Round 4
Jordan Lake Water Supply
Allocation Recommendations

Prepared for the

North Carolina

Environmental Management Commission

by the

N. C. Department of Environmental Quality

Division of Water Resources

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Contents

1 Executive Summary

Jordan Lake was created by the B. Everett Jordan Dam, a multipurpose reservoir constructed by the U.S. Army Corps of Engineers to provide water supply storage and flow augmentation storage in addition to its primary purpose of providing flood damage reductions downstream in the Cape Fear River Basin.

Water supply storage was included in the project at the request of the State of North Carolina. The water supply storage pool was designed to reliably provide 100 million gallons per day of water supply. An analysis of the potential yield of the water supply pool, discussed in the Cape Fear River Surface Water Supply Evaluation, indicates the reservoir can reliably supply the desired100 million gallons per day.

The General Assembly delegated authority to allocate water supply to the Environmental Management Commission (EMC). Allocations can be made to units of local government upon request and proof of need. Allocations are made as a percentage of the water supply pool to address documented needs for 30 years in the future. The rules governing the allocation process are included in this document as Appendix B.

The EMC is mandated by rule to limit allocations that would result in a diversion of water off the Jordan Lake watershed to 50 percent of the water supply pool. This provision was included, prior to initial allocations, to protect the yield of the reservoir. The yield analysis of the water supply pool discussed in the Cape Fear River Surface Water Supply Evaluation indicates this limitation may not be needed given the effects of current management of water resources in the Jordan Lake watershed. The allocations recommended by the Division of Water Resources have a potential for 44 percent of the water supply pool being diverted off the Jordan Lake watershed.

The applications and support documentation submitted for Round 4 of Jordan Lake Water Supply Allocations are available on the Division's website at http://www.ncwater.org/jordan-lake-allocation-round-4 .

The population and water demand projections included in the allocation applications are reviewed in this document as well as similar projections developed by DWR staff. Each application includes projections of water supply needs through 2060 supporting the analysis of long term water needs discussed in the Cape Fear River Surface Water Supply Evaluation. However, allocations are limited to needs over a thirty-year planning horizon. In this case, withdrawals needed to meet expected demands in 2045 are the basis for DWR's recommendations. Applicants' proposed supply alternatives are summarized and discussed in the body of this document.

Division staff used the Cape Fear – Neuse River Basins Hydrologic Model (CFNRBHM or model) to evaluate the potential impacts to water availability and hydrologic conditions for several levels of future water demands. The hydrologic model uses an 81-year historic record compiled using available data for surface water conditions from 1931 to 2011. Conditions produced by withdrawing water to meet demands in 2010 are used as the starting points to evaluate potential changes generated by withdrawing water to meet future demands. Key results of the four hydrologic model scenarios used to derive allocation recommendations are presented in tabular, graph and text formats. The results of the various modeling scenarios used for this analysis are inextricably linked to the assumptions made during model development, especially about how much treated wastewater is returned to the surface waters of the basins. Changes in modeling assumptions will change the model outputs.

Currently 63 percent of the water supply pool in Jordan Lake is allocated to local governments. Allocating the remaining 37 percent will not provide all the water needed to meet expected 2060 regional customer demands. Additional sources of water will need to be developed. Using additional water from Jordan Lake can provide the regional water utilities with time to develop additional practical supply options, while continuing to meet customer needs.

Developing the infrastructure necessary to use water from the Jordan Lake water supply pool is the responsibility of the allocation holders. Currently, there is only one water supply intake on Jordan Lake. The current raw water intake does not have the capacity to withdraw 100 million gallons per day, therefore another raw water intake will be required to make optimal use of the water storage for which the State contracted with the USACE.

Based on the analyses conducted for the Cape Fear River Surface Water Supply Evaluation and the review of water needs in 2045 of the applicants for water supply allocations the Division of Water Resources recommends to the Environmental Management Commission the following allocations. Modeling for this evaluation does not indicate any flow related water shortages for the Fayetteville Public Works Commission that may limit their ability to meet 2060 water demands from their current surface water sources.

Table ES-1 Jordan Lake Water Supply Pool Allocations

Jordan Lake Water Supply Pool			
Applicant	Current Allocation Percent	Requested Allocation Percent	DWR Recommended Allocation Percent December 2016
Cary,Apex,Morrisville,Wake Co.-RTP	39	46.2	46.2
Chatham Co.-North*	6	13	13.1
Durham*	10	16.5	16.5
Fayetteville PWC	0	10	0
Hillsborough	0	1	1
Holly Springs	2	2	2
Orange County	1	1.5	1.5
Orange WASA*	5	5	5
Pittsboro*	0	6	6
Raleigh	0	4.7	4.7
Total Percentage	63	105.9	95.9
*Western Intake Partners			

2 Introduction

This document focuses on information relevant to decisions concerning the allocation of water supply storage in Jordan Lake. A companion document, Cape Fear River Surface Water Supply Evaluation (CFRSWSE), discusses longer term water demands and water availability for surface water withdrawers in the Cape Fear River watershed. The CFRSWSE provides detailed discussions of the computer model used to support both documents and the results of the model scenarios used. This document and the CFRSWSE are available at http://www.ncwater.org/jordan-lake-allocation-round-4.

Increasing development and population growth in the Research Triangle Region focused concerns within regional water utilities on the need to secure reliable water supply sources to meet long-term community needs.

In 2009 thirteen local governments and public entities formed the Jordan Lake Regional Water Supply Partnership to cooperatively plan for meeting the region's water resource needs. Later that year, the Jordan Lake Partnership submitted a request to the Division of Water Resources (DWR) to initiate a fourth round of allocations from the Jordan Lake water supply pool. This document focuses on the evaluation of the allocation requests used to develop allocation recommendations for the Environmental Management Commission.

In January 2010 the Environmental Management Commission granted permission for the Division of Water Resources to initiate a fourth round of water allocations from Jordan Lake.

DWR notified potentially interested parties in 32 counties surrounding and downstream of Jordan Lake of the opportunity to apply for water allocations.

An informational meeting was held on February 24, 2010 to explain the process and answer questions. DWR proposed to evaluate 50-year water supply needs for surface water users in the basin in addition to the needs over the 30-year planning horizon required for evaluation of allocation requests. In addition, DWR agreed to investigate if changes are warranted to the current requirement limiting allocations for use outside of the reservoir's watershed to 50 percent of the total water supply yield and to evaluate the yield of the Jordan Lake water supply pool. These evaluations are presented in the Cape Fear River Surface Water Supply Evaluation.

Division of Water Resources staff developed allocation recommendations based on information contained in applications submitted by local governments and incorporating information from the Cape Fear River Surface Water Supply Evaluation. Portions of the water supply evaluation are presented in this document to help clarify information used for developing allocation recommendations. Readers who wish more detailed discussions of the basinwide water demand and water availability analysis can find additional information in the Cape Fear River Surface Water Supply Evaluation available at http://www.ncwater.org/jordan-lake-allocation-round-4.

History of B. Everett Jordan Lake

B. Everett Jordan Dam and reservoir is a multi-purpose project built and managed by the U.S. Army Corps of Engineers (USACE) located on the Haw River in Chatham County, North Carolina. Downstream of the dam, the Haw River merges with the Deep River to form the Cape Fear River. The Cape Fear River experienced several significant flooding events prior to a devastating flood in September 1945 that produced an estimated $4.7 million dollars of damage[1] in Fayetteville. The Deep River Basin and Haw River Basin received about six inches of precipitation during the first week of September that year producing river flows at Lillington of 140,000 cubic feet per second, upstream of Fayetteville. The citizens of Fayetteville saw the Cape Fear River rise to 68.9 feet above mean sea level, more than 33 feet above flood stage. Shortly after this event the U.S. Congress commissioned the USACE to study water resource needs in the basin.

In 1963, based on the results of the USACE study, the U.S. Congress authorized the construction of "New Hope Reservoir" on the Haw River to address issues identified by the study with the primary goal of reducing flood damages. After consultation with the U.S. Public Health Service the USACE included storage capacity to provide water to augment downstream river flows to meet flow targets intended to protect water quality. The State of North Carolina requested the inclusion of water supply storage in the project and agreed to assume financial responsibility for expanding the storage capacity to provide 100 million gallons per day of water for future water

[1] 2007; Carolina Public Health; "The Lake That Almost Wasn't"; Spivey, Angela; Fall 2007

supply needs. The project was later renamed in honor of U.S. Senator B. Everett Jordan. According the USACE, "The purposes of B. Everett Jordan Dam and Lake are to provide flood damage reduction, water supply, water quality control, fish and wildlife conservation and outdoor recreation."[2] Construction began in 1967 and the reservoir was filled to normal water level in 1982.

Figure 1 Jordan Lake Storage Diagram

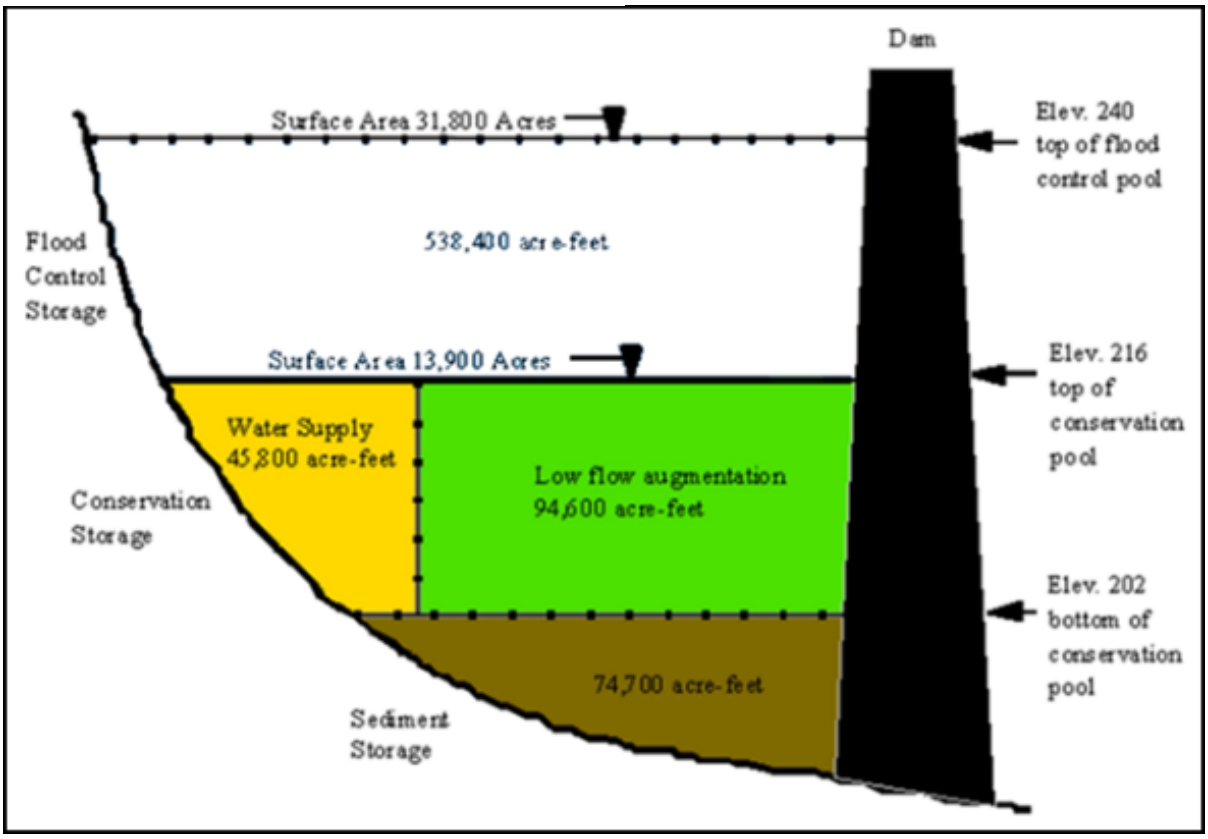


Figure 1 shows a generalized representation of the water storage pools in Jordan Lake. The completed project provides 538,400 acre-feet of controlled flood storage, 94,600 acre-feet of flow augmentation storage, 45,800 acre-feet of water supply storage and 74,700 acre-feet of storage to compensate for reductions in storage due to sediment accumulation.

During normal operations the reservoir is managed to maintain the water level at 216 feet above mean sea level. At this level the flow augmentation, water supply storage and sediment storage pools are full. The space between 216 feet mean sea level and 240 feet mean sea level is normally empty providing storage space to retain water during high precipitation events to manage flooding impacts downstream. The storage between 202 feet mean sea level and 216 feet mean sea level, the conservation pool, is dedicate to flow augmentation and water supply. Storage below 202 feet mean sea level is reserved to compensate for sediment accumulation in the reservoir.

[2] http://www.saw.usace.army.mil/Locations/DistrictLakesandDams/BEverettJordan.aspx

The water supply and flow augmentation pools are managed as if they were physically separate. The USACE monitors water withdrawals and releases from the flow augmentation pool and deducts withdrawals from the appropriate storage accounts.

Allocating Water Supply Storage

This document focuses on the management and disposition of the water in Jordan Lake in the water supply pool. Disposition of the water in the flow augmentation pool is regulated independently under management rules linked to the status of storage in that pool.

The State of North Carolina requested inclusion of water supply storage in the B. Everett Jordan Dam project sufficient to supply 100 million gallons of water per day. Therefore, the state is responsible for allocating 32.62 percent of the conservation pool storage designated as the water supply pool. Based on North Carolina's request, the potential yield of the water supply pool has been assumed to be 100 million gallons per day. Consequently, one percent of the storage in the water supply pool is assumed to be able to provide one million gallons of water per day. Allocations are delineated as a percentage of water supply pool storage. They are not based on providing access to a specific daily average number of gallons of water.

Under General Statute § 143-354 (a) (11) the General Assembly authorized the Environmental Management Commission to allocate water supply storage in Jordan Lake to units of local government upon proof of need and the commitment to pay the capital, interest, administrative and operating costs for Jordan Lake. The charges to each entity receiving an allocation are based on the percent of water supply storage allocated to it.

The rules regulating allocations allow the Environmental Management Commission to make allocations to units of local government sufficient to meet water supply needs over a 30 -year planning horizon. The EMC received the first round of water allocation requests in 1982. The Commission approved the first set of allocation in 1988, allocating a total of 42 percent of the water supply pool, presumed to provide 42 million gallons per day.

The allocation rules also stipulate that for allocation requests where the withdrawal or return flows would be a transfer of surface water requiring an interbasin transfer certificate the review of the application for an interbasin transfer certificate must be coordinated with the review of the allocation request. [3]

In 1996 a second round of allocation requests were submitted for review. In 1997 requests that did not require certification of an interbasin transfer were approved, resulting in a total of 35 percent of the water supply pool being allocated. In 2000 the second round applications requiring interbasin transfer certificates were approved raising the total allocation to 44 percent of the water supply pool. A third round of allocation requests were submitted in 2000 resulting in allocation approvals in 2002 for 63 percent of the water supply pool.

[3] http://www.ncwater.org/?page=297 15A NCAC 02G .0504 (h)

Round 4 Jordan Lake Water Supply Allocation Process

In 2009, the communities of Apex, Cary, Durham, Hillsborough, Holly Springs, Morrisville, Pittsboro, Raleigh and Sanford along with Chatham County, Orange County and Wake County joined with the Orange Water and Sewer Authority to form the Jordan Lake Regional Water Supply Partnership. The purpose of the organization was to provide a forum where members could collaborate and jointly plan for future water supply needs. Their cooperative efforts over several years produced a regional water needs assessment released in February 2012 and the *Triangle Regional Water Supply Plan Volume II: Regional Water Supply Alternatives Analysis*, released in April 2014. These documents are available at http://www.jordanlakepartnership.org/ .

The evaluations presented in the Cape Fear River Surface Water Supply Evaluations and the recommendations presented in this document are based on computer modeling done by DWR staff using the Cape Fear – Neuse River Basins Hydrologic Model. The model is discussed in detail in the CFRSWSE and additional information is available on the Division's website at http://www.ncwater.org/data_and_modeling/Cape_Fear-Neuse/ . The model is used to compare the effects of various surface water withdrawal options on surface water availability over the range of hydrologic conditions in these basins defined by historic flows between 1931 and 2011.

Jordan Lake Water Supply Storage Applications

The State of North Carolina assumed financial responsibility for including water supply storage in B. Everett Jordan Lake. Under G.S. 143-354(a) (11) the State, acting through the Environmental Management Commission, assigns storage to local governments documenting a need for water. Administrative rule T15A: 02G.0500, included as Appendix B, describes the specific information that must be included in a request for a water supply allocation and the procedures to be used when allocating the Jordan Lake water supply storage. The two main criteria for Jordan Lake water supply allocations are documented future water needs and availability of practical, alternative water sources.

During 2010, the Division of Water Resources staff held a series of meetings with potential applicants and other interested parties to discuss updating the existing river basin hydrologic models and information required to prepare and evaluate allocation applications. Since 2010 the Cape Fear River Basin Hydrologic Model and the Neuse River Basin Hydrologic Model were updated and combined to produce the Cape Fear – Neuse River Basins Hydrologic Model (CFNRBHM or model). The model provides a tool to analyze the effects of surface water withdrawal options in both basins at the same time. The model includes documented surface water withdrawers in the Deep River, Haw River, Cape Fear River, Neuse River and Contentnea Creek sub-basins as well as current allocation holders and applicants for new allocations.

Round 4 Jordan Lake Water Allocation Timeline

- November 2009-DWR receives request to start Round 4 allocation process
- January 2010 - Environmental Management Commission authorized DWR to proceed with Round 4 allocation process (JLA-4)
- March 2010 –letters expressing an interest in applying for a water supply allocation from Jordan Lake were submitted to DWR by thirteen local governments
- 2010-2014- upgrade hydrologic models of Cape Fear and Neuse River Basins and merge the separate basin models together into the Cape Fear – Neuse River Basins Hydrologic Model. Develop alternative demand scenarios based on estimated water needs of all surface water users in the basins.
- November 2014 - Final Jordan Lake Water Supply Allocation Applications submitted DWR
- November 2014 – April 2015 Review applications and revise the CFNRBHM to analyze proposals in the applications
- April 2015 >> Analyze modeling results and develop a Draft Cape Fear River Surface Water Supply Evaluation and Draft Jordan Lake Water Supply Allocation Recommendations
- December 2015 - Draft Jordan Lake Water Supply Allocation Recommendations posted to DWR website
- January 2016 - Draft Jordan Lake Water Supply Allocation Recommendations presented to the Water Allocation Committee of the Environmental Management Commission which granted permission for DWR to proceed with public meetings to receive comments
- March 2016 22nd and 30th- Public meetings held in Pittsboro and Wilmington to discuss the Draft document and receive comments
- April 2016 to October 2016 Revise hydrologic model to address comments on draft document and revise the analysis to produce the Round 4 Jordan Lake Water Supply Allocation Recommendations
- December 2016 Round 4 Jordan Lake Water Supply Allocation Recommendations and Cape Fear River Surface Water Supply Evaluation posted to DWR website
- January 2017 presentation of Round 4 Jordan Lake Water Supply Allocation Recommendations to the EMC

Division staff prepared the *Jordan Lake Water Supply Storage Allocation Application Guidelines* that described in detail the information to be included in an application for an allocation. To

accompany this document DWR prepared a spreadsheet template to be used by applicants to supplement local water supply plan information and provide additional information needed for the allocation review process. The guidelines can be found in Appendix A or on the Division's website at http://www.ncwater.org/?page=317, which also contains a link to the "Local Water Supply Plan supplemental information for Jordan Lake Allocation Application" spreadsheet file.

