated at a new or expanded WTP from a new intake structure. After treatment, the finished water would be provided to Cary either through an interconnection with Raleigh or Durham or direct pipeline from the new WTP.

Table V.1 – Source Options descriptions

Source	Type	Basin	WQ Classification	Year Online (earliest)	Available Supply (MGD)	Supply Range (MGD)
Jordan Lake Allocation - Round 4	Jordan Lake	Haw (2-1)	WS IV B NSW CA	2015	7.2	7.2
Jordan Lake Allocation - Future	Jordan Lake	Haw (2-1)	WS IV B NSW CA	2050	2.3	2.3
Increased Jordan Lake WS Pool	Modify Reservoir	Haw (2-1)	WS IV B NSW CA	2028	9.5	9.5
Cape Fear River @ Harnett County	Stream Withdrawal	Cape Fear (2-3)	WS IV CA	2031	9.5	9.5
Crabtree Creek & Triangle Quarry	Quarry/Raw Transfer	Neuse (10-1)	C NSW	2029	9.5	9.5
Kerr Lake	Storage Allocation	Roanoke (14-1)	WS III B CA	2036	9.5	9.5

Jordan Lake Allocation

Currently, only 63 mgd of the 100-mgd Jordan Lake water supply volume has been allocated by the North Carolina EMC. The total water supply that has been allocated to the Towns of Apex, Cary, and Morrisville, and Wake County (RTP South), is 39 mgd. The Jordan Lake Partnership (JLP) submitted a request to the Environmental Management Commission (EMC) to initiate a new round of Jordan Lake water supply allocations in November 2009. The NC Division of Water Resources (DWR) is in the process of using the results of the recently completed Cape Fear River Hydrologic Model to evaluate the safe yield of Jordan Lake and to evaluate diversions out of the lake's watershed, as required to analyze new allocation requests.

For the Towns and County to be able to access their full current allocation of 39 mgd, an IBT certificate modification, approved by the EMC, is required. The Towns and County notified the EMC on September 20, 2013, that they are requesting an IBT certificate modification to address

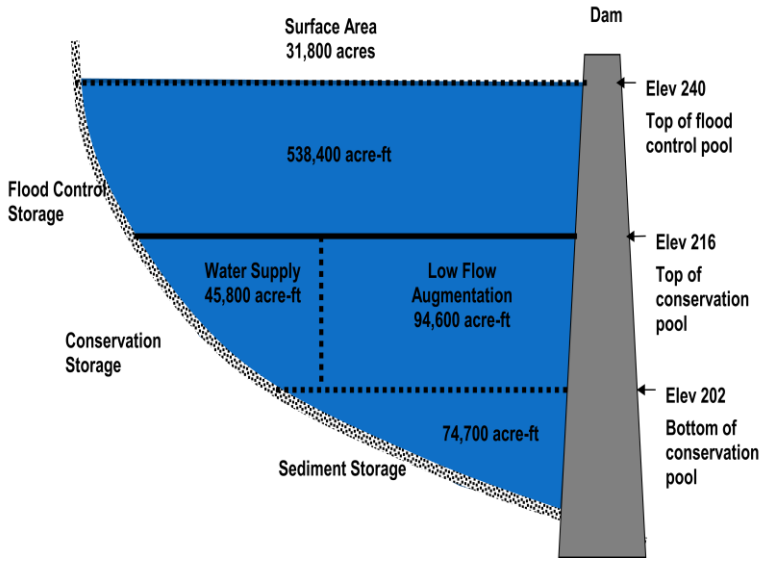
changes in the IBT statute, to address a request from DWR to include Haw River Subbasin consumptive use transfer, and that is consistent with the Jordan Lake allocation timeframe of 2045.

Increase Jordan Lake Water Supply Pool

Each of the storage pools in Jordan Lake has a dedicated amount of storage, as shown in Figure 1 (CH2M HILL and Brown and Caldwell, 2013). A study would need to be completed by the USACE to reallocate water from the sediment or flood control storage pools to the conservation pool. USACE would evaluate the impacts of reallocating storage on Jordan Lake as well as on downstream flows and users. In general, increasing municipal water supply does not require Congressional authorization; however, the two-part, multi-year Section 216 study must be completed, including:

- Reconnaissance Study – The USACE leads and pays for this high level evaluation of the proposed project
- Section 216 Study – Compares the benefits lost by reducing the sediment or flood control pools with the benefits gained. The federal government and local governments cost-share this study.