The Division of Water Resources uses hydrologic modeling to evaluate surface water availability under various water withdrawal and management scenarios. A hydrologic model creates a hypothetical representation of surface water conditions based on historic data, and inferences derived from known data, to characterize the relationships between water withdrawals, return flows and management protocols. A model is a mathematical characterization of surface water volumes and stream flows based on conditions defined for a point in time when water withdrawals, wastewater discharges, and water management protocols are fixed and data describing the resultant surface water conditions are available. For the Cape Fear – Neuse River Basins Hydrologic Model that point is the year 2010. The model coding is adjusted to closely approximate the known conditions in 2010. This model scenario captures current conditions at the time of model development, based on conditions up to that time and provides the "basecase" for the model. The basecase scenario provides the benchmark against which the impacts from changes in management regimes and water withdrawals can be compared.

While future demand scenarios are developed using withdrawals thought to be needed to meet demands some year in the future, the model does not project future surface water flows. It evaluates various water demand quantities against the range of stream flows that have occurred in the historic record. For this model the historic record was derived from hydrologic conditions from 1931 to 2011. Comparing model scenarios provides information to describe how surface water conditions may differ for alternative withdrawal scenarios compared to conditions in the basecase scenario.

The 2010 basecase scenario is a point in time with which many people living and working in the basin had direct experience. Looking at the outputs from the basecase of the model provides information on the magnitude and duration of water shortages that might have occurred with the 2010 levels of water demands during historic flow conditions or that may occur if similar flow conditions occur in the future. For instance, what might water resource conditions be like if water withdrawers were trying to meet 2010 water demands during the water availability conditions that existed during the 1953-54 drought?

The model was used to evaluate requests for allocations from Jordan Lake and to evaluate long-term water supply needs in both basins. The analysis discussed in this document is based on model revisions made to address comments to the December 2015 draft document and additional withdrawal information received during the comment period. In addition to the 2010 basecase scenario, five modeling scenarios portraying alternative withdrawal and supply options were used to analyze the effects of DWR's allocation recommendations and withdrawals estimated to be needed to meet demands in 2045 and 2060 for surface water withdrawers in both basins.

Details of the model and the water withdrawal, wastewater returns and the Jordan Lake Drought Contingency Plan are discussed in detail in the Cape Fear River Surface Water Supply

Evaluation. The document also discusses the effects of allocation options on Jordan Lake water levels, the water supply pool and the flow augmentation pool focusing on meeting projected 2060 water demands.

The rules governing Jordan Lake water supply allocations limits the Environmental Management Commission to making allocations sufficient to meet expected needs over a 30-year planning horizon. With an initial presumption that allocation decisions would likely be finalized in late 2015 the analysis used to develop allocation recommendations focuses on estimated needs in 2045. Table 1 summarizes the current allocations and the allocations requested in the applications submitted in November 2014.

Table 1 Allocation Summary

Jordan Lake Water Supply Pool		
Applicant	Current Allocation Percent	JLA-4 Requested Allocation Percent
Cary Apex Morrisville RTP	39	46.2
Chatham Co North*	6	13
Durham*	10	16.5
Holly Springs	2	2
Hillsborough	0	1
OWASA*	5	5
Orange Co	1	1.5
Pittsboro*	0	6
Raleigh	0	4.7
Fayetteville	0	10
Total Percent	63.0	105.9
* Western Intake Partners		

Cape Fear-Neuse River Basins Hydrologic Model Review

Each Cape Fear-Neuse River Basins Hydrologic Model scenario balances surface water coming into the streams in the basins with water going out of the streams at each node, subject to goals, constraints and management protocols defined for the scenario. Water withdrawals are given a priority at each node during model development so that water is apportioned between competing uses to emulate real world conditions. At the reservoir nodes water is stored and released subject to operating rules established in consultation with reservoir managers and users. Each model scenario run calculates water availability at each node for each of the 29,858 days in the historic flow dataset using daily average values.

For future demand scenarios water systems that depend on neighboring water systems for their current water supplies are assumed to continue having their demands met in the future by the same suppliers, unless information is available describing planned changes.

Public water systems that submit a local water supply plan provide estimates of future water demands. The plans do not include estimates of future wastewater return flows. Therefore, for model scenarios other than the basecase scenario wastewater return flows are estimated at the same percentage of water withdrawal or water use as that used in the 2010 basecase scenario, unless additional information is available. The actual amount of treated wastewater returned to the surface waters in these basins will be determined by the utilities' desire and ability to construct the necessary collection systems and treatment facilities as well as the ability to secure the necessary permits.

The model scenarios used for the December 2015 Draft Cape Fear River Water Supply Evaluation and the Draft Jordan Lake Water Supply Allocation Recommendations were updated for this analysis. The updated model includes revised estimates for water needs to support electric generation and updated demand estimates for the Lower Cape Fear Water and Sewer Authority to better describe the cumulative demands of their members and customers. Future water demand estimates for non-applicant surface water withdrawers in the model were updated as needed for compatibility with the LCFWSA estimates.

Modeling results presented in this evaluation include additional information on fluctuation of water levels in Jordan Lake and the magnitude of the daily fluctuations. Also, fluctuations in the distribution of the magnitude of stream flows are emphasized in this analysis rather than the variations in extreme low flows.

Modeling results needed to describe possible conditions related to meeting the levels of withdrawals expected to be needed to meet 2045 demand levels are presented in this document. The CFRSWSE presents modeling results related to meeting withdrawals needed to meet 2060 water demands.

The results of the various modeling scenarios used for this analysis are inextricably linked to the assumptions that needed to be made for model development, especially about how much treated wastewater is returned to the surface waters of the basins. Changes in modeling assumptions will change the model outputs.

Jordan Lake Water Supply Allocation

DWR received ten applications for allocations of water supply storage in Jordan Lake. The applications represent requests from the Fayetteville Public Works Commission and twelve members of the Jordan Lake Partnership.

The Jordan Lake Partners worked together to develop mutually acceptable projections of future population and water demand growth to estimate future regional water needs. This effort included evaluating existing water system interconnections and commissioning studies of options to improve water sharing among regional water utilities. The work of the Jordan Lake Partners placed a high priority on developing a consensus on regional water supply alternatives and prudent use of the water supply storage in Jordan Lake, assumed to be 100 million gallons per day. Currently 63 percent of the water supply pool in Jordan Lake is allocated to local

governments. Allocating the remaining 37 percent will not provide all the water needed to meet expected 2060 regional customer demands. Additional sources of water will need to be developed. Using additional water from Jordan Lake can provide the regional water utilities with time to develop additional practical supply options, while continuing to meet customer needs.

There is only one water supply intake on Jordan Lake. It is jointly owned by the towns of Cary and Apex. The Cary-Apex raw water pump station, with a capacity limit of about 80 million gallons per day, provides access to the water for all current allocation holders. This intake provides raw water for the Chatham County water treatment plant, supplying the Chatham County-North water system as well as the Cary-Apex water treatment plant. The Cary-Apex water treatment plant supplies water to their service area customers and it can also provide potable water to other allocation holders through distribution system interconnections. The capacities of the existing water system interconnections limit the amount of water that can be passed from the Cary-Apex system to other allocation holders.

The portion of storage set aside for water supply was intended to reliably provide 100 million gallons per day and subsequent studies have supported that calculation.[4] The potential yield of the water supply pool was evaluated using the Cape Fear-Neuse River Basins Hydrologic Model. A detailed discussion of the potential yield of the water supply pool is presented in the Cape Fear River Surface Water Supply Evaluation. The evaluation indicates that even if all the water from the water supply pool is used out of the Cape Fear River basin, with none returned to the Jordan Lake watershed, the potential yield is estimated to be104 million gallons per day. Under current and anticipated future water use and wastewater return scenarios water is, and will continue to be, returned to the Jordan Lake watershed raising the potential yield of the water supply pool. With this slightly higher than expected yield estimate, continuing to assume a yield of 100 million gallons per day for the allocation analysis improves the probability of being able to reliably supply expected withdrawals given the uncertainty of future hydrologic conditions.

Developing the infrastructure necessary to use water from the Jordan Lake water supply pool is the responsibility of the allocation holders. The current raw water intake does not have the capacity to withdraw 100 million gallons per day. Therefore, another raw water intake will be required to make optimal use of the water storage for which the State contracted with the USACE to provide water supply for local governments.

The applications for water supply storage submitted by members of the Jordan Lake Partnership support the joint development of an additional regional water supply intake and treatment facility. Completion of the facility is expected to provide for the optimal use of the water supply storage in Jordan Lake. The proposed treatment and transmission facilities would improve regional water supply reliability and redundancy to meet community water needs.

[4] See “Jordan Lake Water Supply Pool Potential Yield” section of the Cape Fear River Surface Water Supply Evaluation available on the DWR website at http://deq.nc.gov/about/divisions/water-resources/planning/basin-planning/map-page/cape-fear-river-basin-landing/jordan-lake-water-supply-allocation/jordan-lake-water-supply-allocation-round-4

Chatham County, the City of Durham, Orange Water and Sewer Authority and the Town of Pittsboro are jointly evaluating options for a regional water supply intake along the western shore of Jordan Lake. A new water treatment plant would be constructed on property currently owned by Orange Water and Sewer Authority adjacent to the project's boundary. The new facilities, in combination with the existing facilities, would allow allocation holders to make optimal use of their current allocations and the allocations recommended in this document.

Jordan Lake Water Supply Allocation applications and supporting documentation submitted to the Division of Water Resources are available on the division's website at http://www.ncwater.org/jordan-lake-allocation-round-4.

Regional Growth in Population and Water Demand:

The success of the Research Triangle Park has contributed to consistent economic and population growth in the surrounding region. Population growth in surrounding communities leads to growth in the demand for reliable drinking water and fire protection services to protect the public health. Jordan Lake is, and will continue to be, a major source of water for the Triangle Region.

All the applicants for a water supply allocation expect significant population growth through 2045, the permitting horizon for this round of allocation decisions, and continued growth through 2060. Table 2a shows the applicants' service population projections. Table 2b shows county population estimates developed by DWR based on data from the Office of State Budget and Management for 1990 to 2034 with trend extensions by DWR staff to 2060.

Table 2a Applicant Population Estimates

Applicants Estimated Service Population					
JLA-4 Applicants	**County Served**	**2010**	**2035**	**2045**	**2060**
Cary-Apex-Morrisville-WakeCoRTP	Wake / Chatham	182,600	309,600	344,150	360,600
Chatham Co-North	Chatham	10,200	49,450	65,350	94,000
Pittsboro	Chatham	3,700	69,250	83,500	96,800
Durham	Durham	246,180	350,922	393,924	458,426
Hillsborough	Orange	12,216	22,150	26,600	33,800
Holly Springs	Wake	24,700	68,371	81,931	103,261
Orange County	Orange	132	11,897	17,185	25,115
OWASA	Orange	79,400	115,700	129,950	149,700
Raleigh	Wake	485,219	879,441	1,048,700	1,316,200
Fayetteville PWC	Cumberland	199,102	350,574	398,380	440,390
	Total Service Population	1,243,449	2,227,355	2,589,670	3,078,292

Table 2b DWR Population Estimates

Estimated County Population				
County	**2010**	**2035**	**2045**	**2060**
CHATHAM	63,751	93,544	105,802	124,189
CUMBERLAND	327,445	375,428	396,220	427,407
DURHAM	271,297	397,205	446,627	520,761
ORANGE	134,303	178,148	196,202	223,284
WAKE	906,909	1,433,761	1,657,599	1,993,356
Total Estimated Population	1,703,705	2,478,086	2,802,450	3,288,996
http://www.osbm.state.nc.us/ncosbm/facts_and_figures/socioeconomic-data.shtm				
Estimated 1990-2034 & extensions				

Comparing the population totals for each time period for the applicants and the counties served, the numbers show fairly comparable growth expectations. However, there are some significant variations that need to be highlighted, most notably the variations between DWR's population estimates, based on the Office of State Budget and Management population projections, for Chatham County and the estimated service populations for the Chatham County – North and Pittsboro water systems included in their allocation applications.

The recent proposal to develop the Chatham Park project, east of Pittsboro, forced both of these water utilities to revise service population estimates based on projections of development within the boundary of the project and expectations of growth in the surrounding county lands. Extending the growth trends in the OSBM projections, at best, indicates what future populations might have been without the Chatham Park project.

There is uncertainty associated with all these population estimates. However, the applicants' estimates show the number of customers the water utilities anticipate needing to supply with potable water in the future. The growth expectations define the scope of the distribution system that has to be developed and the water supply that has to be available to meet anticipated customer demands when those demands become real.

Table 3a summarizes the growth in customers' average day water demands anticipated by allocation applicants. These figures reflect expected demands based on the water utilities current understanding of the potential growth in the number of customers to be served in relation to distribution system expansion and development within their current service areas.

Table 3b shows demand estimates developed by DWR based on county population projections shown in Table 2b and per person water use in 2010 by the applicants' customers, as shown in their local water supply plans. This approach includes county residents that do not get water from the applicant systems as well as those that do. There are residents in all counties that do not get their drinking water from local government water systems. Many residents rely on household wells and others get their water from community water systems not operated by a unit of local government. Therefore, it is not surprising that the total county population based demand

estimates are greater than the estimates provided by the allocation applicants. Similar to the population estimates provided in Tables 2a and 2b, the applicants demand estimates for Chatham County are higher due to inclusion of the needs for the Chatham Park project.

Table 3a Applicants Water Demand Estimates in Million Gallons per Day

Applicants Estimated Average Day Demand (MGD)					
JLA-4 Applicants	**County Served**	**2010**	**2035**	**2045**	**2060**
Cary-Apex-Morrisville-WakeCoRTP	Wake / Chatham	20.72	40.82	45.82	48.33
Chatham Co-North	Chatham	2.16	10.13	13.03	18.12
Pittsboro	Chatham	0.56	8.41	9.92	11.24
Durham	Durham	25.27	36.12	39.98	44.37
Hillsborough	Orange	1.17	2.87	3.22	3.70
Holly Springs	Wake	1.98	6.23	7.24	8.78
Orange County	Orange	0.02	2.01	2.81	3.92
OWASA	Orange	7.86	10.24	11.32	12.91
Raleigh	Wake	52.75	84.76	97.02	115.01
Fayetteville PWC	Cumberland	28.01	55.03	65.41	78.92
Total Estimated Average Day Demand		140.50	256.62	295.77	345.30

Table 3b Population based County Water Demand Estimates in Million Gallons per Day

Estimated System Demand based on Estimated County Population (MGD)				
Based on projected county population figures and average				
2010 system wide per capita use of applicants in each county				
County	**2010**	**2035**	**2045**	**2060**
CHATHAM	11.60	17.02	19.25	22.60
CUMBERLAND	46.07	52.82	55.75	60.14
DURHAM	27.85	40.77	45.85	53.46
ORANGE	16.90	22.42	24.69	28.10
WAKE	91.40	144.49	167.05	200.89
Total Estimated Demand	193.82	277.53	312.59	365.18

3 Allocation Requests

Ten applications, representing twelve members of the Jordan Lake Partnership and the Fayetteville Public Works Commission, were received by the Division of Water Resources. This section presents condensed summaries of the allocation requests. The complete applications for Jordan Lake water supply allocations are available on the division's website at http://www.ncwater.org/jordan-lake-allocation-round-4.

The following discussions include tables that summarize information from the applications for water supply allocations submitted in November 2014. The applications and associated workbooks contain information in five-year increments from 2010 to 2060. The following discussion will focus on data for those periods that are important for determining the needs for water supply allocations from Jordan Lake.

The starting point for this analysis is the conditions that existed in 2010. This year is the starting point for determining water demand and service population growth for 50 years into the future, which defines the end of the long-term analysis period at 2060 for the CFRSWSE. During previous allocation processes members of the Environmental Management Commission requested reviews of conditions 50 years in the future to identify water utilities that may need additional water beyond the 30-year period used to determine allocations. The water system's and water resources conditions in 2010 are used as representative of current conditions and provide reference conditions against which modeled future conditions are compared.

The rules governing the allocation process limit allocations to the amounts needed to meet estimated water needs 30 years in the future. At the beginning of Round 4, allocation decisions were expected to be finalized in 2015. Therefore, allocation recommendations are based on the amount of water needed to meet the expected demands in 2045, 30 years from the expected approval of Round 4 allocations. Evaluations of conditions associated with expected demands in 2035 presented in the December 2015 draft recommendations are not included in this evaluation.

The allocation rules established Level 1 and Level 2 allocations with two different payback protocols. Holders of Level 1 allocations must pay proportional costs for capital investments, interest, operations and maintenance based on the size of the allocation. Holders of Level 2 allocations, which were not expected to be used within the first five years after approval, were only required to pay interest, operation and maintenance costs until they began to use their allocation. This distinction is no longer relevant because the rules also require complete repayment of capital costs associated with an allocation by 2012. Therefore, local governments that receive new allocations in this round will be required to pay the total amount of the capital cost, operations and maintenance, and interest associated with the percentage of the water supply pool allocated to them.

Each application includes estimates of the population the water utility expects to serve in the future. This figure represents the number of people the system anticipates being dependent on the water distribution system at each point in time. The size and geographic coverage of the

distribution system is a function of where local decision makers expect growth to occur and local policies about expansion of utility service boundaries. The number of people served by a particular water utility may not correspond to municipal or county census figures. Also, some water utilities in North Carolina have service areas encompassing areas in multiple counties. The estimated service populations in the applications are best judgements based on available information at the time the applications were developed. They may include locally known information that may or may not have been available when other sources of population projections were being developed.

An important consideration of alternative water sources is whether the alternative can be brought online by the time additional water is needed to meet customer demands. Some of the alternative sources presented in the applications face considerable hurdles that could limit their timely development. The uncertainty associated with getting legal access and regulatory approval can seriously limit the ability to bring a source online in a timely manner.

Statutory and administrative rule requirements outline specific requirements that must be met for many of the decisions that must be made. Also, approval processes can be significantly influenced by local and regional politics. Regulatory uncertainty can make an allocation of water from Jordan Lake an important supplemental supply as development of other alternative sources progress through the approval process. Granting an allocation of water supply storage from Jordan Lake, an existing reservoir can also avoid or at least postpone development of new or expanded water supply sources and the associated environmental impacts.

The information included in each application will be discussed focusing on the documentation of need and consideration of supply alternatives. Tables summarizing each applicants water needs and their proposed alternatives to meet those needs are included in each discussion. It is useful to keep in mind that while most of the demand data contained in the applications are based on annual average water demands actual water use varies considerably throughout the year. Each applicant's data summary table includes estimates of the average day demand in the month when water use is typically the highest as well as the annual average day demand estimates. The multipliers used to produce maximum month daily demands were derived from the water demand monthly distribution factors in the Cape Fear – Neuse River Basin Hydrologic Model. As noted above, the tables include data for 2060 but the evaluation of need for an allocation are limited by rule to needs documented for 30 years after the allocations are made. In this case estimated demands for 2045 are used as the basis for allocation recommendations.

Jordan Lake Regional Perspective

The map below shows the current and future service area boundaries of the members of the Jordan Lake Partnership. It is followed by a map showing water system inter-connections among the partner communities in 2012. This group includes all allocation applicants except for the Fayetteville Public Works Commission.

Figure 2 Triangle Regional Water Service Areas (from the TRWSP)

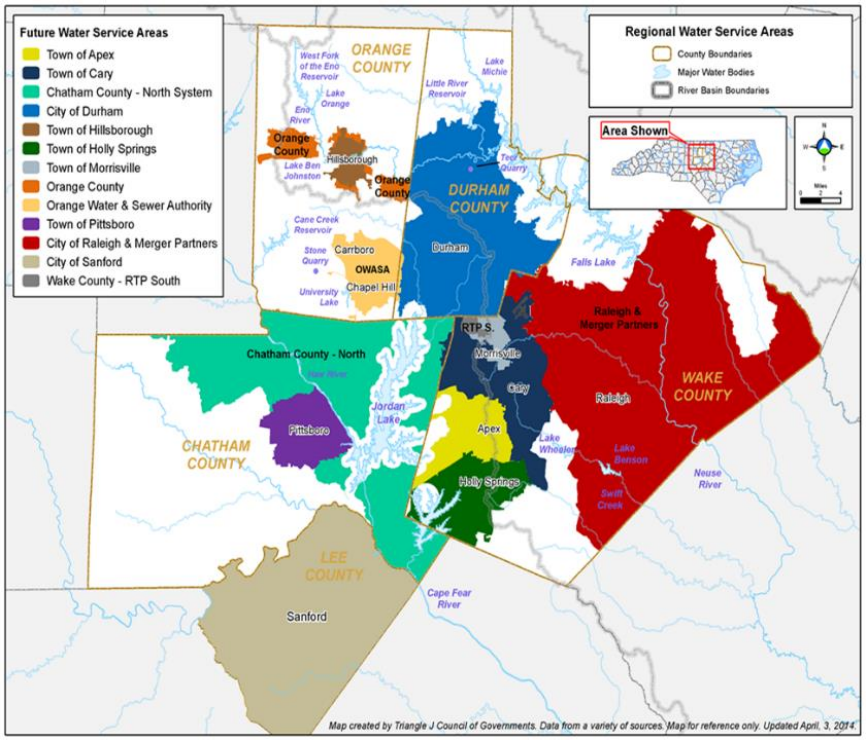
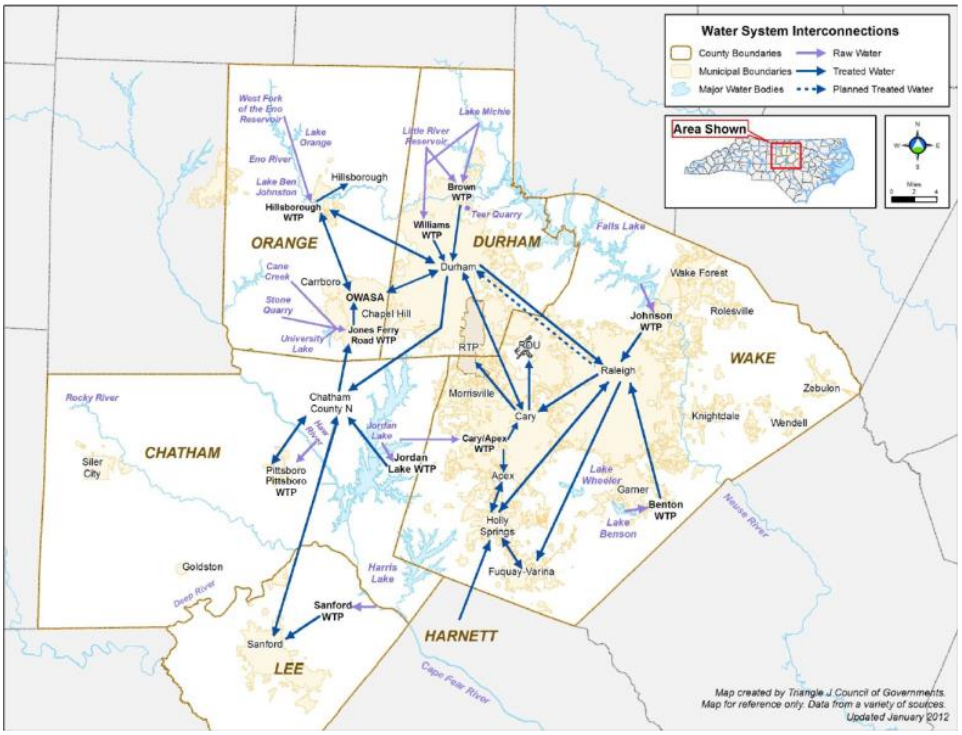


Figure 3 Triangle Regional Water System Interconnections as of 2012 (from the TRWSP)



A. Cary, Apex, Morrisville and Wake County – Research Triangle Park

Table 4 labeled "Cary, Apex, Morrisville, Wake Co-RTP" summarizes the information submitted in the joint application for water to supply the residents and businesses served by the Cary and Apex public water systems. Cary and Apex jointly hold a 32 percent allocation from Jordan Lake. Morrisville and Wake County each hold 3.5 percent allocations. The four utilities together have allocations totaling 39 percent of the water supply pool. In the joint application they are seeking an increase of 7.2 percent to give them a total of 46.2 percent to cover expected water demands through 2045. Morrisville's application requests that they retain their 3.5 percent allocation. The remaining 42.7 percent allocation would be held by Cary and Apex jointly.

By 2045 these water systems are planning to need water to meet the demands of over 344,000 people and supporting institutions. Currently Jordan Lake is the sole source of water for these communities to meet daily customer demands. Under Alternative 1 the Towns of Cary and Apex would continue to withdraw and treat water from the current raw water intake to meet the needs of Apex and the combined needs of Cary, Morrisville and RTP-South. Plans are underway to expand water treatment capacity to 56 million gallons per day with completion expected in 2016. Some of the wastewater collected and treated by these utilities will be discharged to the Neuse River Basin under an Interbasin Transfer Certificate approved by the Environmental Management Commission. The remainder of the collected and treated wastewater will be discharged to the Cape Fear River below Jordan Dam contributing to the flow at the USGS streamflow gage at Lillington.

Alternatives 2, 4 and 5 all involve significant regulatory approval processes. Alternative 3 may offer a second best option to an increased allocation from Jordan Lake but would generate environmental impacts that would not be produced by simply increasing withdrawals from the current facilities at Jordan Lake. This option would withdraw water downstream of Jordan Dam and pump water to the existing water treatment plant or a newly constructed water treatment plant. Alternative 3 may require additional releases from the flow augmentation pool to meet downstream flow targets.

Alternative 1 requires no new construction to access water supply beyond what is already planned. Expansions to the distribution system to accommodate growth would be similar for all alternatives.

Table 4 Cary, Apex, Morrisville, Wake Co.-RTP Alternatives Summary

Cary,Apex,Morrisville,WakeCo-RTP		2010	2015	2035	2045	2060
MaxMonMultiplier	Service Population	182,600	201,200	309,600	344,150	360,600
1.4	Maximum Month Daily Demand	29.01	33.36	57.15	64.15	67.66
	Annual Average System Demand (MGD)	20.72	23.83	40.82	45.82	48.33
Cary & Apex	Demand	18.40	20.90	34.80	39.15	41.40
Morrisville	Demand	1.72	2.03	3.32	3.47	3.63
RTP-South	Demand	0.60	0.90	2.70	3.20	3.30
Alternative 1	Water Sources	39.00	46.20	46.20	46.20	48.50
	Current Jordan Lake Allocation	39	39	39	39	39
	JLA4 Allocation		7.2	7.2	7.2	7.2
	JLA5 allocation					2.30
Alternative 2	Water Sources	39.00	39.00	48.50	48.50	48.50
	Current Jordan Lake Allocation	39	39	39	39	39
	Allocation from Increased JL Water Supply Pool			9.5	9.5	9.5
Alternative 3	Water Sources	39.00	39.00	48.50	48.50	48.50
	Current Jordan Lake Allocation	39	39	39	39	39
	Cape Fear River @ Harnett County			9.5	9.5	9.5
Alternative 4	Water Sources	39.00	39.00	48.50	48.50	48.50
	Current Jordan Lake Allocation	39	39	39	39	39
	Crabtree Creek and Triangle Quarry			9.5	9.5	9.5
Alternative 5	Water Sources	39.00	39.00	39.00	48.50	48.50
	Current Jordan Lake Allocation	39	39	39	39	39
	Kerr Lake				9.5	9.5
JLA4 Request	Average Annual System Demand (MGD)	20.72	23.83	40.82	45.82	48.33
	Water Sources	39.00	46.20	46.20	46.20	46.20
	Current Jordan Lake Allocation	39	39	39	39	39
	JLA4 Allocation		7.2	7.2	7.2	7.2
Cary-Apex-Morrisvill	**Total JLA4 Allocation Request**	**39**	**46.2**	**46.2**	**46.2**	**46.2**

B. Western Water Intake Partners

Pittsboro, Chatham County, Durham and the Orange Water and Sewer Authority have been working together on a proposal to construct a new intake and water treatment plant on the western shore of Jordan Lake. A guaranteed source of water is essential for the success of this cooperative project. The new facilities would allow these systems to access their requested allocations and provide the ability to fully utilize the water supply storage in Jordan Lake reservoir. Development of a new intake, treatment plant and transmission pipelines faces an extensive review and approval process. The new facility may not be operational until around 2035. With the 80 million gallon per day limit on the existing raw water intake an additional intake will be required if the state is to reap the maximum benefits of the water supply storage in Jordan Lake reservoir. As currently envisioned the project would include a new raw water intake

and pump station in or adjacent to the reservoir, a treatment plant constructed on land owned by the Orange Water and Sewer Authority adjacent to the Corps of Engineers' property and finished water pumping and transmission facilities to deliver water to the project partners.

This proposal, supported by the Jordan Lake Partnership, is explained in more detail in the TRWSP and the allocation applications submitted by JLP members.

C. Pittsboro

The Town of Pittsboro is facing a very significant increase in the number of residents and businesses dependent on the municipal pubic water system. Development of the proposed 7000 acres in the Chatham Park project east of the town will include about 22,000 residential units with about 64,000 new residents over the 30 years anticipated to reach build out. In addition, the project will include about 2.4 million square feet of commercial space, 16.6 million square feet of office space and 2.5 million square feet of civic, school and hospital space.

Pittsboro approved the Planned Development District for Chatham Park and committed to provide water service. The town proposes to expand its current two million gallons per day water treatment capacity from the Haw River.by expanding the existing Haw River facilities in two stages of two million gallons per day each to reach of total of six million gallons per day. Pittsboro has submitted an allocation request for six percent of the water supply pool in Jordan Lake to supplement the supply available from the Haw River.

Pittsboro plans to access their allocation through the proposed western Jordan Lake intake and water treatment plant. The expansions of the Haw River facilities are expected to cover demands while the western treatment and transmission facilities are being developed. Without water from Jordan Lake it is unclear if Pittsboro, or any other entity, could reliably supply the level of water demands necessary to support development of the Chatham Park project and the secondary development expected in the surrounding areas. The only alternative to the water supply scheme submitted by Pittsboro relies on a larger allocation from Jordan Lake which would be utilized earlier in the planning horizon. While Pittsboro could possibly access water from the Cape Fear River below Jordan Dam such an arrangement would likely require larger flow augmentation releases from Jordan Lake to meet management rules. There are many unanswered question about how water demand will grow in Chatham County because of the Chatham Park project. Additional water supplies will be needed to meet the increased water needs to be generated by this development project.

Table 5 Pittsboro Alternative Summary

Pittsboro		2010	2015	2035	2045	2060
MaxMonMultiplier	Service Population	3,700	13,850	69,250	83,500	96,800
1.15	Maximum Month Daily Demand	0.65	2.07	9.67	11.41	12.93
	Annual Average System Demand (MGD)	0.56	1.80	8.41	9.92	11.24
Alternative 1	**Water Sources total**	2.00	2.00	9.00	12.00	12.00
	Existing Haw River	2	2	2	2	2
	Haw River Expansion			2	2	2
	Haw River Expansion			2	2	2
	Requested Total JL Allocation			3	6	6
Alternative 2	**Water Sources total**	2	2	12	12	12
	Existing Haw River	2	2	2	2	2
	Jordan Lake Allocation			10	10	10
JLA4 Request	Annual Average System Demand (MGD)	0.56	1.80	8.41	9.92	11.24
	Water Sources total	2.00	8.00	12.00	12.00	12.00
	Existing Haw River	2	2	2	2	2
	Haw River Expansion			2	2	2
	Haw River Expansion			2	2	2
Pittsboro	**JLA4 Request**	**0**	**6**	**6**	**6**	**6**

D. Chatham County-North Water System

Chatham County initiated the first inquiries for a fourth round of allocations of water supply storage in Jordan Lake. The Chatham County-North water system continues to face rapid growth in water demand with limited capacity in the existing water treatment plant. Discussions generated by Chatham County's inquiries evolved into formation of the Jordan Lake Partners and ultimately in the development of the Triangle Regional Water Supply Plan. The Chatham County-North service area includes the Chatham County lands surrounding Jordan Lake, except for Pittsboro and its extra-territorial jurisdiction. While the water system's service area borders the Chatham Park project it does not include the project. Chatham County is experiencing growth as development, particularly residential development, expands southward from Orange and Durham counties. In addition, the success of the Chatham Park project is expected to foster development in the county areas around the project.

The County estimates the service population to increase to about 65,300. Residential growth and associated non-residential growth are expected to produce estimated annual average water demands of 13.3 million gallons per day by 2045. These estimates are based on current development patterns and the area of developable parcels served by the county water system and anticipated changes due to surrounding development.

Chatham County currently holds a six percent allocation from the Jordan Lake the water supply pool, which supplies a three million gallons per day water treatment plant. Water to supply the treatment plant comes from the raw water pipeline supplying the Cary-Apex water treatment plant. Part of the systems' current demand is met through a time-limited arrangement to purchase finished water from Durham. This arrangement is intended to help Chatham County meet water demands over the time period needed to secure additional water supply and develop the

infrastructure to use it. Chatham County is requesting an additional seven percent allocation from the water supply pool, giving the Chatham County-North water system a 13 percent allocation to meet estimated 2045 customer demands. The Chatham County-North water system intends to access its Jordan Lake allocation through the proposed western intake and treatment facilities.

Table 6 Chatham County-North Alternative Summary

Chatham County-North		2010	2015	2035	2045	2060
MaxMonMultiplier	Service Population	10,200	18,050	49,450	65,350	94,000
1.36	Maximum Month Daily Demand	2.94	5.07	13.77	17.72	24.64
	Annual Average System Demand (MGD)	2.16	3.73	10.13	13.03	18.12
Alternative 1	Water Sources	6.00	13.00	13.00	13.00	18.10
	Current Jordan Lake Allocation	6	6	6	6	6
	JLA4		7	7	7	7
	JLA5					5.1
Alternative 2	Water Sources	6.00	6.00	18.20	18.20	18.20
	Current Jordan Lake Allocation	6	6	6	6	6
	Cape Fear River -Harnett County			12.2	12.2	12.2
JLA4 Request	Average Annual System Demand (MGD)	2.16	3.73	10.13	13.03	18.12
	Water Sources	6	13	13	13	13
	Jordan Lake Allocation	6				
Chatham County-No	**JLA4 Request**		**13**	**13**	**13**	**13**

E. Durham

Durham's primary sources of water are Lake Michie, on the Flat River, and the Little River Reservoir both of which are upstream of Falls Lake in the Neuse River Basin. The combined yield of these two reservoirs is estimated to be 27.9 million gallons per day. Durham has been pursuing the development of the Teer Quarry as an off-stream supplemental water source. The quarry would be filled by pumping water from the Eno River during high flow conditions. Downstream of Durham's water withdrawals, the Flat, Little and Eno rivers flow into Falls Lake contributing to the water supply and flow augmentation storage of that reservoir. Falls Lake is the major source of water for Raleigh and its water system partners Garner, Knightdale, Rolesville, Wake Forest, Wendell and Zebulon.

Durham's sources are supplemented by a current allocation of 10 percent of the water supply pool in Jordan Lake. Durham has access to their allocation by arrangement with Cary to provide finished water through interconnections of their distribution systems.

As one corner of the Research Triangle, Durham has grown significantly since the formation of Research Triangle Park and continues to do so. Over the fifty-year planning horizon of the CFRSWSE analysis the Durham water system projects an 86 percent increase in its service area population from about 246,000 to over 458,000. Increasing water withdrawals from Durham's sources, other than Jordan Lake, will decrease flows into Falls Lake as Raleigh's water demands continue to increase.

Durham submitted an allocation request for an additional 6.5 percent of the water supply pool of Jordan Lake giving the system a total allocation of 16.5 percent. Durham is one of the four Jordan Lake Partners cooperatively working to develop a raw water intake and water treatment plant on the western side of Jordan Lake. This project will expand the availability of public water supplies to the region. The current understanding, and the way Durham's demands are modeled for this analysis, assumes that upon completion of the western water treatment plant and transmission facilities Durham's Jordan Lake allocation will become its primary source with withdrawals from Lake Michie and Little River Reservoir used to meet demands exceeding the amount available from Jordan Lake. Depending on actual demand growth this arrangement has the potential to reduce Durham's withdrawals from the Falls Lake watershed.

All of Durham's supply alternatives assume that they will maintain the current 10 percent allocation which to date has been used when supply from their reservoirs is limited. With Durham's current ten percent allocation their estimated reliable supply is 37.9 million gallons per day. To meet future demands through 2045 current water sources could be increased by expanding Lake Michie Reservoir using two possible enlargement options, increasing pumping from the Eno River for off-stream storage and/or increasing distribution of reclaimed water. Except for the reclaimed water option, the other options would all result in increased withdrawals above Falls Lake.

The Durham Water Management Department has three locations where collected wastewater is treated and discharged. The South Durham Water Reclamation Facility and the Triangle Regional Wastewater Treatment Plant treat about 60 percent of the systems collected wastewater discharging it to the Jordan Lake watershed. The remainder of collected wastewater is treated at the North Durham Water Reclamation Facility which discharges to the Falls Lake watershed. Durham has the capacity to return water withdrawn from Jordan Lake to the reservoir's watershed, reducing the net effect of withdrawals on storage in the conservation pool. Currently almost all of the water discharged by Durham to the Jordan Lake watershed in the Haw River Basin was withdrawn from sources in the Neuse River Basin, above Falls Lake.

By using more water from Jordan Lake, and discharging the associated wastewater back to the reservoir's watershed, Durham's use of the requested allocation has the potential to reduce withdrawals from the Falls Lake watershed leaving more water to support Raleigh's water supply. This outcome depends on the successful completion of the western Jordan Lake intake, treatment plant and transmission facilities. This, in turn, depends on the project partners securing the requested water supply allocations guaranteeing access to water.