Figure 1
Jordan Lake Existing Storage Area and Surface Area Schematic



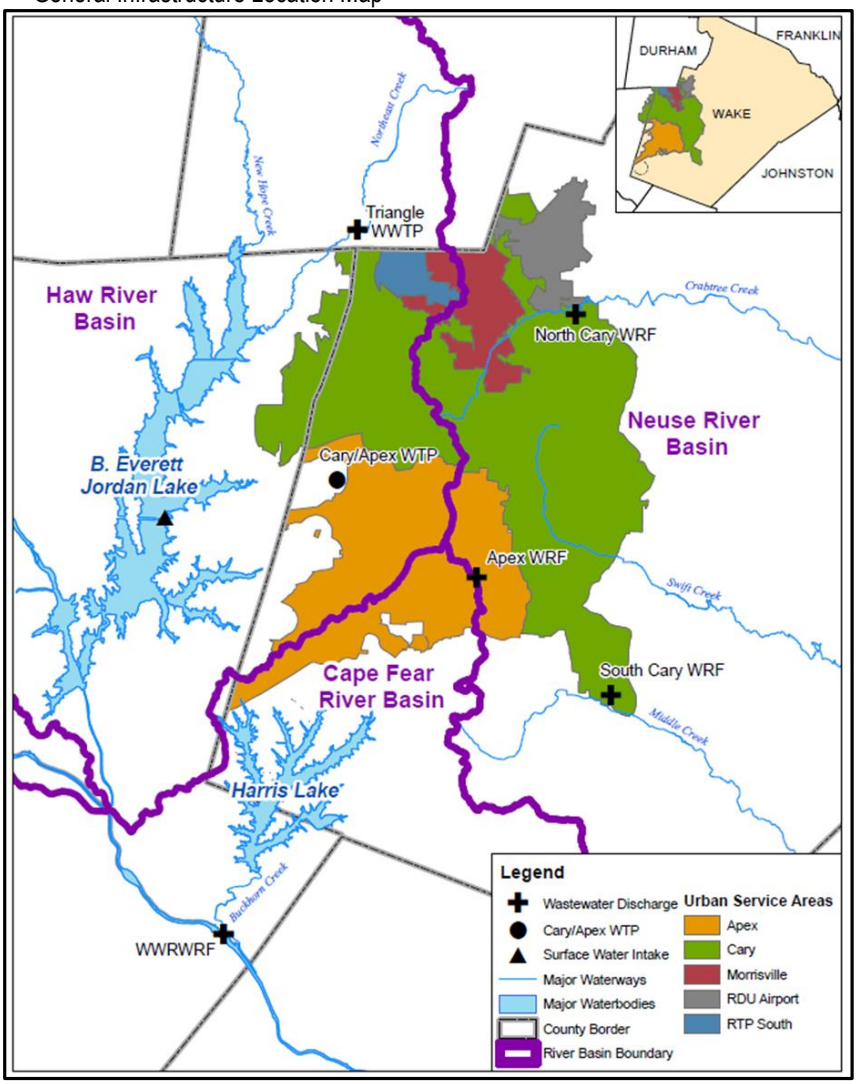
The complexity of a 216 study varies based on the potential impacts. The USACE would decide whether an environmental assessment (EA) or an environmental impact statement (EIS) would be needed. For the Towns to access additional water supply from the Jordan Lake water supply pool under this strategy, Jordan Lake water supply allocations would have to be approved by the EMC under the normal process.

Water Supply from Cape Fear River

Raw water would be pumped from the Cape Fear River in the reach between Jordan Lake Dam and the Town of Lillington. Water would be withdrawn using either a reservoir intake within the Buckhorn Dam impoundment or a run-of-river intake. Based on an initial evaluation of this reach, a range of approximately 11 mgd to 31 mgd of average day water supply should be available in the summer peak demand months.

Water would be treated either at a new WTP, between the intake location and the connection to the Towns' current distribution systems, or at the existing Cary/Apex WTP. To transmit water from the Cape Fear River to the Towns' current distribution facilities would require approximately 21 miles of pipeline, depending on the point of interconnection. Figure 2 (CH2M HILL and Brown and Caldwell, 2013) shows a potential pipeline alignment.