Table 7 Durham Alternatives Summary

Durham		2010	2015	2035	2045	2060
MaxMonMultiplier	Service Population	246,180	266,300	350,922	393,924	458,426
1.182	Maximum Month Daily Demand	29.87	33.05	42.69	47.25	52.45
	Annual Average System Demand (MGD)	25.27	27.97	36.12	39.98	44.37
Alternative 1	Water Sources total	37.90	44.40	44.40	44.40	44.40
	Lake Michie/Little River Reservoir	27.9	27.9	27.9	27.9	27.9
	Current Jordan Lake Allocation	10	10	10	10	10
	Requested Total JL Allocation		16.5	16.5	16.5	16.5
Alternative 2	Water Sources total	37.90	37.90	45.30	45.30	45.30
	Lake Michie/Little River Reservoir	27.9	27.9	27.9	27.9	27.9
	Current Jordan Lake Allocation	10	10	10	10	10
	Teer Quarry			5.2	5.2	5.2
	Reclaimed Water System			2.2	2.2	2.2
Alternative 3	Water Sources total	37.90	37.90	49.90	49.90	49.90
	Lake Michie/Little River Reservoir	27.9	27.9	27.9	27.9	27.9
	Current Jordan Lake Allocation	10	10	10	10	10
	Raise Lake Michie to 365' MSL			12	12	12
Alternative 4	Water Sources total	37.90	37.90	63.90	63.90	63.90
	Lake Michie/Little River Reservoir	27.9	27.9	27.9	27.9	27.9
	Current Jordan Lake Allocation	10	10	10	10	10
	Raise Lake Michie to 380' MSL			26	26	26
Alternative 5	Water Sources total	37.90	37.90	49.20	49.20	49.20
	Lake Michie/Little River Reservoir	27.9	27.9	27.9	27.9	27.9
	Current Jordan Lake Allocation	10	10	10	10	10
	Aggressive Reclaimed Water System			11.3	11.3	11.3
JLA4 Request	Annual Average System Demand (MGD)	25.27	27.97	36.12	39.98	44.37
	Water Sources total	37.90	44.40	44.40	44.40	44.40
	Lake Michie/Little River Reservoir	27.9	27.9	27.9	27.9	27.9
Durham	**JLA4 Request**	**10**	**16.5**	**16.5**	**16.5**	**16.5**

F. Orange Water and Sewer Authority (OWASA)

The Orange Water and Sewer Authority provides water and sewer services to the Towns of Chapel Hill and Carrboro, the University of North Carolina at Chapel Hill and portions of southern Orange County. OWASA manages the Cane Creek and University Lake reservoirs which have an estimated combined yield of 10.5 million gallons per day. OWASA currently holds a 5 percent allocation of the water supply pool in Jordan Lake. The Cary-Apex water treatment plant can treat water from OWASA's allocation and send finished water to them through Cary-Durham and Durham-OWASA interconnections.

OWASA has plans to expand the available supply by 2.1 million gallons per day when the utility takes control of a local quarry for water supply storage in 2035. Currently about ten percent of daily system demand is met by providing reclaimed water to UNC-CH for cooling water. OWASA's demand projections are based on presumptions that UNC-CH will continue to be able to use reclaimed water and that OWASA's customers will meet aggressive water use efficiency goals.

OWASA has expressed concern that changes in wastewater treatment processes, required to meet total nitrogen limits on the discharge water, may change the reclaimed water's chemistry to the point it may no longer be economically feasibility for UNC-CH to use it in cooling towers. Also, increased infill in some recent developments is producing population densities higher than have been seen historically in the OWASA service area for some recent developments. Changing land use patterns and population densities raise the uncertainty of projected future water demands. Also, the reliability of current demand projections depends on utility customers' acceptance and adoption of water conservation practices. OWASA's five percent allocation from Jordan Lake increases the reliability of the utilities total water supply especially in the period before the quarry project comes online around 2035. The allocation also provides OWASA with an alternative supply if current sources become compromised and a water source from a larger watershed thereby increasing supply reliability, especially during droughts. OWASA is a key player in the development of a western intake on Jordan Lake.

OWASA's allocation application presents five alternative supply scenarios that could meet estimated public water demands through 2060. Alternative 1 reflects existing planned supply expansions and maintaining the utilities current 5 percent allocation of the water supply pool in Jordan Lake. Alternative 2 proposes developing a larger storage capacity in the quarry project with the possibility of relinquishing their Jordan Lake allocation. The third alternative includes developing a new run-of-river raw water intake on the Haw River upstream of Jordan Lake in combination with the currently planned quarry project. Water from the Haw River would be pumped to the Cane Creek Reservoir supplementing natural inflow. The fourth alternative proposes increased use of reclaimed water to supplement the future supply from existing sources and the quarry project.

Table 7 Orange Water and Sewer Authority Alternatives Summary

Orange Water and Sewer Authority		2010	2015	2035	2045	2060
MaxMonMultiplier	Service Population	79,400	86,850	115,700	129,950	149,700
1.142	Maximum Month Daily Demand	8.98	9.24	11.69	12.93	14.74
	Annual Average System Demand (MGD)	7.86	8.09	10.24	11.32	12.91
Alternative 1	Water Sources total	15.50	15.50	17.60	17.60	17.60
	UnivLake/CaneCrk Sys	10.5	10.5	10.5	10.5	10.5
	Future Stone Quarry Expansion	0	0	2.1	2.1	2.1
	Current Jordan Lake Allocation	5	5	5	5	5
Alternative 2	Water Sources total	15.5	15.5	13.9	13.9	13.9
	UnivLake/CaneCrk Sys	10.5	10.5	10.5	10.5	10.5
	Future Stone Quarry Expansion	0	0	3.4	3.4	3.4
	Current Jordan Lake Allocation	5	5			
Alternative 3	Water Sources total	15.5	15.5	20.3	20.3	20.3
	UnivLake/CaneCrk Sys	10.5	10.5	10.5	10.5	10.5
	Future Stone Quarry Expansion	0	0	2.1	2.1	2.1
	Current Jordan Lake Allocation	5	5			
	Haw River Intake			7.7	7.7	7.7
Alternative 4	Water Sources total	15.5	15.5	12.94	12.94	12.94
	UnivLake/CaneCrk Sys	10.5	10.5	10.5	10.5	10.5
	Future Stone Quarry Expansion	0	0	2.1	2.1	2.1
	Current Jordan Lake Allocation	5	5			
	Reclaimed Water			0.34	0.34	0.34
JLA4 Request	Annual Average System Demand (MGD)	7.86	8.09	10.24	11.32	12.91
	Water Sources total	15.50	15.50	17.60	17.60	17.60
	UnivLake/CaneCrk Sys	10.5	10.5	10.5	10.5	10.5
	Future Stone Quarry Expansion	0	0	2.1	2.1	2.1
OWASA	**JLA4 Request**	**5**	**5**	**5**	**5**	**5**

G. City of Raleigh Public Utilities Department

The City of Raleigh Public Utilities Department (CORPUD, Raleigh) provides water and sewer services to residential and non-residential customers in Raleigh, Garner, Knightdale, Rolesville, Wake Forest, Wendell and Zebulon. The primary water supply source is Falls Lake with an estimated yield of 66.1 million gallons per day. An additional 11.2 million gallons per day is available from Lake Benson and Lake Wheeler on the Swift Creek watershed, giving the system a total estimated available supply of 77.3 million gallons per day.

All of Raleigh's dependable water supply comes from sources in the Neuse River Basin. According to information included in Raleigh's allocation request annual average demand is expected to increase to over 84 million gallons per day by 2035 and 97 million gallons per day by 2045. During the month of the year when water use is typically the highest the system could see water demands in excess of 84 million gallons per day by 2025 given the estimated increases in population and water demand.

The Raleigh's allocation application presents several supply alternatives that could secure adequate supplies of water through 2060 in addition to an allocation from Jordan Lake. However, there is a high level of uncertainty associated with making any of these projects a reality.

Similar to Jordan Lake, the water conservation pool of Falls Lake is managed as two separate accounts. During the design of Falls Lake the Raleigh contracted with the USACE for water supply storage of 42.3 percent of the conservation pool. The remaining 57.7 percent is managed for flow augmentation to meet flow targets in the Neuse River at the streamflow gage near Clayton.

Raleigh is investigating the possibility of changing the proportions of storage in the two storage accounts to provide an additional 14 million gallons per day in the water supply pool. Raleigh withdraws water from the water supply pool in Falls Lake to supply its customers. Raleigh's treated wastewater is discharged to the Neuse River downstream of Falls Lake supplementing streamflows with water withdrawn from the water supply pool. This arrangement reduces the dependency on the flow augmentation pool to maintain flow targets at the Clayton streamflow gage. The reallocation of storage in the two storage accounts requires an extensive study and approval process by the USACE that could extend beyond 2020. Even with an additional 14 million gallons per day available from Falls Lake, Raleigh may need an additional supply to meet anticipated 2045 water demands.

One alternative for increasing the available water supply for Raleigh's customers in the application proposes to develop a new surface water intake in the Neuse River downstream of Falls Lake and upstream of the city's Neuse River water reclamation facility discharge. This option is thought to have the potential to supply 23.7 million gallons per day. A new water withdrawal at the proposed location could affect management of the flow augmentation pool in Falls Lake by reducing flows above the Clayton streamflow gage. This project would face extensive environmental reviews and regulatory permitting requirements. It is unlikely it could be operational prior to 2035.

The CORPUD has been considering two other options for potential water supply sources both of which are not expected to be available prior to 2045 due to the complexity of the projects and regulatory requirements.

Raleigh has proposed building a reservoir on the Little River in Wake County which at one time was thought to be able to provide up to 14 million gallons per day. Regulatory compliance issues and the existence of other options with less environmental impacts means this is best considered as a long-range project that is unlikely to be developed for several decades.

Similarly, a proposal to pump water from the Neuse River to a nearby quarry for off-stream storage is a long-range possibility. This project, thought to be able to supply about 10.6 million gallons per day, also faces extensive regulatory requirements which are further complicated by the fact that the quarry is expected to continue being productive for its current owners beyond the time Raleigh needs the additional supply.

Raleigh submitted an application for a 4.7 percent allocation from the Jordan Lake water supply pool. Raleigh's application includes an approach designed to avoid the necessity of transferring surface water between river basins. To avoid the necessity of getting an interbasin transfer certificate Raleigh proposed having any approved allocation released from the reservoir so it could be withdrawn from the Cape Fear River down steam in the vicinity of Lillington and be

piped to the D.E. Benton WTP. Treated wastewater would be returned to the Cape Fear River near where the water was withdrawn, reducing and possibly avoiding a surface water transfer which would trigger the need for Raleigh to get a surface water transfer certification from the EMC.

Raleigh's allocation application indicates their willingness to investigate the possibility of accessing an allocation through one of the Jordan Lake Partners to which they are already connected. Raleigh's interconnections with Cary and Durham may have the capacity to move this volume of water. However, the IBT Certificate recently issued to Cary and Apex specifically prohibits them from selling water from Jordan Lake to any water system that is not included on the certificate. Raleigh is not included as a potential user on this IBT Certificate.[5] However, options may exist to partner with Durham in the future to access water from Jordan Lake.

Modeling scenarios used for this evaluation include a 4.7 million gallons per day allocation that is withdrawn from Jordan Lake and a corresponding wastewater return flow to the Cape Fear River at Lillington. As noted above Raleigh's estimated average day demand in 2045 is 97 million gallons per day. With the additional supply from Jordan Lake there is no indication of flow related shortages associated with meeting the 97 million gallons per day annual average day demand with the aggressive drought response plan Raleigh included in the hydrologic model. During drought conditions, implementation of the drought response plan is expected to reduce normal demands as supply declines. Modeling does not indicate any flow related limitations in meeting the reduced demands.

[5] Details of the IBT certificate is available on the DWR website at http://deq.nc.gov/node/82411

Table 8 Raleigh Public Utilities Alternatives Summary

Raleigh Public Utilities Department		2010	2015	2035	2045	2060
MaxMonMultiplier	Service Population	485,219	561,882	879,441	1,048,700	1,316,200
1.181	Maximum Month Daily Demand	62.30	69.61	100.10	114.58	135.82
	Annual Average System Demand (MGD)	52.75	58.95	84.76	97.02	115.01
Alternative 1	Water Sources total	77.30	77.30	115.00	115.00	115.00
	Falls lake	66.1	66.1	66.1	66.1	66.1
	L.Benson/L.Wheeler	11.2	11.2	11.2	11.2	11.2
	Current Jordan Lake Allocation	0	0	0	0	0
	Future Source_Falls Lake Reallocation			14	14	14
	Future Source_Neuse River Intake			23.7	23.7	23.7
Alternative 2	Water Sources total	77.30	77.30	105.70	119.40	119.40
	Falls lake	66.1	66.1	66.1	66.1	66.1
	L.Benson/L.Wheeler	11.2	11.2	11.2	11.2	11.2
	Current Jordan Lake Allocation	0	0	0	0	0
	Future Source_Neuse River Intake			23.7	23.7	23.7
	Requested Total JL Allocation			4.7	4.7	4.7
	Little River Reservoir				13.7	13.7
Alternative 3	Water Sources total	77.30	77.30	105.70	119.60	119.60
	Falls lake	66.1	66.1	66.1	66.1	66.1
	L.Benson/L.Wheeler	11.2	11.2	11.2	11.2	11.2
	Current Jordan Lake Allocation	0	0	0	0	0
	Future Source_Neuse River Intake			23.7	23.7	23.7
	Requested Total JL Allocation			4.7	4.7	4.7
	Water Purchase (Cary?)				3.3	3.3
	Neuse River Intake - Raleigh Quarry				10.6	10.6
JLA4 Request	Average Annual System Demand (MGD)	52.75	58.95	84.76	97.02	115.01
	Water Sources total	77.30	77.30	82.00	82.00	82.00
	Falls lake	66.1	66.1	66.1	66.1	66.1
	L.Benson/L.Wheeler	11.2	11.2	11.2	11.2	11.2
Raleigh	**JLA4 Request**	**0**	**0**	**4.7**	**4.7**	**4.7**

H. Orange County

Orange County does not operate a public water system. However, the county assists with securing water to supply areas of the county bordering the service areas of Hillsborough and the Orange-Alamance Water System. Orange County is a member of the Jordan Lake Partnership and contributed to the development of the Triangle Regional Water Supply Plan. The county benefited from the assistance provided by other JLP members in developing water demand projections for their economic development areas. Orange County currently has a one percent allocation of the water supply pool in Jordan Lake.

The county has three economic development areas that it is committed to support by assisting with provision of public water services. The total estimated demand for these areas in 2045 of 2.8 million gallons per day is divided between two public water systems. Orange County has a contract with the City of Mebane that is expected to be able to supply water to the area west of Hillsborough through 2045. The amount of water available from Mebane will have to be increased to meet expected future demands in the economic development area it supplies. Orange

County plans to meet the demands of the areas in the eastern side of the county using its Jordan Lake allocation which would be delivered as finished water through Durham's distribution system.

To support the expected development in these areas, Orange County is requesting to increase its current Jordan Lake allocation to 1.5 percent of the water supply pool. As an alternative to the preferred allocation Orange County proposes to maintain its purchase from Mebane at its current level of 0.25 million gallons per day and increase its allocation request to 3 percent of the water supply pool. For communities that rely on others to provide potable water to their service areas maintaining their own source of water, such as a Jordan Lake allocation, makes negotiating for treatment and delivery of potable water easier because the supplying utility does not have to commit a portion of their own supply to cover the purchaser's demands. This is a common arrangement among the current allocation holders.

Table 9 Orange County Alternatives Summary

Orange County		2010	2015	2035	2045	2060
MaxMonMultiplier	Service Population	132	2,049	11,897	17,185	25,115
1.077	Maximum Month Daily Demand	0.03	0.39	2.16	3.03	4.22
	Annual Average System Demand (MGD)	0.02	0.36	2.01	2.81	3.92
Alternative 1	Water Sources total	1.25	1.75	2.25	2.25	2.25
	From Mebane	0.25	0.25	0.25	0.25	0.25
	Mebane Increase			0.5	0.5	0.5
	Current Jordan Lake Allocation	1	1	1	1	1
	Requested Total JL Allocation		1.5	1.5	1.5	1.5
Alternative 2	Water Sources total	0.25	3.25	3.25	3.25	3.25
	From Mebane	0.25	0.25	0.25	0.25	0.25
	Requested Total JL Allocation		3	3	3	3
JLA4 Request	Annual Average System Demand (MGD)	0.02	0.36	2.01	2.81	3.92
	Water Sources total	1.25	1.75	2.25	2.25	2.25
	From Mebane	0.25	0.25	0.25	0.25	0.25
	Mebane Increase			0.5	0.5	0.5
	Current Jordan Lake Allocation	1	1	1	1	1
Orange County	**JLA4 Request**	**1**	**1.5**	**1.5**	**1.5**	**1.5**

I. Hillsborough

The Town of Hillsborough currently gets its water supply from Lake Ben Johnson on the Eno River in the Neuse River Basin. Lake Ben Johnson receives water from Lake Orange and the West Fork of the Eno Reservoir. Water is supplied to augment flow in the Eno River to maintain adequate water at the water supply intake and to maintain a one cubic foot per second release to the Eno River. Plans are underway to expand the West Fork reservoir increasing its estimated yield from 2.56 to 3.76 million gallons per day. With relatively small drainage areas the town's water supply reservoirs are susceptible to shortages during drought conditions in the upper Neuse River Basin. Hillsborough is dependent on water from the upper Neuse River Basin to meet all its everyday drinking water needs.

Hillsborough has interconnections with Durham and Orange Water and Sewer Authority. To improve water supply resilience and meet essential water needs during drought conditions Hillsborough is requesting a one percent allocation from the Jordan Lake water supply pool. The allocation would be accessed through interconnections with Durham and OWASA. These utilities have access to Jordan Lake water through agreements to receive finished water from the Cary-Apex water treatment plant that is debited against their own allocations. Development of the western Jordan Lake intake and water treatment facility is expected to improve access to water from Jordan Lake for Hillsborough.

Table 20 Hillsborough Alternatives Summary

Hillsborough		2010	2015	2035	2045	2060
MaxMonMultiplier	Service Population	12,216	14,508	22,150	26,600	33,800
1.068	Maximum Month Daily Demand	1.25	1.86	3.07	3.43	3.95
	Annual Average System Demand (MGD)	1.17	1.74	2.87	3.22	3.70
Alternative 1	Water Sources total	2.60	3.60	4.80	4.80	4.80
	Upper Eno Res Sys	2.6	2.6	2.6	2.6	2.6
	WF Eno Res Expansion (In Process)			1.2	1.2	1.2
	Current Jordan Lake Allocation	0	0	0	0	0
	Requested Total JL Allocation		1	1	1	1
Alternative 2	Water Sources total	2.60	2.60	3.80	3.80	3.80
	Upper Eno Res Sys	2.6	2.6	2.6	2.6	2.6
	WF Eno Res Expansion (In Process)			1.2	1.2	1.2
	Requested Total JL Allocation	0	0	0	0	0
JLA4 Request	Annual Average System Demand (MGD)	1.17	1.74	2.87	3.22	3.70
	Water Sources total	2.60	3.60	4.80	4.80	4.80
	Upper Eno Res Sys	2.6	2.6	2.6	2.6	2.6
	WF Eno Res Expansion (In Process)			1.2	1.2	1.2
Hillsborough	**JLA4 Request**	**0**	**1**	**1**	**1**	**1**

J. Holly Springs

The Town of Holly Springs provides water to about 35,000 residents of southwestern Wake County. The Harnett County Regional Water System provides Holly Springs with finished water that it produces from water withdrawn from the Cape Fear River near Lillington. The current contract allows Holly Springs to receive up to ten million gallons per day from the Harnett County water system. In addition, Holly Springs has a two percent allocation of the Jordan Lake water supply pool that it can access through an interconnection with the Apex water distribution system. Having this alternative source of water available through another water treatment plant provides Holly Springs with redundancy to meet customer needs and protect health during emergencies and other disruption of deliveries from their primary water supplier. Holly Springs currently has a time-limited contract with the City of Raleigh to provide up to 1.2 million gallons per day in emergencies that will expire in 2017.

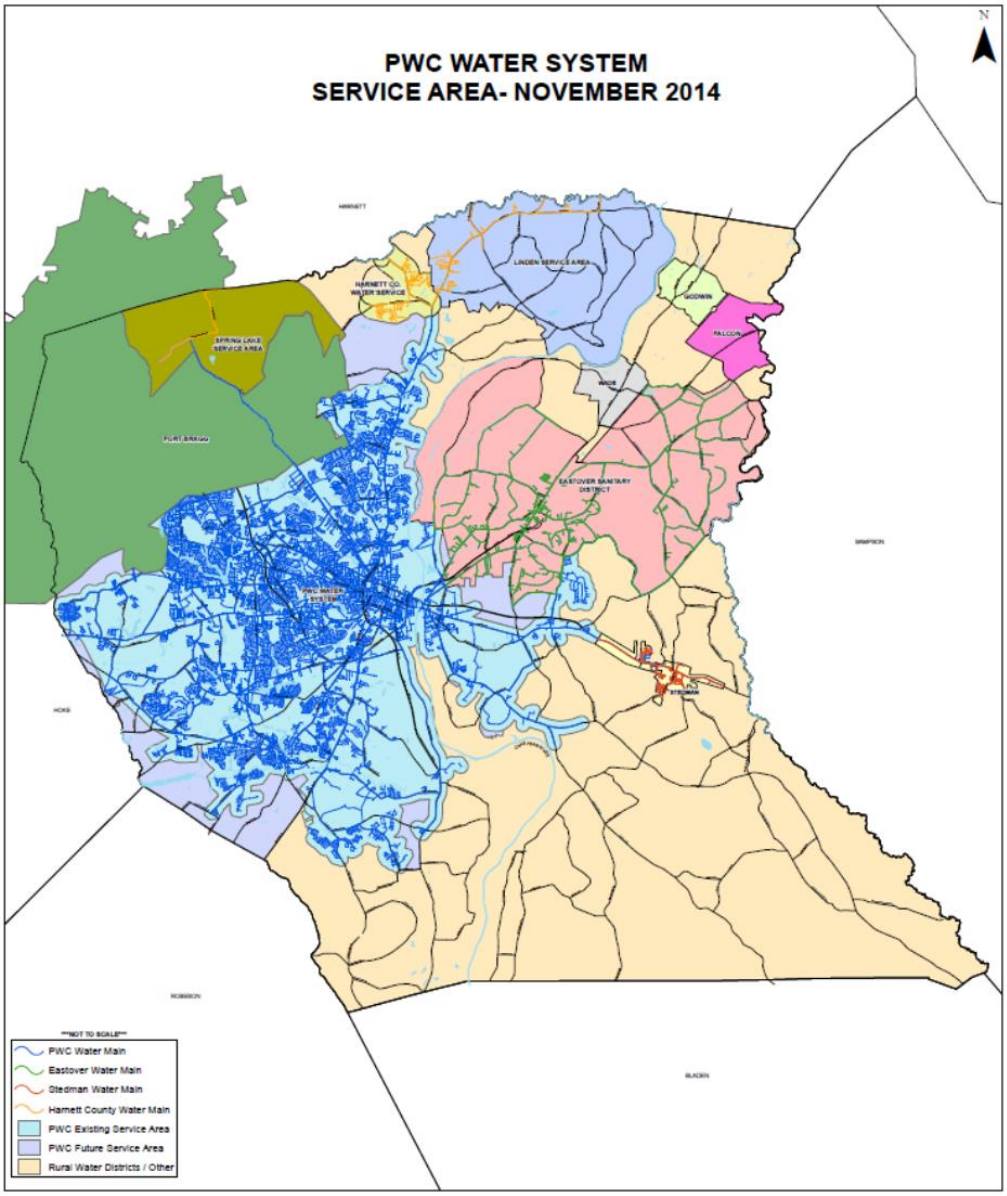
The Town of Holly Springs is requesting to maintain its current two percent allocation of the water supply pool in Jordan Lake. The Town intends to use this allocation as needed to meet essential water needs of their customers and to protect the general public health. The role of public health protection is emphasized in their allocation application. Holly Springs is currently the location of major international vaccine production facilities.

Table 11 Holly Springs Alternatives Summary

Holly Springs		2010	2015	2035	2045	2060
MaxMonMultiplier	Service Population	24,700	35,705	68,371	81,931	103,261
1.221	Maximum Month Daily Demand	2.42	4.07	7.61	8.84	10.72
	Annual Average System Demand (MGD)	1.98	3.34	6.23	7.24	8.78
Alternative 1	Water Sources total	12.00	12.00	12.00	12.00	12.00
	Cape Fear River (Harnett Co RWS)	10	10	10	10	10
	Current Jordan Lake Allocation	2	2	2	2	2
	Requested Total JL Allocation	2	2	2	2	2
Alternative 2	Water Sources total	10	12	12	12	12.2
	Cape Fear River (Harnett Co RWS)	10	10	10	10	10
	IncreaseCape Fear River (HCRWS)		2	2	2	2.2
Alternative 3	Water Sources total	10	12.2	12.2	12.2	12.2
	Cape Fear River (Harnett Co RWS)	10	10	10	10	10
	City of Raleigh		2.2	2.2	2.2	2.2
Alternative 4	Water Sources total	10	18.8	18.8	18.8	18.8
	Cape Fear River (Harnett Co RWS)	10	10	10	10	10
	Cape Fear River new intake & wtp		8.8	8.8	8.8	8.8
JLA4 Request	Annual Average System Demand (MGD)	1.98	3.34	6.23	7.24	8.78
	Water Sources total	12.00	12.00	12.00	12.00	12.00
	Cape Fear River (Harnett Co RWS)	10	10	10	10	10
Holly Springs	JLA4 Request	2	2	2	2	2

K. Fayetteville Public Works Commission

Figure 4 Fayetteville Public Works Commission Service Areas (including neighboring communities that depend on water from Fayetteville PWC)



The Fayetteville Public Works Commission provides water and sewer services to about 60 percent of the residents of Cumberland County. Fayetteville PWC's Jordan Lake allocation application indicates it expects to be serving 90 percent of the estimated county population of 384,000 persons in 2040. Several neighboring water systems are dependent on Fayetteville PWC for water service. PWC uses water from the Cape Fear River, Big Cross Creek and Little Cross Creek to meet customer demands. PWC has two water treatment facilities the Glenville Lake

WTF with a permitted capacity of 18 million gallons per day and the P.O. Hoffer WTF with a permitted capacity of 39.5 million gallons per day giving the utility a combined treatment capacity of 57.5 million gallons per day. An estimated 4.5 million gallons per day is available to the Glenville Lake WTF from the Little Cross Creek watershed which is supplemented by pumping water from the Cape Fear River. The Cape Fear River is the sole raw water source for the P.O. Hoffer WTF. The two pump stations on the Cape Fear River have combined design capacities of 92 million gallons per day and a combined firm capacity of 58 million gallons per day.

The pump stations withdraw water from a section of the river that is impounded by the William O. Huske Lock and Dam, also referred to as Lock and Dam #3. This structure, located 95 miles upstream from the mouth of the Cape Fear River, creates an impoundment in the river that backs up water for approximately 29 miles upstream, to river mile 124. With water levels maintained above the elevation of the top of the dam this section of the river has characteristics of a reservoir. Above the elevation of the top of the dam water levels fluctuate as streamflows fluctuate.

The rules governing the Jordan Lake allocation process require applicants to include a discussion of how much water is available from their current water supply sources. The Jordan Lake Water Supply Storage Allocation Application Guidelines state; *"For run-of-river sources, applicants will use the results of an instream flow study, when such is available, to determine the available supply. If the results of an instream flow study are not available for a given source, the applicant's available supply is assumed to be 20% of the 7Q10 flow as determined using the basecase scenario of the appropriate river basin hydrologic model if there are no other intakes in close proximity."*

This guideline was originally selected because of its relationship to one of the thresholds used to distinguish between major and minor projects and the level of environmental review required for proposed water supply projects under DEQ's rules for implementing the North Carolina Environmental Policy Act. The Cape Fear – Neuse River Basins Hydrologic Model is intended as a planning tool using a reconstruction of historic flow conditions to produce a simulation of water resource conditions. It can assist water utilities and resource management agencies to evaluate management alternatives but it is not used to evaluate water availability to determine project feasibility or permit criteria. Those evaluations have to be conducted using data that describe actual flow conditions, not simulations. The model provides the ability to identify relative changes in flow conditions for different scenarios using simulated conditions.

Fayetteville PWC chose to present their Cape Fear River water supply source as a run-of-river source. Following the guidelines, the available supply reported by Fayetteville PWC in the allocation application is 20 percent of the model estimated 239 million gallons per day or 47.8 million gallons per day. Information in PWC's application indicates existing treatment capacity of 57.5 million gallons per day and the installed pumping capacity of 92 million gallons per day of water from the existing intake locations on the Cape Fear River. The installed capacity for withdrawal and treatment exceed the available supply estimated using simulated flow data.

Fayetteville PWC collects and treats a high percentage of the water it delivers to its customers as well as receiving and treating wastewater from several neighboring communities. The treated wastewater is discharged downstream of PWC's water supply intake in the backwater of Lock and Dam #3, replacing most of the water removed at the upstream pump stations. In the 2010 local water supply plan, PWC's wastewater discharges into the backwater of Lock and Dam #3, on average, exceeded the amount of water it withdrew from the Cape Fear River. Likewise, wastewater discharges exceeded withdrawals in PWC's 2014 local water supply plan. Based in information submitted in the local water supply plans, it appears that Fayetteville's net use of water from the Cape Fear River is unlikely to have more than minimal negative impacts to the amount of water flowing downstream.

In review, Fayetteville PWC's capacity to withdraw over 90 million gallons per day from the Cape Fear River exceeds the model estimated 47.8 million gallons per day for 20 percent of the 7Q10 flow. However, because of its cooperative arrangements with neighboring communities, PWC often discharges more wastewater to the river than it withdrawers negating the effects of its withdrawals on the quantity of water behind Lock and Dam #3.

In the modeling done to evaluate water availability from the backwater of Lock and Dam #3 to meet Fayetteville's estimated 2045 demands PWC's demands are modeled at 60.6 million gallons per day with estimated wastewater return flows of 60.8 million gallons per day. Looking at PWC's withdrawals to meet anticipated 2060 demands, withdrawals are modeled at 73.5 million gallons per day with wastewater return flows of 73.7 million gallons per day. An in-depth discussion of evaluating the impacts of Fayetteville PWC's withdrawals on flows in the Cape Fear River is available in Appendix B of the *Cape Fear River Surface Water Supply Evaluation December 2016*.

Fayetteville PWC submitted a request for a 10 percent allocation from the Jordan Lake water supply pool. If the allocation is granted, PWC indicated it would request that the water be released from Jordan Lake into the Cape Fear River to be withdrawn at the current intake location in Fayetteville. Table 12 summarizes the water supply alternatives included in PWC's allocation application. Alternatives 2, 3 and 4, which do not include a Jordan Lake allocation, will require extensive environmental review.

PWC's withdrawal location benefits from the water quality releases from Jordan Lake. Modeling indicates the utility's future supply needs can reliably be met without an allocation from Jordan Lake. Based on the modeling done for the Cape Fear River Water Supply Evaluation, there is no indication of flow related shortages associated with Fayetteville PWC's ability to meet its expected 2060 water demands from its current water supply sources.

Table 12 Fayetteville Public Works Commission Alternatives Summary

Fayetteville Public Works Commission		2010	2015	2035	2045	2060
MaxMonMultiplier	Service Population	199,102	226,655	350,574	398,380	440,390
1.208	Maximum Month Daily Demand	33.84	37.43	66.47	79.02	95.34
	Annual Average System Demand (MGD)	28.014	30.982	55.03	65.41	78.92
Alternative 1	Water Sources total	57.50	67.50	67.50	67.50	67.50
	PO Hoffer WTF	39.5	39.5	39.5	39.5	39.5
	Glenville Lake WTF	18.0	18.0	18.0	18.0	18.0
	Current Jordan Lake Allocation	0	0	0	0	0
	Requested Total JL Allocation		10	10	10	10
Alternative 2	Water Sources total	57.50	57.50	95.50	95.50	95.50
	PO Hoffer WTF	39.5	39.5	39.5	39.5	39.5
	Glenville Lake WTF	18	18	18	18	18
	New Reservoir in Cumberland Co	0	0	38	38	38
Alternative 3	Water Sources total	57.50	57.50	87.50	87.50	87.50
	PO Hoffer WTF	39.5	39.5	39.5	39.5	39.5
	Glenville Lake WTF	18	18	18	18	18
	Blewett Falls Intake(100% IBT)	0	0	30	30	30
Alternative 4	Water Sources total	57.50	57.50	87.50	87.50	87.50
	PO Hoffer WTF	39.5	39.5	39.5	39.5	39.5
	Glenville Lake WTF	18	18	18	18	18
	Blewett Falls Intake(reduced IBT)	0	0	30	30	30
JLA4 Request	Annual Average System Demand (MGD)	28.01	30.98	55.03	65.41	78.92
	Water Sources total	57.50	67.50	67.50	67.50	67.50
	PO Hoffer WTF	39.5	39.5	39.5	39.5	39.5
	Glenville Lake WTF	18	18	18	18	18
Fayetteville PWC	**JLA4 Request**	**0**	**10**	**10**	**10**	**10**

4 DWR Allocation Recommendations

Based on the information presented in the allocation applications and the hydrologic modeling comparing projected future demands to the 2010 basecase scenario of the Cape Fear – Neuse River Basins Hydrologic Model, the allocations of the water supply pool in Jordan Lake in Table 13 are recommended. DWR supports the allocation requests for all applicants except Fayetteville Public Works Commission.

Table 13 Division of Water Resources' Allocation Recommendations

Jordan Lake Water Supply Pool		
Applicant	Current Allocation Percent**	Recommended Allocation Percent**
Cary,Apex,Morrisville,Wake Co.-RTP	39	46.2
Chatham Co.-North*	6	13.1
Durham*	10	16.5
Hillsborough	0	1
Holly Springs	2	2
Orange County	1	1.5
Orange WASA*	5	5
Pittsboro*	0	6
Raleigh	0	4.7
Fayetteville PWC	0	0
Total Percentage	63	95.9
*Western Intake Partners		
** Allocations amounts are defined as a percentage of the storage		

The evaluation of the options for water supply allocations focuses on the amount of water estimated to be needed to meet regional public water supply needs in 2045. The four model scenarios described in Table 14 were used to evaluate the impacts of allocation alternatives.

Analysis of the ability of Fayetteville PWC to withdraw water sufficient to meet expected future demands in 2045 and 2060 indicates that the quantity of water available at their Cape Fear River intakes will be sufficient without releasing water from the water supply pool in Jordan Lake. Being downstream of the streamflow gage in Lillington, used to determine the need for water quality releases from Jordan Lake, Fayetteville PWC's available supply is augmented during low-flow conditions by releases from the flow augmentation pool. Modeling for the Cape Fear River Surface Water Supply Evaluation indicates the Fayetteville PWC is not expected to face

flow related water shortages under any of the model scenarios run. Appendix C of the Cape Fear River Surface Water Supply Evaluation presents a table summarizing the water system supply shortages shown by hydrologic modeling.

Summary of Modeling results

By rule, allocations of the Jordan Lake water supply pool are limited to the amount of water needed to meet demands for thirty years in the future. With final decisions about allocations initially expected to be made in late 2015 the planning horizon for evaluation of allocations extends to 2045. Four model scenarios were run to determine variations in water resource conditions produced by allocation options. Each of these model scenarios is described in Table 14.

The "Simbase_Current" model scenario characterizes current conditions in 2010, providing a point of comparison to evaluate changes under alternative water supply options. The "0_Simbase_2045" scenario models the ability of all surface water users in the model to meet expected 2045 water demands from existing and future sources reported in their local water supply plans. The "01_JLA_2045" scenario models the effects if the round four recommended allocations are approved. An additional model scenario was run to evaluate the sensitivity of water availability if future streamflows are outside of the range of flows reflected in the historic flow record. Since this analysis focuses on being able to meet water withdrawal needs, the critical range of flows are when streamflows are low. The model scenario labeled "01_JLA_2045_Climate" evaluates water availability if flows are ten percent less than the flows in the historic record. For this scenario values in the flow record were reduced by ten percent for each of the 29,858 days in the historic record.

For the model scenarios used in this analysis the water level in the Jordan Lake Reservoir is at or above the normal operating elevation of 216 feet above mean sea level for at least 60 percent of the daily simulations in the historic record. Figure 5 shows the 40 percent of the time when water levels are predicted to drop below 216 feet mean sea level. The graph indicates that as the water supply storage is put to its intended use and withdrawals increase water levels in Jordan Lake will likely be below 216 feet mean sea level for longer and drop to lower levels than in the 2010 basecase scenario. For the basecase scenario the model indicates water levels may be at or below 214 feet mean sea level about 10 percent of the time. In the future demand scenarios, the estimated likelihood of water levels being at or below 214 feet mean sea level is about 15 to 17 percent of the time. The minimum level for the future demand scenarios drops to 207.4 feet mean sea level from the Simbase_Current minimum of 209.7 feet mean sea level.

Table 14 Hydrologic Model Scenario Descriptions

Jordan Lake Water Supply Allocation Recommendations	
Model Scenario Descriptions	
Simbase_Current	This scenario models the baseline current conditons in 2010 based on available water supplies, infrastructure and customer demands at that time
0_Simbase_2045	**Simbase** indicates this scenario uses the quantity of water available to withdrawers in 2010 reported in local water supply plans and water withdrawal registration data submitted to DWR. **2045** indicates this scenario is modeling the ability to meet the estimated water withdrawals needed to meet 2045 demands.
01_JLA_2045	**JLA** indicates this scenario uses the allocation amounts recommended in the Round 4 Jordan Lake Water Supply Allocation Recommendations_December 2016 **2045** indicates this scenario is modeling the ability to meet the estimated water withdrawals needed to meet 2045 demands. Demands for water systems not requesting an allocation from Jordan Lake are based on data provided in 2014 local water supply plans as well as data supplied as comments to the draft documents.
01_JLA_2045_Climate	**JLA** indicates this scenario uses the allocation amounts recommended in the Round 4 Jordan Lake Water Supply Allocation Recommendations_December 2016 **2045** indicates this scenario is modeling the ability to meet the estimated water withdrawals needed to meet 2045 demands. Demands for water systems not requesting an allocation from Jordan Lake are based on data provided in 2014 local water supply plans as well as data supplied as comments to the draft documents. **Climate** indicates the flow record used for this scenario was reduced by 10 percent for each day in the flow record.