FIGURE 2
General Infrastructure Location Map



Progress Energy has expressed its intent to construct a new intake and raw water pipeline from the Cape Fear River at Buckhorn Dam to Harris Lake; the water would be used to supplement cooling water supply for a new nuclear reactor unit at the Shearon Harris Nuclear Power Plant (Progress Energy, 2007). Nuclear Regulatory Commission (NRC) licensing guidelines may prevent or limit the ability of Progress Energy to partner with the Towns for the shared development of a raw water intake and/or transmission pipelines.

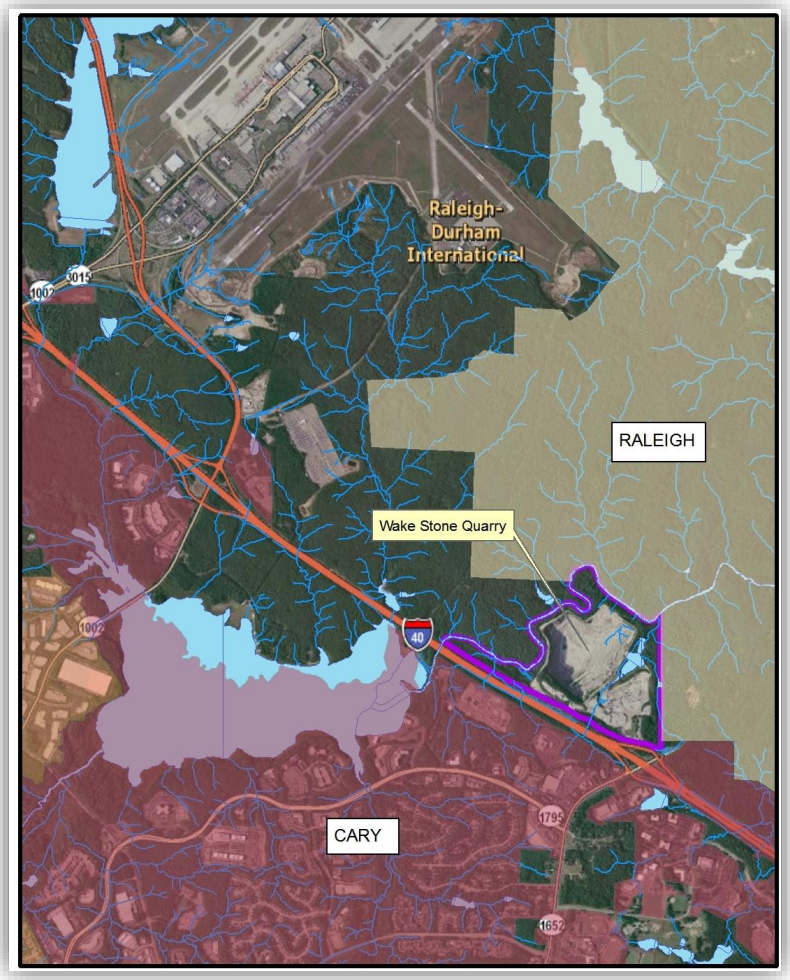
The City of Sanford and Harnett County have existing raw water facilities on this reach of the Cape Fear River and present partnership opportunities for facility expansions. It is likely that partnering with Harnett County would lead to a strategy implementation similar to Strategy 3. It is important to note that if the cumulative withdrawals along this reach of the Cape Fear River exceed 20 percent of 7Q10 flows (7-day, consecutive low flow with a 10-year recurrence interval), an instream flow study may be required by the NC DWR. An environmental document meeting SEPA requirements would be necessary for the new water supply and infrastructure development. As with Strategy 2B, one of the key issues associated with receiving the appropriate approvals will be how to address potential direct impacts of the

water withdrawal, including maintaining minimum instream flows to meet habitat and water quality requirements.

Water Supply from Crabtree Creek with Storage in Existing Triangle Quarry

Raw water would be pumped from Crabtree Creek, stored in Wake Stone Corporation Triangle Quarry (CH2M HILL and Brown and Caldwell, 2013, Figure 3), treated at a new WTP located nearby, and distributed through the existing water system.