Jordan Lake Water Levels

Figure 5 Jordan Lake Reservoir Elevation Duration

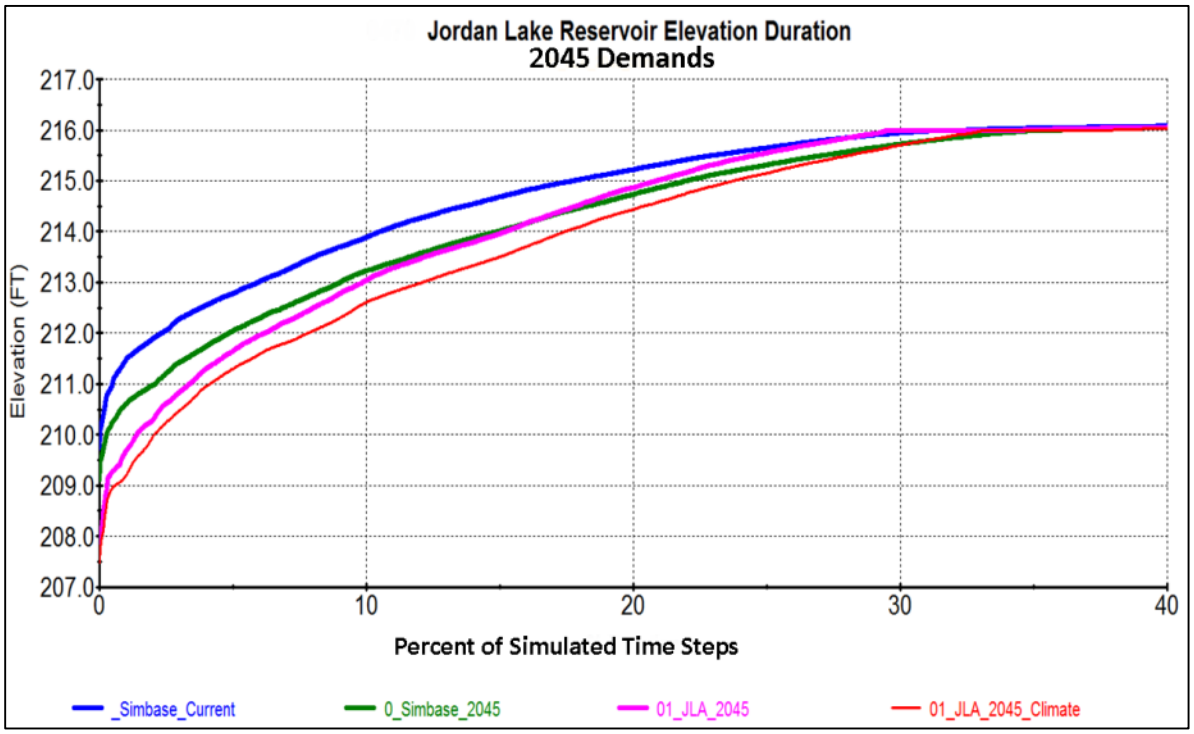


Figure 5 illustrates the percent of the 29,858 days in the historic flow record in the model when water levels in Jordan Lake are predicted be below the elevations shown on the vertical scale. This graph only shows the estimated forty percent of the time when water levels may be below the normal elevation of 216 feet above mean sea level, the top of the conservation pool.

Figure 6 also shows the percent of time the model shows water levels below 216 feet above mean sea level focusing on the typical recreation season of May to September. It shows the approximate elevations of the boat ramps on Jordan Lake that may be affected by the longer periods of lower water levels predicted for the time when water withdrawals reach the levels currently thought to be needed to meet 2045 customer demands. The levels noted on the graph are approximately two feet above the bottom of the ramps as listed in Table 3 of the Drought Contingency Plan, included as Appendix D. As withdrawals increase and water levels are lower for longer periods of time boat launching facilities may experience more time when use may be restricted.

Figure 6a shows the model predicted percent of time when the daily declines in water levels during the months of April, May and June in the reservoir will be within the ranges specified. The data on which this graph is based indicates that, during this three-month period, water levels are estimated to decline about one-tenth of a foot or less eighty-five percent of the time. And, daily declines could be as much a foot in elevation about three percent of the time.

Figure 6 Jordan Lake Reservoir Elevation Duration including Boat Ramp Elevations

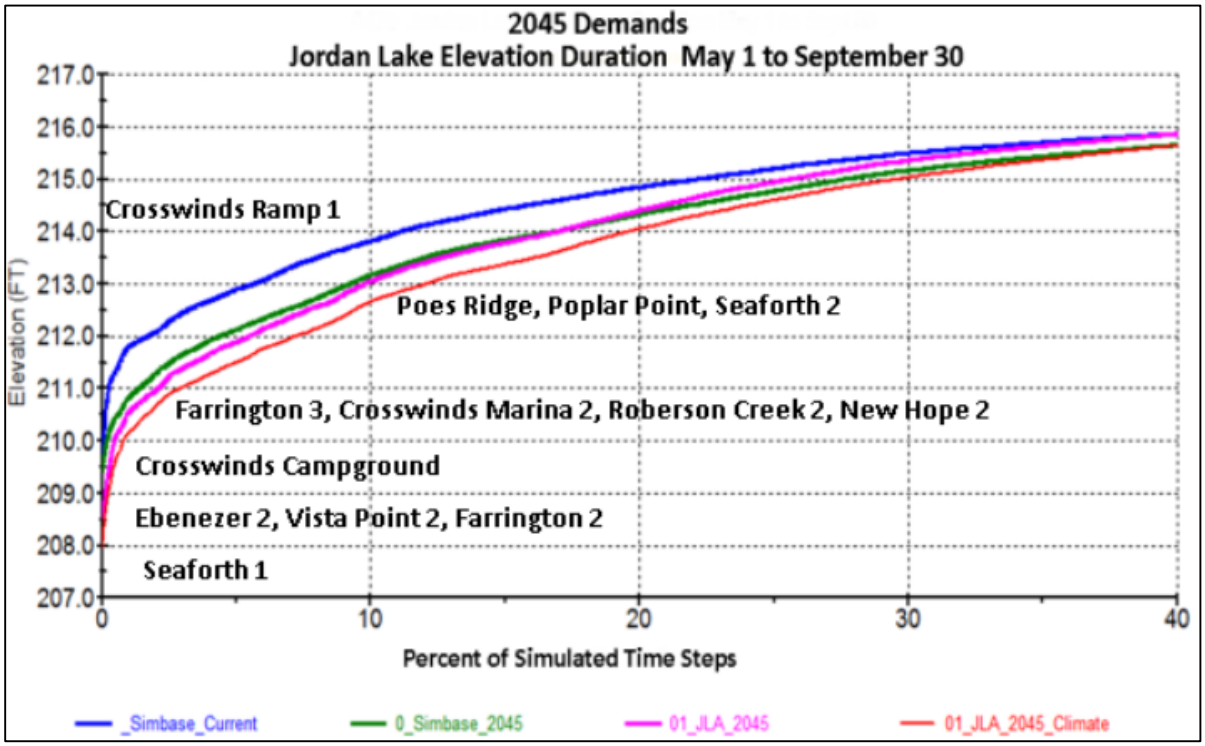
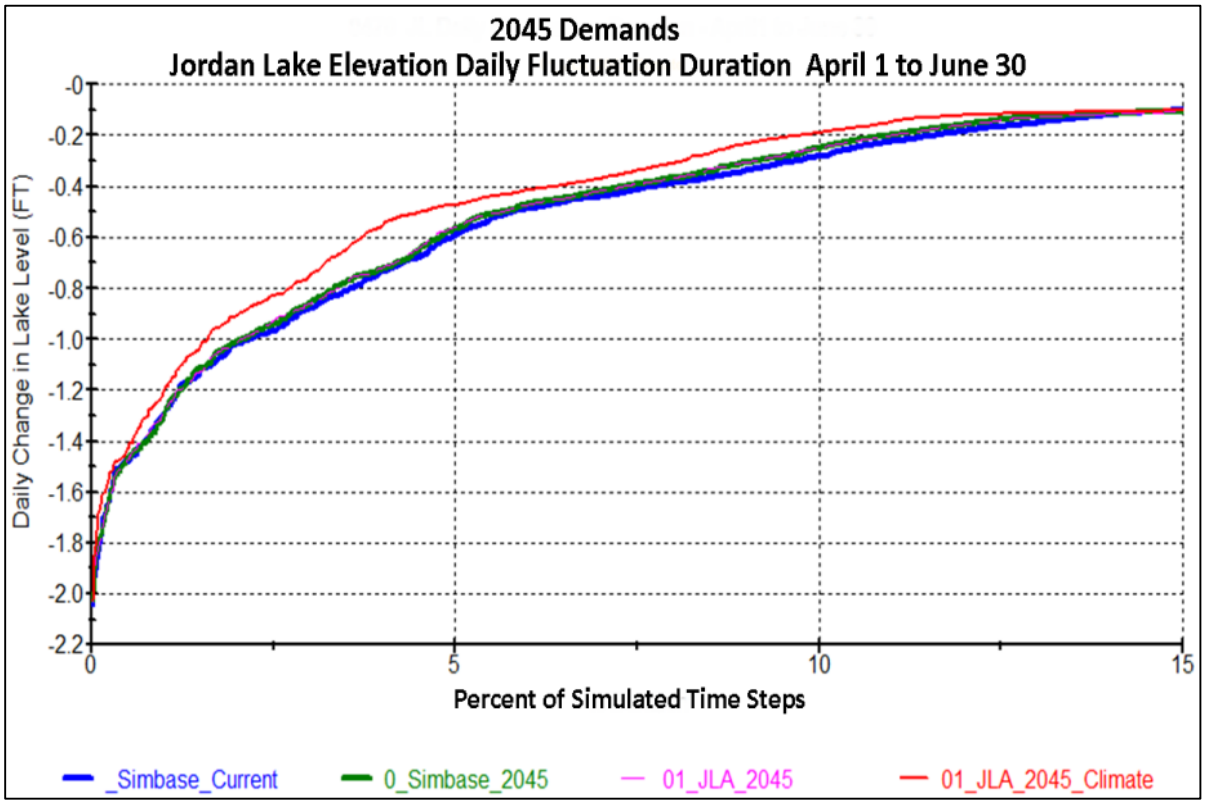


Figure 6a Jordan Lake Reservoir Daily Elevation Fluctuations



Water Supply Pool Evaluation

Water supply storage was included in the B. Everett Jordan Project, at the request of North Carolina, to provide water to meet the needs of local governments. As more stored water is used from a water supply pool the remaining storage will decline. About 65 percent of the time in the flow record inflows to the reservoir are sufficient to replace the amount of water withdrawn and the amount needed to meet target flows so the normal operating water level is maintained. Figure 7 shows the thirty-five percent of time over the range of flows in the flow record when storage in the water supply pool is less than 100 percent. For the 2010 level of withdrawals, shown in the Simbase-Current scenario plot, the water supply pool is predicted to be less than full about 7 percent of historic record reaching a minimum of 90.9 percent of capacity. The local water supply plans for water systems throughout the modeled area predict increasing water demands in the future. By 2045 water supply withdrawals from Jordan Lake Reservoir are expected to result in more time below full and lower minimum storage volumes. Figure 7 shows the percent of time over the entire flow record from 1931 to 2011 when storage in the water supply pool will be at or below percentages shown in the vertical scale.

Figure 7 Duration of Jordan Lake Water Supply Pool Storage

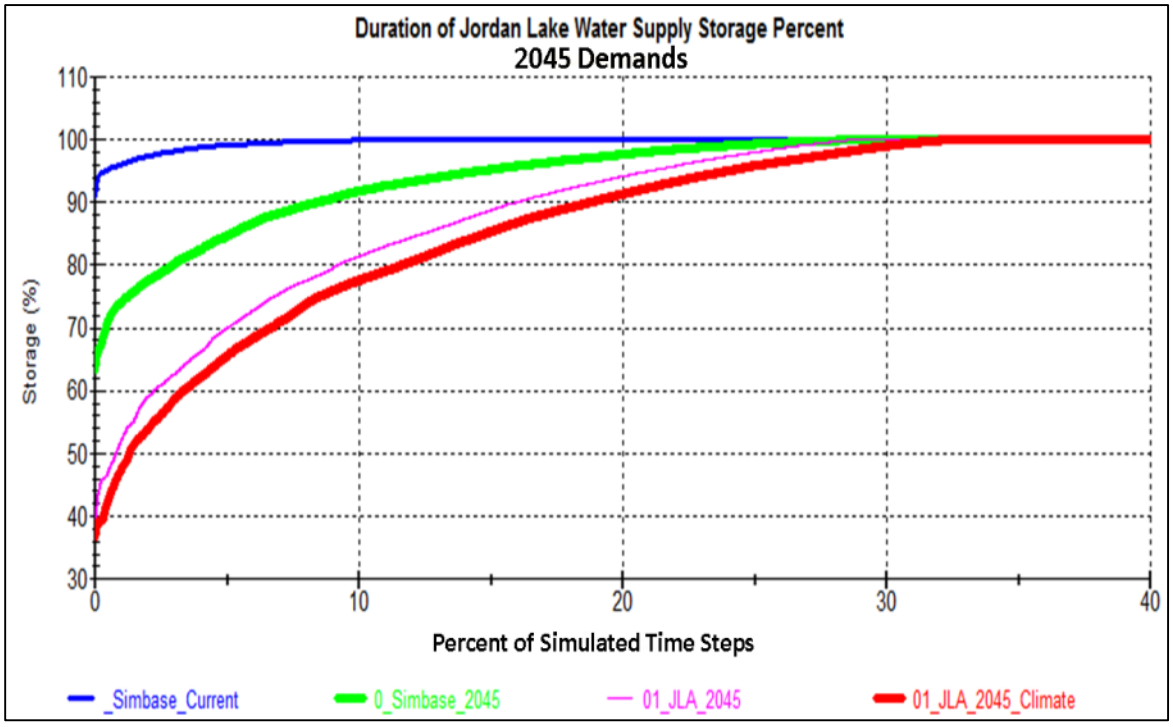


Figure 8 provides more detail of the status of water supply storage over the period from 2000 to 2011 which covers recent significant droughts. The minimum values and dates of the flow conditions under which they occur are shown in Table 15.

Figure 8 Jordan Lake Water Supply Storage (flows from 2000 to 2011)

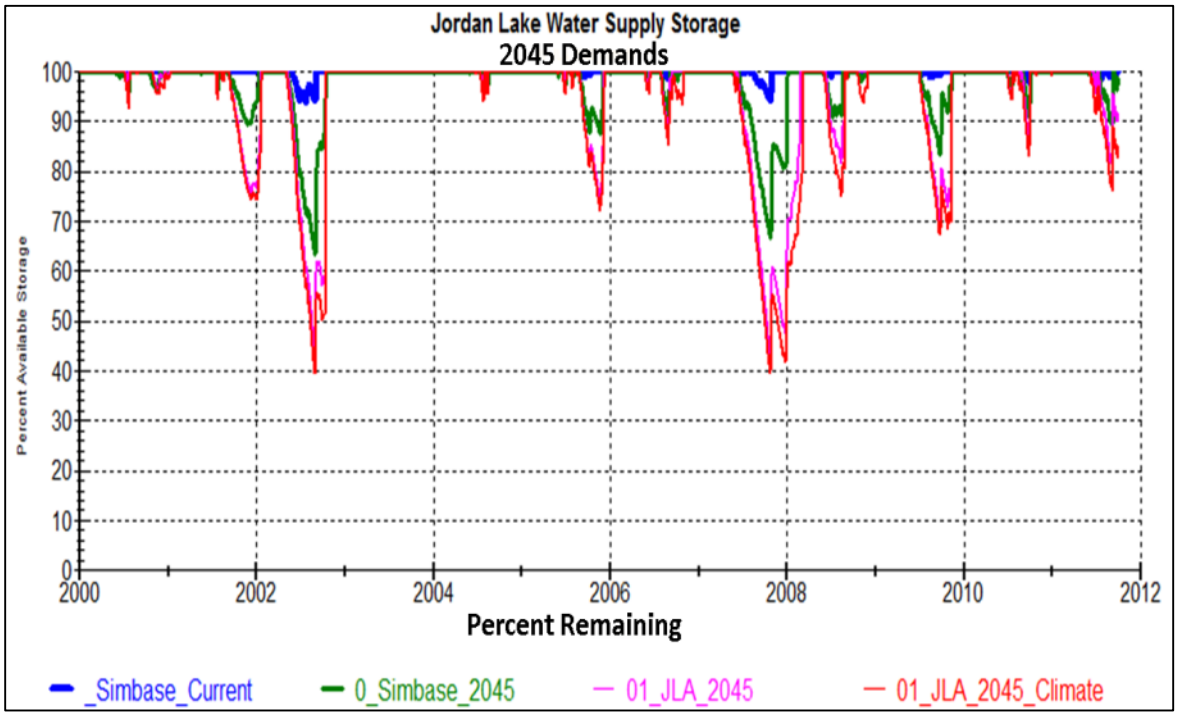


Table 15 Jordan Lake Water Level and Water Supply Storage Minimums

Jordan Lake Water Level and Water Supply Storage Minimums							
Model Scenario	Jordan Lake Water Level		Jordan Lake Water Supply Pool Critical Period (<100%)				
	Minimum Level, feet above mean sea level	Date of Minimum Water Level	Minimum Water Supply Storage %	Minimum Water Supply Period	Days in Minimum Supply Period	Longest Critical Period	Days in Critical Period
Simbase-current	209.7	8/30/2002	90.9	7/9/1953 - 12/9/1953	154	7/9/1953 - 12/9/1953	154
0_Simbase_2045	209.1	10/23/2007	63.5	5/2/2002 - 10/10/2002	162	5/17/1933 -2/26/1954	287
01_JLA_2045	207.9	12/1/1953	39.6	7/9/1953 - 1/16/1954	192	5/17/1933 - 3/7/1934	293
01_JLA_2045_Climate	207.5	10/23/2007	36.7	5/19/1933 - 3/19/1934	305	5/19/1933 - 3/19/1934	305

Water Quality/Flow-augmentation Pool Evaluation

The B. Everett Jordan Project includes storage to augment downstream flows, based on estimates prepared during design of the reservoir, to avoid water quality standards violations. Water is released from the flow augmentation pool to maintain streamflows of 600 ± 50 cubic feet per second at the U.S. Geological Survey's streamflow gage in the Cape Fear River at Lillington. In 2008 the Army Corps of Engineers adopted a Drought Contingency Plan that provides for reductions in the flow target as storage in the water quality pool declines during periods of low inflows to the reservoir. A copy of the Drought Contingency Plan is included as Appendix D.

Figure 9 shows the thirty-five percent of the time in the historic flow record when modeling indicates storage in the flow augmentation pool may be lower than in the 2010 basecase scenario. Figure 10 shows the minimum levels of flow augmentation storage for the period 2000 to 2011.Table 16 shows the minimum values for the flow augmentation storage and dates when the flow conditions in the historic record produced the minimum values. The improvement of the minimum storage conditions in the future demand scenarios is the product of changes in water sourcing for some utilities, wastewater discharge changes and implementation of minimum releases from Randleman Reservoir. Table 16 also shows the estimated minimum daily average flows at the Lillington streamflow gage for each of the model scenarios.

Figure 9 Duration of Jordan Lake Water Quality/Flow Augmentation Storage

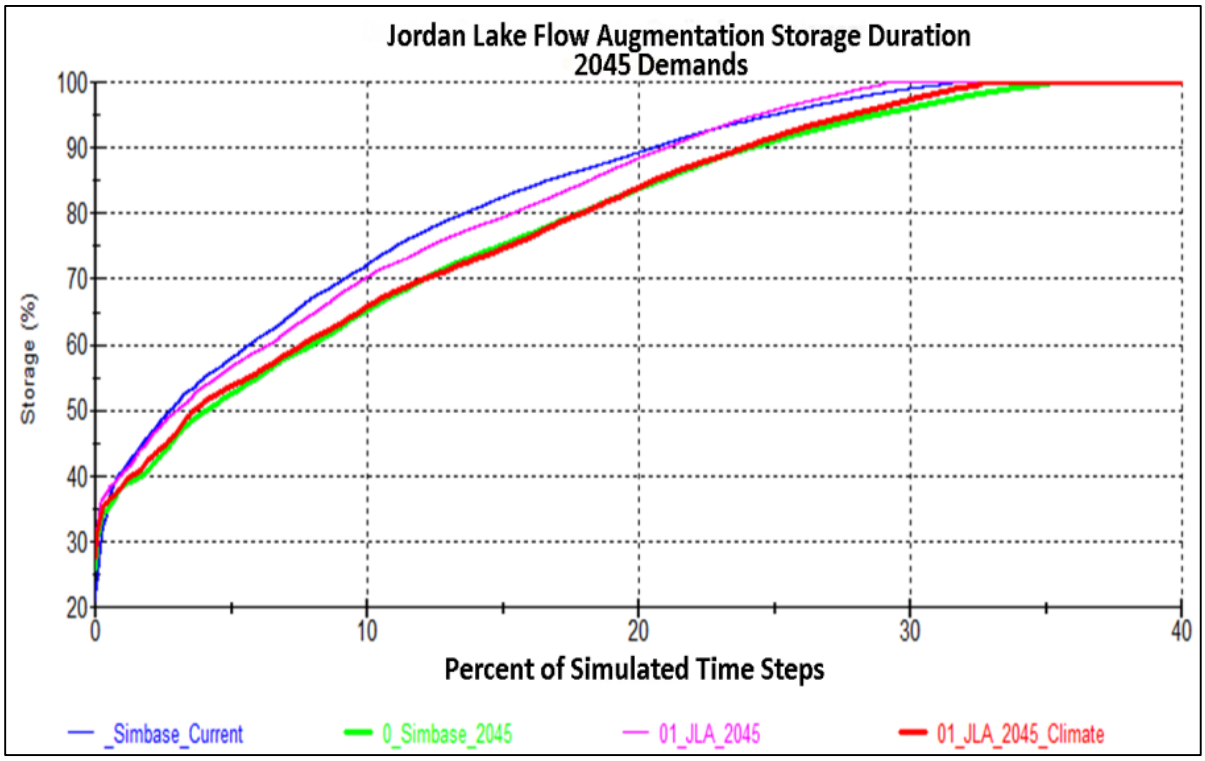
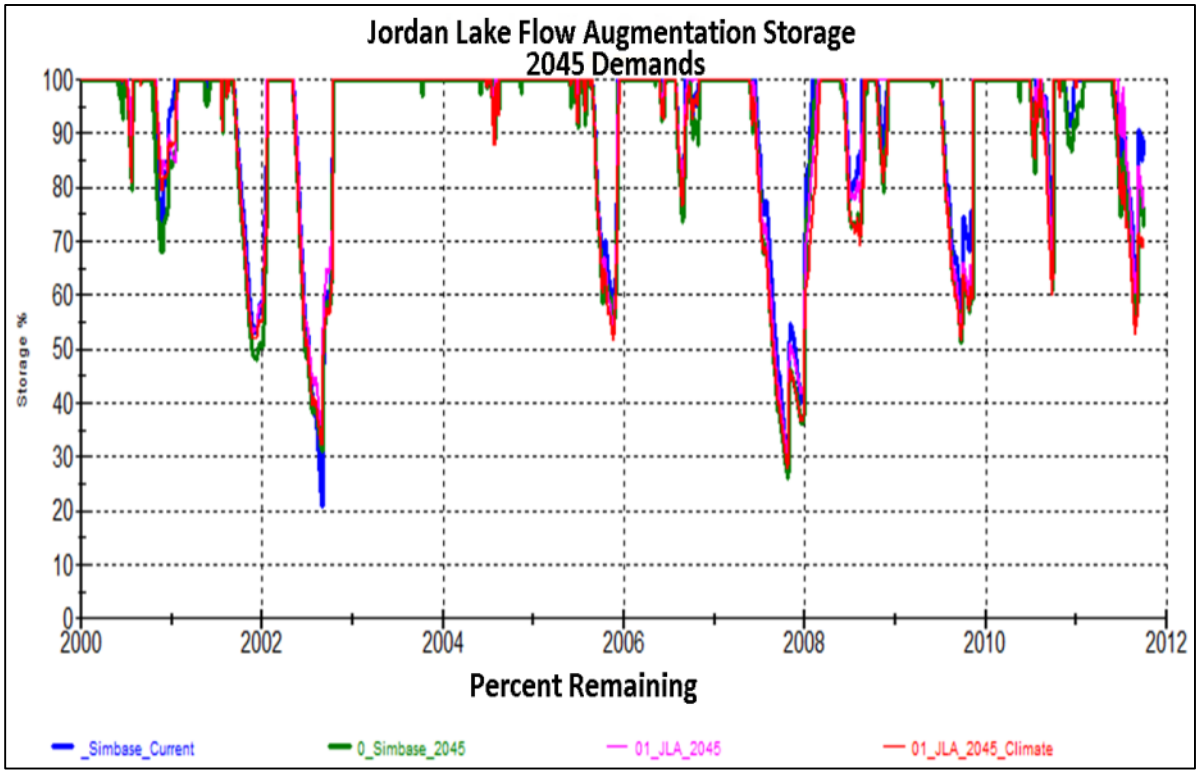


Figure 10 **Jordan Lake Water Quality/Flow Augmentation Storage (flows from 2000 to 2011)**



Based on the modeling results during the extreme low flow conditions in the historic record about 30 percent of the flow augmentation pool storage remained. Even with a 10 percent in the daily inflows the minimum flow augmentation storage is above 27 percent of the storage. Modeling results suggest there is enough storage available in the flow augmentation pool to compensate for lower than historic flow conditions if flows diverge from the range seen from 1930 to 2011.

Table 16 **Jordan Lake Water Quality Pool Storage & Lillington Streamflow Minimums**

Minimums of Jordan Lake Flow Augmentation Pool and Streamflow at Lillington						
Model Scenario	Jordan Lake Flow Augmentation Pool		Streamflow at Lillington (cubic feet per second)			
	Minimum Storage, %	Date of Minimum	Lowest Daily Average Flow, cfs	Date	Years with Average Daily Flow <600cfs**	Days with Average Daily Flow <600cfs*
Simbase-current	20.82	8/30/2002	284.55	10/1/2007	61	4,274
0_Simbase_2045	25.98	10/23/2007	126.18	7/22/2002	65	5,191
01_JLA_2045	30.33	10/23/2007	168.87	8/19/2002	60	4,485
01_JLA_2045_Climate	27.72	10/23/2007	153.97	9/29/1968	64	5,123
Note: * The flow record used for these model scenarios contains 29,858 days						
Note: ** The flow target at the Lillington streamgage is 600 ± 50 cubic feet per second. The counts of days when estimated flows may be below 600 cfs includes days when flows are estimated to be between 550 cfs and 600 cfs, not technically a violation of the flow target.						

Review of Allocations off the Jordan Lake Watershed

The rules regulating water supply allocations from Jordan Lake include the following charge to the Environmental Management Commission.

"To protect the yield of Jordan Lake for water supply and water quality purposes, the Commission will limit water supply allocations that will result in diversions out of the lake's watershed to 50 percent of the total water supply yield. The Commission may review and revise this limit based on experience in managing the lake and on the effects of changes in the lake's watershed that will affect its yield."

Table 17 summarizes the estimates of off-the-watershed use of water from the water supply pool based on the Division of Water Resources' allocation recommendations. DWR does not recommend an allocation from the Jordan Lake water supply pool for the Fayetteville Public Works Commission. Hydrologic modeling indicates that Fayetteville PWC has sufficient water available at its current intake location to meet future demands. If Fayetteville PWC continues to discharge similar percentages of water withdrawals as treated wastewater into the backwater of Lock and Dam #3, then PWC's increased withdrawals will have minimal effects on the quantity of water available at their intake. Without an allocation to Fayetteville PWC diversions off the watershed of Jordan Lake will remain below the 50 percent threshold in the allocation rules. If the recommended allocations are approved there is no need at this time to reassess the criteria limiting allocations off the watershed of Jordan Lake to 50 percent of the total water supply yield.

Table 17 Diversions Off the Jordan Lake Watershed for Recommended Allocations

Estimated Destination of Jordan Lake Water Use			
Applicant	Recommended	Percent of Water Supply Pool	
	Allocation Percent**	On Jordan Lake Watershed	Off Jordan Lake Watershed
Cary,Apex,Morrisville,Wake Co.-RTP	46.2	13.2	33
Chatham Co.-North*	13	11	2**
Durham*	16.5	16.5	
Hillsborough	1		1
Holly Springs	2		2
Orange County	1.5		1.5
Orange WASA*	5	5	
Pittsboro*	6	6	
Raleigh	4.7		4.7
Fayetteville PWC	0		
Total Percentage	95.9	51.7	44.2
Estimated Percent of Water Supply Pool Off the Jordan Lake Watershed			44.2
*Western Intake Partners			
** Haw River Basin off Jordan Lake Watershed			

Variations in stream flows

The guidelines for Jordan Lake water supply allocation applications indicated that, if no better information was available, an applicant withdrawing water from a river or stream could use 20 percent of the estimated 7Q10 flow, at the intake location, as a planning guideline for available water supply. This threshold is used in DEQ's rules for implementing the State Environmental Policy Act. It is one of several thresholds that help define the level of environmental review required for proposed projects.

In 2015, the General Assembly amended the State Environmental Policy Act by increasing the magnitude of public expenditures and the acreage of land disturbance a project would need to exceed in order to require a SEPA review. The new thresholds reduce the likelihood that water supply projects will be required to perform a SEPA review. Many of the existing public water systems using surface waters already have intake structures capable of withdrawing the amounts of water expected to be needed in the foreseeable future with sufficient pumping capacity. With sufficient intake capacity expansions to pumping and treatment capacity are less likely to require SEPA review.

Therefore, the review of variations in stream flows between model scenarios in this document will be considered from the broader perspective of changes in the distribution of flow patterns rather than comparing variations in estimated 7Q10 flows, as was done in the draft document. The analysis is based on use of the Cape Fear – Neuse River Basin Hydrologic Model to compare future water use alternatives. The model is a mathematical tool, based on available information, customized to reproduce conditions in these two river systems for planning purposes. It can show how water availability might vary under differing surface water withdrawal scenarios. The hydrologic model shows the effects on water quantity of the surface water withdrawals and management protocols included in alternative scenario. The model does not provide information on water quality parameters or potential impacts to water quality from the use and management options in model scenarios.

New surface water withdrawals in the Cape Fear River system, in combination with potential changes in water withdrawals and management protocols, could reasonably be expected to produce changes in streamflow patterns. The modeling used to evaluate the potential impacts of the requested water supply allocations included several different options for meeting the estimated surface water withdrawals needed to meet expected 2045 and 2060 water demands. This section presents one way of describing how flow regimes may vary due to changes in how water is used in the alternative model scenarios.

This analysis looks at the daily average streamflow at thirteen locations in the Cape Fear Basin for each of the 29,858 days in the historic flow record. For each location the relationship of daily average flow is compared to the mean annual flow. The results are presented in graphs showing nine groupings covering ranges from less than 10 percent to greater than 200 percent of mean annual flow. Each graph shows the results of six model scenarios for each percentage group.

The graph bars labeled "1Sim2010" show the estimated variations in the percent of days that fall within that grouping for the conditions characterized in the "Simbase_Current" model scenario

that describes 2010 conditions. Output from the "Simbase_Current" model scenario establishes the current conditions within each flow group. Comparing results of other model scenarios to the current conditions indicates how conditions vary between model scenarios Model data are estimated from historic flow data therefore they cannot be directly compared to steam gage data that report measured stream flow.

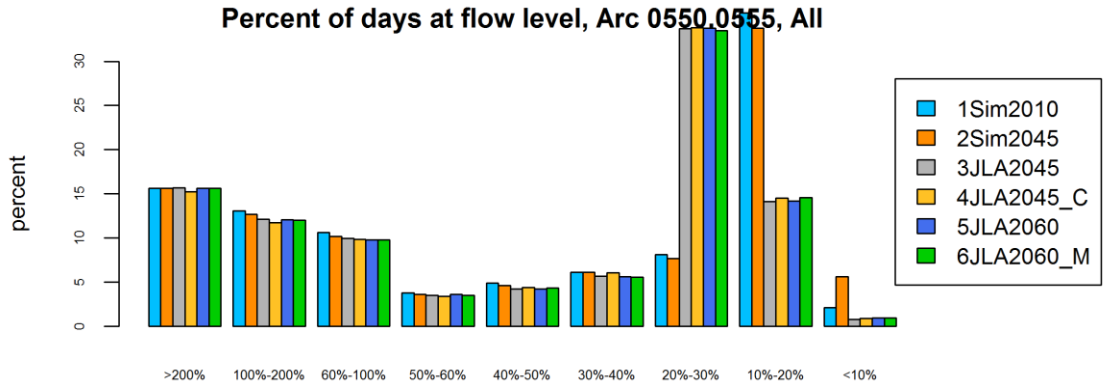
Comparing the graph bars for alternative model scenarios to the bars labeled "1Sim2010" shows the estimated variations in the percent of days that fall within that grouping in relation to the current conditions characterized in the "Simbase_Current" model scenario.

The flow variation graphs are included in Appendix E. Figure 11 is a sample of the information presented in Appendix E.

Figure 11 Flow Variations in Cape Fear River at Lillington

Cape Fear River USGS gage 02102500 at Lillington, NC		
Model Scenario	**Description**	**Mean Annual Flow (cfs)**
1Sim2010	basecase conditions in 2010	3150
2Sim2045	2010 available supplies and 2045 demands	3022
3JLA2045	recommended Jordan Lake allocations added to 2010 available supplies and 2045 demands	2998
4JLA2045_C	same as 3JLA2045 with daily data in the flow record reduced 10%	2676
5JLA2060	recommended Jordan Lake allocations and 2060 demands	2973
6JLA2060	full allocation of Jordan Lake water supply pool and 106mgd withdrawals during peak month at L&D#1	2959

January-December



Water supply allocations from Jordan Lake are limited by rule to documented needs over a thirty-year planning horizon. For this round of allocations that horizon is fixed at 2045. The model scenarios in the shaded cells in Figure 11 indicated the scenarios relevant to the Jordan Lake water supply allocation recommendations. In previous rounds of allocations members of the Environmental Management Commission requested a review with a longer planning horizon in an attempt to identify potential problems beyond the allocation planning horizon. The other two model scenarios were included for that reason. A detailed discussion of the ability of surface water dependent water utilities in the Cape Fear River Basin is available in the Cape Fear River Basin Water Supply Evaluation.

5 Recommendation Summary

The Division of Water Resources staff reviewed the information in each allocation application for water supply storage in Jordan Lake. The ability to meet expected water demands in 2045 from current water sources and sources supplemented by new or increased allocations from Jordan Lake were evaluated using the Cape Fear – Neuse River Basins Hydrologic Model. Key to this analysis is the desire for reliable drinking water sources for the citizens served by the applicants within the context of existing rules and statutes. The current allocations, requested allocations and DWR's recommended allocations are shown in Table 13.

DWR staff accepts that the local government entities submitting applications are the best judges of the amount of water needed to reliably provide drinking water to the expected number of customers to be served in 2045. DWR staff concluded Fayetteville Public Works Commission is not in need of additional raw water supplies. DWR's modeling analysis indicates that Fayetteville PWC is not expected to face water quantity related supply shortages in meeting the expected demand in 2045 from current raw water sources. The Cape Fear River Surface Water Supply Evaluation shows that Fayetteville PWC is not likely to face water quantity related shortages meeting their expected demands in 2060 from their current sources.

The other applicants demonstrated needs for additional raw water sources because of demands that are expected to exceed available water supplies or the need to provide redundant sources to protect system reliability to meet essential water needs if their other water sources are compromised.

The City of Raleigh documented the need for additional sources of raw water to meet expected future customer demands. Raleigh Public Utilities Department requested an allocation of 4.7 percent of the water supply pool, assumed to provide 4.7 million gallons per day. With its service area in the Neuse River Basin Raleigh is faced with the need to develop an approach for using a Jordan Lake allocation that will not be a surface water transfer in order to avoid the need to get an interbasin transfer certificate.

Raleigh's proposal is to have any approved allocation released from the Jordan Lake Dam to be withdrawn from the Cape Fear River in the vicinity of Lillington. The proposal includes construction of an additional pipeline to return treated wastewater to the Cape Fear River near the point of withdrawal to avoid the need for an interbasin transfer approval. The proposal to return treated wastewater to the vicinity of the withdrawal could negate the effects of the withdrawal. Raleigh's use of water from this location is likely to have minimal measureable effects on flows or water availability from the Cape Fear River below the discharge location.

DWR staff recommends approval of the requested allocation percentages shown in Table 13 for the remaining applicants. Staff recognizes that some portion of these allocations may not be used in the immediate future. However, approving the requested allocations for Durham, Pittsboro, Chatham County and the Orange Water and Sewer Authority will provide these entities with the

assurances of access to sufficient water supplies to pursue the development of an additional raw water intake and water treatment plant on Jordan Lake. The only raw water intake on Jordan Lake can only withdraw about 80 million gallons per day. Without an additional intake about 20 percent of the water supply pool would remain inaccessible to local governments.

The recommended allocations leave 4.1 percent of the water supply pool unallocated. There exists a significant level of uncertainty associated with projecting conditions in 30 years from today's vantage point. The expected economic development and growth in water demand may or may not become a reality. Some factors influencing growth and development within water utility service areas can be influenced by local government policies. However, there are many factors beyond local control.

The allocation rules provide the Environmental Management Commission the ability to "*…assign, reassign, or transfer allocations based on the applicants' or holders' need(s) and alternative water sources available (as defined in the application requirements), the existing or proposed average degree of utilization of the resource (relative to the total allocation application),…"*

This authority gives the Commission the ability to redistribute allocations from the water supply pool if it becomes prudent to do so in the future. The results of this round of allocations can be revisited if the need arises.

During the discussion of staff's allocation recommendations by the Water Allocation Committee of the EMC a question was raised about staff's interpretation of the need for Raleigh to be pursuing a certification for an interbasin transfer in order to receive a water supply allocation.

The rules governing allocations of Jordan Lake water supply storage in sub-section (h) includes the following language: "For applicants whose discharge or intake represents a diversion pursuant to G.S. 153A-285 or 162A-7, the Commission will coordinate the review of the diversion with the review of the allocation request." The statutes cited are the precursors of the current statute regulating surface water transfers. The Committee's interpretation of the phrase "will coordinate" does not prevent the assignment of an allocation if the impacts of a surface water transfer had not been evaluated prior to or were not being evaluated simultaneously with the application for a water supply allocation. Raleigh's proposal includes an option that has the potential to negate a surface water diversion.