FIGURE 3
Wake Stone Corporation Triangle Quarry Location



The quarry has the potential to provide up to 4.6 billion gallons of raw water storage at the projected final excavated volume. However, if the quarry mining operations are not complete when this strategy needs to be initiated, the total storage volume would be reduced and the Towns could have to purchase the remaining un-mined rock. This would add significant costs to this strategy effectively making this strategy more expensive with less water supply yield. In addition, the State of North Carolina has the first right of refusal for the quarry parcel when the mining is complete, so the state would have to agree to relinquish that right to the property.

For this strategy, raw water would be withdrawn under operational guidelines based on thresholds for different withdrawal scenarios that could occur based on available flows in Crabtree Creek. Based on an initial evaluation:

- Water would be withdrawn only when flows in the creek are above approximately 17 mgd
- 30 mgd would be the maximum withdrawal capacity
- The difference between the daily water withdrawn and the daily demand would refill the quarry
- When the quarry reaches 100 percent storage capacity, the withdrawals from the creek would return to the amount of the average day demand

Based on these preliminary guidelines, an annual average safe yield of 10 mgd from Crabtree Creek is projected. During the summer peak demand months, up to 12 mgd could be provided from the quarry storage.

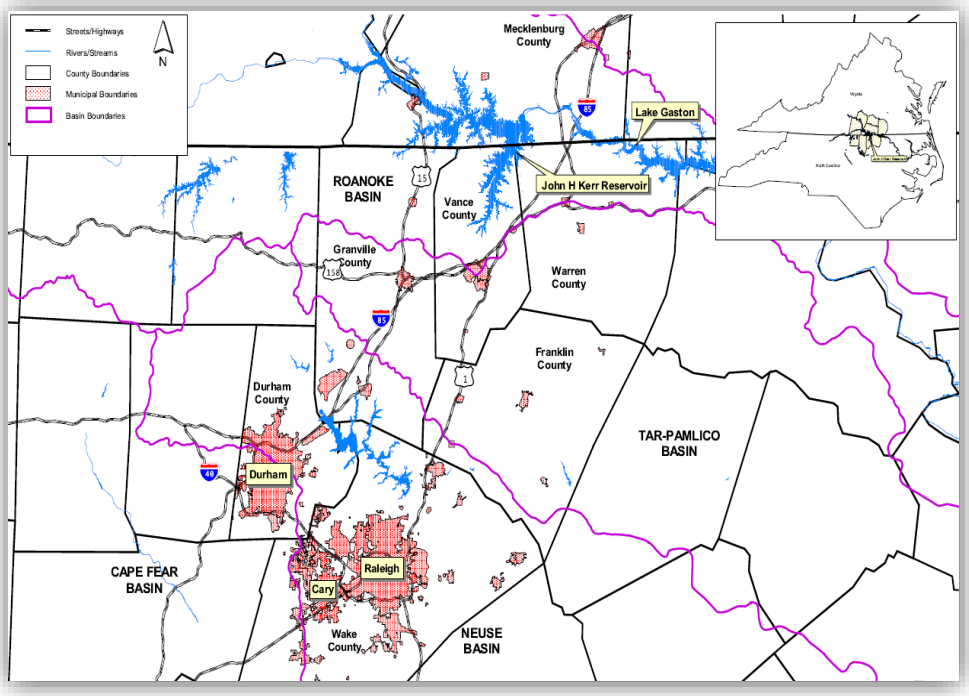
An environmental document meeting the State Environmental Policy Act (SEPA) requirements would be necessary for this strategy. There are several key issues which could affect the feasibility of this alternative including:

- Potential direct impacts of the water withdrawal, including maintaining minimum instream flows to meet habitat and water quality requirements.
- Reclassification of the highly urbanized Crabtree Creek watershed to a water supply watershed that would involve not only Cary but potentially also portions of the Town of Morrisville, City of Raleigh, City of Durham, Wake County and Durham County jurisdictions. The reclassification would be contingent on the water quality of Crabtree Creek meeting water supply watershed water quality criteria.
- The Crabtree Creek watershed has a Superfund site in the headwater area.

Water Supply from Kerr Lake

A feasibility study was completed for use of Kerr Lake by the Town of Cary, City of Raleigh, City of Durham, and Granville County in 2001 (CH2M HILL, 2001). On behalf of the group, Raleigh submitted an allocation request for 50 mgd to the USACE in 2002, but the USACE elected not to consider this request in its recent Section 216 study. Subsequently, Granville County has pursued other options to access water from Kerr Lake by working with the Kerr Lake Regional Water Supply partners, led by the City of Henderson.

FIGURE 4
Kerr Lake Vicinity Map (Source: CH2M HILL, 2001)



Raw water supply would be withdrawn from Kerr Lake on the North Carolina-Virginia line (CH2M HILL and Brown and Caldwell, 2013, Figure 4). Kerr Lake is managed by the USACE and is used for hydroelectric power and water supply by municipalities in both states, including the

Kerr Lake Regional Water System (City of Henderson, City of Oxford, and Warren County), and Virginia Beach, VA. Raw water would be conveyed to either Raleigh or Durham via pipeline and treated at a new or expanded WTP from a new intake structure. To transmit water from Kerr Lake to the Triangle area would require approximately 50 to 60 miles of pipeline, depending on the location of the WTP. After treatment, the finished water would be provided to Cary either through an interconnection with Raleigh or Durham or direct pipeline from the new WTP. Other communities in the region may benefit from a joint venture to withdraw water supply from Kerr Lake.

Obtaining a municipal water supply allocation from Kerr Lake would require a USACE Section 216 study process. USACE approval for the Kerr Lake allocation is not assured due to competing users and interbasin/interstate transfer issues, and such an application could take many years.

Supply Alternatives Summary

The following alternatives are based on the source options described above. Each alternative includes at least one source option and would meet the projected demands for Cary, Apex, Morrisville, and RTP South through the 2060 planning horizon.

Alternative 1 – This alternative consists of obtaining additional Jordan Lake water supply storage allocation to meet 2045 projected demands in Round 4, followed by a future Jordan Lake water supply storage allocation to meet 2060 projected demands. This alternative is consistent with the JLP's RWSP recommendation.

Alternative 2 – This alternative consists of the Increased Jordan Lake Water Supply Pool source option. A study would need to be completed by the USACE to reallocate water from the sediment or flood control storage pools to the conservation pool. For the Towns to access additional water supply from the increased Jordan Lake water supply pool, Jordan Lake water supply allocations would have to be approved by the EMC under the normal process.

Alternative 3 – This alternative consists of the Cape Fear River water supply option. Raw water would be pumped from the Cape Fear River in the reach between Jordan Lake Dam and the Town of Lillington. Water would be withdrawn using either a reservoir intake within the Buckhorn Dam impoundment or a run-of-river intake. Water would be treated either at a new WTP, between the intake location and the connection to the Towns' current distribution systems, or at the existing Cary/Apex WTP.

Alternative 4 – This alternative consists of the Crabtree Creek and Triangle Quarry water supply option. Raw water would be pumped from Crabtree Creek, stored in the existing Wake Stone Corporation Triangle Quarry, treated at a new WTP located nearby, and distributed through the existing water system.

Alternative 5 – This alternative consists of the Kerr Lake water supply option with an interim source, because of the long time required to develop a Kerr Lake source. Raw water supply would be withdrawn from Kerr Lake on the North Carolina-Virginia line. Raw water would be conveyed to either Raleigh or Durham via pipeline and treated at a new or expanded WTP from a new intake structure. After treatment, the finished water would be provided to Cary either

through an interconnection with Raleigh or Durham or direct pipeline from the new WTP. An interim source of 2 MGD would be required in 2030-2035, depending on the time it would take to obtain a water supply storage allocation in Kerr Lake and build the necessary infrastructure.

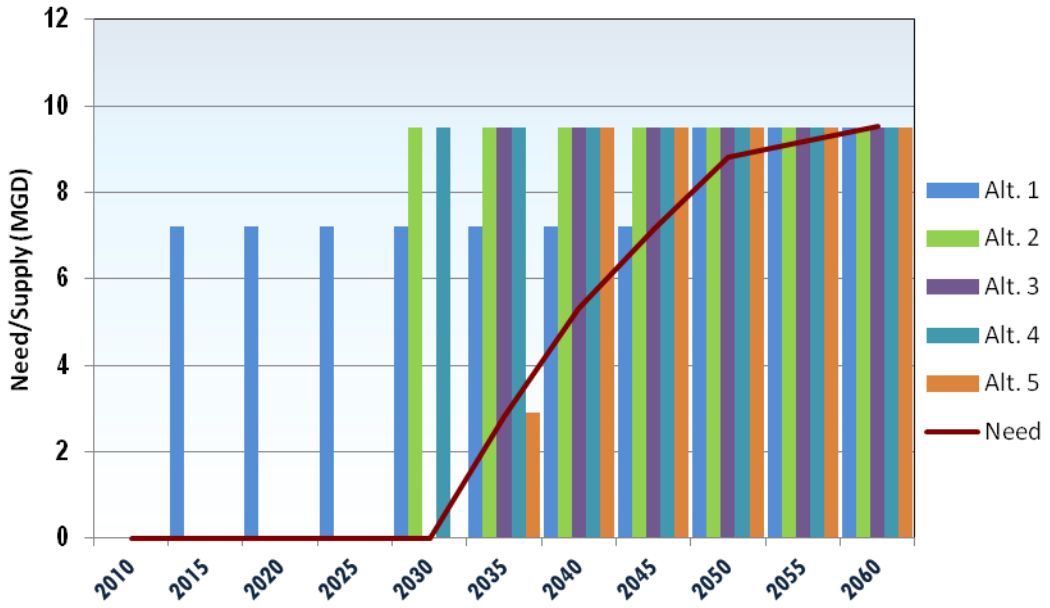
Table V.2 – Alternatives Summary

Alternative	Alternative Description
Alternative 1	Jordan Lake Allocation – Round 4 and Future Round. This alternative is supported by the Jordan Lake Partnership.
Alternative 2	Increased Jordan Lake Water Supply Pool and Jordan Lake Allocations
Alternative 3	Cape Fear River at Harnett County
Alternative 4	Crabtree Creek and Triangle Quarry
Alternative 5	Kerr Lake and Interim Source

Table V.3 – Source Composition of Supply Alternatives (MGD)

Need and Source Options	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Total Projected Need (2045)	*7.2*	*7.2*	*7.2*	*7.2*	*7.2*
Total Projected Need (2060)	*9.3*	*9.3*	*9.3*	*9.3*	*9.3*
Sources:					
Jordan Lake Allocation - Round 4	7.2	0.0	0.0	0.0	0.0
Jordan Lake Allocation - Future	2.3	0.0	0.0	0.0	0.0
Increased Jordan Lake WS Pool	0.0	9.5	0.0	0.0	0.0
Cape Fear River @ Harnett County	0.0	0.0	9.5	0.0	0.0
Crabtree Creek & Triangle Quarry	0.0	0.0	0.0	9.5	0.0
Kerr Lake	0.0	0.0	0.0	0.0	9.5
Total New Supply (MGD)	**9.5**	**9.5**	**9.5**	**9.5**	**9.5**

Figure V.2 –Timeline of Need & Supply Alternatives



Alternatives Analysis

We analyzed water supply alternatives based on the various criteria specified in the DWR Application Guidelines and on the information we have about our source options (as described previously in pages 34-39). Note that:

1. The calculation of interbasin transfer for the alternatives is based on water demands for a maximum month in a calendar year. Calculations required assumptions about service areas, consumptive use, wastewater discharge, etc. The IBT assumptions and calculations are consistent among alternatives. **This IBT estimate should only be used for comparing water supply alternatives for this Jordan Lake Water Supply Storage Allocation Round Four**. Calculating a potential interbasin transfer amount requires many assumptions, all of which are considered and evaluated during the process of requesting an interbasin transfer certificate from the NC Environmental Management Commission.
2. Total cost for an alternative is based on the cost of professional services, storage allocation, construction, land or easement acquisition and other capital costs in the year 2012.
3. Unit cost is based on the total cost divided by the supply yield.

Table V.4 – Water Supply Alternatives Analysis

Classification	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Rd. 4 Allocation Request (% of storage)	7.2	0.0	0.0	0.0	0.0
Total Supply (MGD)	9.5	9.5	9.5	9.5	9.5
Environmental Impacts	Same As	Same As	More Than	More Than	More Than
Water Quality Classification	WS IV B NSW CA	WS IV B NSW CA	WS IV CA	C NSW	WS III B CA
Timeliness	Timely	Timely	Timely	Timely	Timely
Interbasin Transfer (MGD) [1]	9.5	9.5	8.0	4.5	11.0
Regional Partnerships	Yes, JLP	Yes	Yes	Yes	Yes
Technical Complexity	Not Complex	Not Complex	Complex	Very Complex	Complex
Institutional Complexity	Not Complex	Complex	Complex	Very Complex	Very Complex
Political Complexity	Not Complex	Not Complex	Complex	Very Complex	Very Complex
Public Benefits	None	None	None	Few	None
Consistency with local plans	Yes	Yes	Yes	Yes	Yes
Total Cost ($ millions)	52.3	55	174.3	62.7	178
Unit Cost ($ millions/MGD)	5.5	5.8	18.3	6.6	18.8
Selected Alternative	✓				

1. **IBT estimate is only for the purpose of comparing supply alternatives.**

Selected Alternative

The selected alternative is consistent with the Cary/Apex/Morrisville/RTP South Long Range Water Resources Plan and consistent with the JLP's RWSP. A Jordan Lake water supply storage allocation for the Towns of Cary and Apex, Town of Morrisville, and RTP South would have the least cost and fewest negative impacts among all water supply alternatives. The JLP RWSP recommended set of water supply sources meets the projected water supply needs of the Triangle Region without compromising the ability of any downstream community to meet its own future water supply needs.

References

CH2M HILL and Brown and Caldwell, 2013. Long Range Water Resources Plan. Prepared for Towns of Cary, Apex and Morrisville, and Wake County.

Triangle J Council of Governments (TJCOG), 2012. Triangle Regional Water Supply Plan: Volume I – Regional Needs Assessment.

Triangle J Council of Governments (TJCOG), 2014. Triangle Regional Water Supply Plan: Volume II – Regional Water Supply Alternatives Analysis.

SECTION VI. PLANS TO USE JORDAN LAKE

The Towns of Cary, Apex, and Morrisville, and Wake County currently hold individual Level I allocations of 32% (Cary and Apex), 3.5% (Morrisville) and 3.5% (Wake County on behalf of RTP South). The Town of Cary and Town of Apex request a total allocation of 39.2% of the Jordan Lake water supply storage pool to meet the water supply needs of Cary and Apex through 2045. This would entail an additional Level I allocation of 7.2% in Round 4.

The Town of Morrisville may request to retain its 3.5% allocation, or that its 3.5% allocation be transferred to the Town of Cary.

Wake County will request that its 3.5% allocation for RTP South be transferred to the Town of Cary.

The resulting total Level I allocation for the Towns of Cary and Apex for Round 4 would be 46.2%. This allocation would meet the 2045 needs of the Towns of Cary, Apex and Morrisville, and RTP South.

Implementation Plan and Timeline

The Towns of Cary and Apex would continue to access their Jordan Lake water supply storage allocation through their jointly owned Cary/Apex Water Treatment Facility. The Towns would continue to meet the potable water needs of the entire Cary, Apex, Morrisville and RTP South service area. For example, the Towns have recently completed a design for expanding the CAWTF from its current 40 MGD capacity to a capacity of 56 MGD, and expect to complete construction in 2016.

Cary and Apex would also continue to provide access to the Jordan Lake water supply storage allocations of Chatham County, the City of Durham, and the Orange Water and Sewer Authority.

Raw and Finished Water Quality Monitoring Plan

The Town of Cary operates the CAWTF under an interlocal agreement with the Town of Apex. Cary will continue to monitor Jordan Lake raw water quality and finished water quality in accordance with its Water System Management Plan (WSMP No. 07-00500) on file with the Public Water Supply Section of DWR.

Jordan Lake Allocation Costs

The Town of Cary, Town of Apex, Town of Morrisville and Wake County have satisfied all requirements for holding Jordan Lake water supply storage allocations, and have repaid all associated capital and operating costs for the allocations they currently hold. The Towns and County would continue to do so for any allocation granted in Round 4.

Based on the DWR Application Guidelines, a new one percent Level I allocation of water supply storage made in 2015 is estimated to cost the holder $91,041. In addition, a fixed $250

administration fee is added to each bill. Based on the figures used for these estimates, in subsequent years the cost of a one percent Level I allocation can be expected to be in the neighborhood of $2,200 based on historical O&M and interest costs.

As such, an additional Jordan Lake water supply storage allocation of 7.2% granted in 2015 would cost the Towns of Cary and Apex a one-time capital repayment of $655,743.47.

In subsequent years, maintaining a total Jordan Lake water supply storage allocation of 46.2% would cost the Towns approximately $102,760.87 annually for operation and maintenance.

APPENDIX A. JORDAN LAKE ALLOCATION WORKBOOK

See attached Excel workbook file, final_JLA4_Workbook_CAMR.xlsx