The Water Allocation Committee approved for public comment the Draft Jordan Lake Water Supply Allocation Recommendations and the supporting Draft Cape Fear River Surface Water Supply Evaluation with the inclusion of the City of Raleigh's requested 4.7 percent allocation included in the recommendations. The following table lists the draft allocation recommendations approved for public comment by the Water Allocation Committee on January 13, 2016.

The Division of Water Resources supports the allocation percentages shown in Table 13 as draft recommendations.

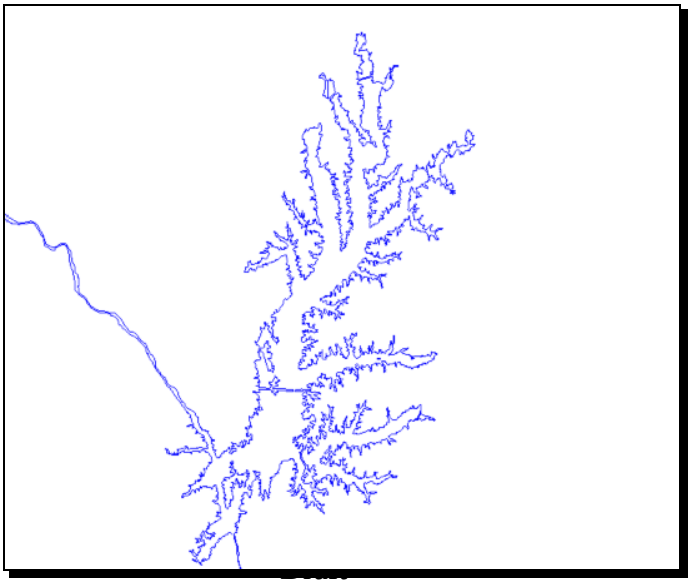
Table 13 Allocation Summary

Allocation of Jordan Lake Water Supply Pool			
Applicant	Current Allocation	Requested Allocation	Draft Recommendation
	Allocation Percent	Allocation Percent	Allocation Percent
Cary Apex Morrisville RTP	39	46.2	46.2
Chatham County-North*	6	13	13
Durham*	10	16.5	16.5
Fayettteville PWC	0	10	0
Hillsborough	0	1	1
Holly Springs	2	2	2
Orange County	1	1.5	1.5
Orange Water&Sewer Authorit	5	5	5
Pittsboro*	0	6	6
Raleigh	0	4.7	4.7
Total Percent	63	105.9	95.9
* Western Intake Partners			

6 Appendix A Application Guidelines

JORDAN LAKE
WATER SUPPLY STORAGE ALLOCATION
APPLICATION GUIDELINES

Round Four



June 3, 2013

Revised February 18, 2014

Division of Water Resources

Department of Environment and Natural Resources

INTRODUCTION

North Carolina General Statute GS 143-354(a)(11)[6] gives the Environmental Management Commission (EMC or Commission) the authority to allocate to local governments any interest in water supply storage held by the State in federal reservoirs. The State controls and allocates about 33 percent of the conservation pool in B. Everett Jordan Lake which is storage dedicated to water supply. The amount of water available from this storage capacity has been estimated at 100 million gallons per day (MGD).[7] Administrative rule 15A NCAC 2G.0503 requires applicants for a water supply allocation from Jordan Lake to provide information substantiating the requested allocation amount. The Division of Water Resources (DWR or Division) developed these guidelines to assist local governments in preparing their application for a Jordan Lake water supply storage allocation.

North Carolina General Statute 143-355(l) requires each unit of local government "that provides public water service or that plans to provide public water service" to prepare and update a Local Water Supply Plan (LWSP). Therefore, all applicants for an allocation should have an approved Local Water Supply Plan on file with the Division. All applicants must have an updated LWSP based on calendar year 2012. For the application process, applicants will be asked to supplement their 2012LWSP information to provide the additional information needed to evaluate an allocation request.

Local water supply plans will be submitted to DWR using the online submission program available on the Division's website at www.ncwater.org. Applicants' 2012 local plan submission must include a map of the existing and expected future service areas that is consistent with the information provided to support an allocation request.

The intent of these guidelines is to provide a common format and common content for allocation requests. Applications should be concise and complete.

The Jordan Lake water supply allocation application will consist of an introductory letter, the general application including the JLA-4 workbook, and a copy of the applicants LWSP that is consistent with the allocation request. Applicants may provide any supporting documents in

[6] (11) The Commission is authorized to assign or transfer to any county or municipality or other local government having a need for water supply storage in federal projects any interest held by the State in such storage, upon the assumption of repayment obligation therefor, or compensation to the State, by such local government. The Commission shall also have the authority to reassign or transfer interests in such storage held by local governments, if indicated by the investigation of needs made pursuant to subsection (a)(1) of this section, subject to equitable adjustment of financial responsibility.

[7] Allocations are made as a percentage of the water supply storage in Jordan Lake. However, since the available supply of the entire (100 percent) water supply storage is estimated to be 100 MGD. For convenience allocations are sometimes expressed in terms of MGD. For example, a 6.0 MGD allocation actually represents an allocation of 6.0 percent of Jordan Lake's water supply storage.

additional appendices. The letter, application contents, and LWSP update are discussed in further detail below. A description of the costs associated with a Jordan Lake water supply storage allocation and the rules for allocation are included in this document.

INTRODUCTORY LETTER

The applicant must provide an introductory letter that includes the following:

1. A commitment to all financial obligations related to receiving an allocation from Jordan Lake
2. The total Level I and Level II allocation requested, stated as a percent of total water supply storage[8]
3. Description of any regional partnerships in which the applicant is participating
4. Any additional information that would be helpful in evaluating the application and documenting the applicant's need to obtain a water supply allocation from Jordan Lake.

APPLICATION CONTENTS

The applicant is required to provide detailed information describing its projected water supply needs, current water supply sources, alternative water supply possibilities, and plans for obtaining water from Jordan Lake should it receive an allocation. This information must be consistent with the applicant's LWSP Update. The application will include the following sections:

Section I – Water Demand Forecast

Section II – Conservation & Demand Management

Section III – Current Water Supply

Section IV – Future Water Supply Needs

Section V – Water Supply Alternatives

Section VI – Plans to Use Jordan Lake

[8] Level I allocations are based on projected water supply needs for a 20-year planning period and the withdrawal must be initiated within 5 years. Level II allocations are based on projected water supply needs for a 30-year planning period.

SECTION I – WATER DEMAND FORECAST

Defensible decisions about allocations require realistic estimates of water system needs. Therefore, the demand projections contained in the local plans must be supplemented to provide additional details on the magnitude and timing of customer demands. DWR has prepared the accompanying JLA-4 workbook for consistent presentations of system demands and the various alternative sources that may be used to meet them.

User Sectors

Demands will be forecast using a disaggregated method based on water use sectors represented in the applicant's customer base.

The applicant must provide a complete description of its user sectors and the customer types included in those sectors and subsectors used in the application. Demands for unique customers may be estimated separately. For example, if an applicant has an unusually water-intensive industrial customer the applicant may project demand for that customer separately taking into consideration its particular usage patterns. The applicant will then project the water demands for each of its user sectors from 2010 to 2060 in five year increments. The "Population & Demand Projections" worksheet in the JLA-4 workbook has a table to enter this information.

Sector	Subsector	Description
Residential	Single Family	May be disaggregated by applicant.
	Multi Family	
Commercial		Disaggregated as appropriate by applicant, and explicitly defined.
Industrial		Disaggregated as appropriate by applicant, and explicitly defined.
Institutional		Disaggregated as appropriate by applicant, and explicitly defined.
Unique	(Specify)	Any large, unique customer that has a justifiable usage rate different from the norm for its typical sector. Each such customer must be specified.

Sector Projections

No specific methodology for estimating growth in service population is required. However, applications must include descriptions of the methodology and calculations used to arrive at the growth projections for the various user sectors used. Growth projections should be consistent with conditions reflected in the boundaries shown on the service area map submitted with the applicant's 2012 LWSP.

The number of *residential* users may be projected based on the number of dwelling units or population. The number of *nonresidential* users may be projected based on the square footage of building space, per employee, or any other reasonable method. The projection may be a function of a local land use plan or a function of the population. If an applicant has users with unique water demands that need to be calculated differently from other users with similar types of water use then those demands may be projected as appropriate. All projections for unique water users must be explained in detail.

DWR will review projections against various benchmarks. For example, a population projection for a particular utility's service area would not be expected to exceed the population projection for the county in which the utility is located unless the service area extends into a neighboring county. Service area build-out, based on local land use plans or stated economic development policies, may also be used to analyze demand projections.

Usage Rates

The applicant will calculate a usage rate for each of its user sectors and subsectors and apply these rates to their projections for each sector and subsector. When applying a usage rate to a sector or subsector projection, the applicant will adjust the usage rate to reflect the potential results of reasonable water conservation efforts within each sector taking into consideration the applicant's plans to reduce long term drinking water demands required by General Statute 143-355(l) as amended by Session Law 2011-374. The applicant's explanation of demand management and water conservation adjustments must be consistent with information provided in their LWSP and Section II of the application.

DWR will review usage rates for each sector based on historic information and reasonable standards, accounting for best practices and conservation.

After projecting the water demand for each sector, the applicants will calculate the resulting service area demand projections.

Total Demand

The applicant determines the total service area demand for each projection year by the following method:

1. Sum the projected demand for each sector and subsector.
2. Add a percentage for *system processes*.
3. Add a percentage for *unaccounted-for* water.

The JLA-4 workbook contains a table to compile this information.

Adjustment	Description
System Processes	Any water use that is not included in the sector breakdown that can be accounted-for by temporary metering or estimating usage can be included in this category. This category could include: filter backwash, line flushing, fire suppression, training activities, etc. Explain what was included and how the final amount was determined.
Unaccounted-For	That portion of the total surface water, groundwater and purchased water that is supplied to the water system that is not accounted for in the water use sector summaries or system process water estimates, but not to exceed 10%.

Bulk Water Sales

The applicant may choose to include bulk water sales to other governmental entities in its allocation request as an existing sale or require a bulk water purchaser to submit its own allocation request. Inclusion as a bulk sale must be based on a long-term, contractual relationship between the two entities. Bulk water purchasers included in an application must have an updated 2012 LWSP (including a service area map) that supports the demand projections included in the application.

Bulk water sales to entities that are not required to complete a LWSP will be included in the appropriate user sector, and their demand projected accordingly over the period of the existing contracts. The applicant's updated 2012 LWSP must include contract amounts and expiration dates for all sale arrangements.

Summary

Applicants will supplement the demand projections in their LWSP using the "Population & Demand Projections" worksheet in the included JLA-4 workbook. The table breaks down water

demand into the following categories: residential, commercial, industrial, institutional, system processes, and unaccounted-for water in five-year increments over a 50-year planning period.

SECTION II – CONSERVATION & DEMAND MANAGEMENT

Demand management and water conservation programs provide valuable tools to manage the average and peak demands experienced by a water system. The applicant will describe and provide documentation of current and planned demand management and water conservation programs and how these initiatives will affect usage rates for each of their user sectors. A water conservation program will include the following elements:

1. Water conservation policy or ordinance
2. Water conservation pricing
3. Leak detection and repair
4. Annual water audits
5. Public education program, including a specific outdoor water use education program
6. Evaluation of plumbing retro-fit program to replace older less efficient water fixtures
7. Evaluation of the potential to use reclaimed water.

SECTION III – CURRENT WATER SUPPLY

The applicant must list all surface water, groundwater, and purchased water sources currently available to the water system in the water supply sources section of its LWSP.

Available Supply

Each application shall describe the available supply from each source based on the following criteria and standards.

For *reservoirs* included in the combined Cape Fear - Neuse River Basin Hydrologic Model the potential yield of a reservoir will be the "period-of-record" yield[9] as estimated by the model. For *reservoirs* not included in the Cape Fear - Neuse River Basin Hydrologic Model, applicants will use the USGS Annual Mass Curve Analysis method, based on a 50-year return period, to

[9] The "period-of-record" yield is estimated using the historical flow record included in the model and increasing the demand on the reservoir until the specified demand level cannot be fully met for every day in the flow data record. The demand level that first creates a total depletion of the useable storage is designated as the "period-of-record" yield for that reservoir.

determine the available supply.[10] This amount should be reduced by the amount required for minimum releases and any reductions in available storage since construction. The Division will provide assistance to estimate minimum releases for proposed reservoirs.

For *groundwater*, applicants will determine the available supply based on a pump test completed no earlier than 2005. The well yield is the maximum amount of water in gallons per minute that can be pumped from a well such that the water level achieves equilibrium (stabilizes) above the pump intake. Based on the resulting well yield estimate, the available supply is the amount of water that the well can provide during 12 hours of pumping.[11]

For run-of-river sources, applicants will use the results of an instream flow study, when such is available, to determine the available supply. If the results of an instream flow study are not available for a given source, the applicant's available supply is assumed to be 20% of the 7Q10 flow as determined using the basecase scenario of the appropriate river basin hydrologic model if there are no other intakes in close proximity. Applicants that wish to explore the possibility of a larger available supply estimate for a run-of-river intake from an unregulated stream should contact the Division of Water Resources to discussed options.

Purchased Water

The applicant will use the contract maximum as the measure of the available supply of purchased water. Only contracts for regular use (i.e., routine, continuous use; not emergency use) will be considered. Similarly, water systems selling water to other systems must include the maximum contract amount as part of their water demand projections.

SECTION III –FUTURE WATER SUPPLY NEEDS

The applicant will summarize its water demand forecast, current water supply, and future water supply needs in the LWSP and supplement that information by completing the "Population & Supply-Demand Projections" worksheet in the JLA-4 workbook.

SECTION IV – ALTERNATIVE WATER SUPPLY OPTIONS

The applicant will describe the various alternative scenarios evaluated to satisfy future water supply needs. Descriptions should provide enough detail so the reader can develop an understanding of the timing of each component and other key factors affecting alternative selection. The JLA-4 workbook provides individual worksheets to summarize the various sets of alternative projects that could meet the identified supply shortages.

[10] The Annual Mass Curve Analysis method is described in *Storage Analyses for Water Supply* (Riggs, H.C. and Clayton H. Hardison. 1973. Techniques of Water-Resources Investigations of the United States Geological Survey. Washington, DC: United States Government Printing Office. Chapter B2).

[11] This is in accordance with the Rules Governing Public Water Systems, 15A NCAC 18C.0402(g).

Alternative scenarios will be presented as sets of possible projects. Each set of projects will provide sufficient water to meet the projected demands through 2060 consistent with demands shown in the LWSP. Jordan Lake water supply will be included as one of the possible projects among the various combinations of projects within the set alternatives.

The applicant will compare the various supply alternatives based on the criteria discussed below. The JLA-4 workbook includes a worksheet labeled "Supply Alternatives Summary" to record the rankings of each alternative. Alternatives will be analyzed using the criteria and standards described below.

Scope of Supply Alternatives

For any set of projects that constitute a supply alternative that includes the transfer of surface water between river basins designated by GS 143-215.22G that would require a certificate under GS 143-215.22L, the Regulation of Surface Water Transfers Act, or an increase in a surface water transfer approved under a prior statute the application shall include two variations for this alternative. In addition to the alternative requiring a new or expanded surface water transfer, the application shall include an alternative describing facilities necessary to avoid the transfer. Copies of the referenced statutes are included in this document.

DWR encourages applicants to consider the following possibilities when exploring their options for meeting future demands, although not all of these options will be relevant for any given applicant. For example, aquifer storage and recovery is probably not a relevant option for most applicants in the vicinity of Jordan Lake.

Potential options include:

- Groundwater
  - Wells
  - Aquifer Storage and Recovery
- Surface Waters
  - Offstream Storage
  - Reservoir Expansions
  - New Reservoirs
  - New Stream Intakes or Expanded Stream Intakes
- Reclaimed Water Use
- Bulk Water Purchase

Categories for Supply Alternative Comparisons

Available Supply

The applicant must determine the available supply for each alternative using the same methodology as presented in Section II. For alternatives that are analyzed as unfavorable (i.e., receive the least favorable rating) for five or more criteria, applicants may use the Draft-Storage-Frequency Relations method for reservoirs.[12]

Environmental Impacts

The applicant will estimate the environmental impacts of any project, and compare them with the environmental impacts associated with developing a Jordan Lake water supply. The applicant should consider only direct environmental impacts. The applicant will classify the expected environmental impacts of each project as either *More than*, *the Same as*, or *Less than* a Jordan Lake water supply allocation.

The applicant may also include a discussion of each alternative's sustainability with respect to resource management.

Water Quality Classification

The applicant will provide the water quality classification designated by the Division of Water Quality for each surface water source included in the alternatives. The classification provides a measure of existing water quality protection for surface water sources. Applicants do not need to provide the classification for ground water supplies.

Timeliness

Timeliness refers to the ability of a project to be operational prior to when its contribution to the system's supply will be needed. The timeliness of a given project may justify its inclusion or exclusion from a set of projects for a given alternative. The timeliness of a given project may also justify its order within a set of projects for a given alternative.

Interbasin Transfer

The applicant will estimate surface water transfers regulated by the Regulation of Surface Water Transfers Act (GS 143-215.22L) for each alternative using the maximum daily average for a calendar month in million gallons per day. The applicant will estimate the consumptive losses in each basin within the system's service area. The applicant will use a maximum daily average for a calendar month consistent with their LWSP. The applicant will estimate the quantity to be transferred between a source basin and receiving basin for each time period when the volume of the transfer would change due to implementation of a specific supply alternative. In addition the applicant will calculate the surface water transfer as the maximum daily average for a calendar

[12] The Draft-Storage-Frequency Relations method is described in *Evaluation of Reservoir Sites in North Carolina: Regional relations for estimating the reservoir capacity needed for a dependable water supply* (Arteaga, F.E. and E.F. Hubbard. 1975. U S Geological Survey Water Resources Investigations 46-74. Raleigh, NC: US Department of the Interior)

month for the year 2045. The applicant will indicate if a transfer might exceed a grandfathered transfer amount, might require a minor modification to an existing IBT certification, or might require a full IBT certification process. If the proposed surface water transfer would require an increase in an existing transfer certification or approval of a new transfer certification describe the volume and timing of the desired certification.

Regional Partnerships

The applicant will discuss the possibilities of developing regional partnerships for any project. For every project with the potential for partners, the applicant will provide a list of the prospective partners. The applicant should provide any documentation supporting such partnerships in an appendix.

Technical Complexity

The applicant will discuss the relative technical complexity of implementing each project. The applicant will summarize the technical complexity as *Not Complex*, *Complex*, or *Very Complex* and generally justify the rating. For example, a project limited to building a transmission line to convey purchased water might be rated "not complex," while a project to build a new reservoir would be "very complex."

Institutional Complexity

The applicant will discuss the relative institutional complexity of implementing each project. The applicant will consider current and anticipated statutory and regulatory constraints, including such issues as water supply reclassification and environmental review requirements. The applicant will summarize the institutional complexity of each project as *Not Complex*, *Complex*, or *Very Complex* and generally justify the rating. For example, expanding a water supply intake up to the capacity of a previously estimated available supply determination might be rated "not complex," while a new water supply source that requires reclassification or a surface water transfer certificate might be rated "very complex."

Political Complexity

The applicant will discuss the relative political complexity of implementing each project. The applicant will consider such issues as the likely acceptance by publicly elected officials and anticipated public perceptions. The applicant will summarize the political complexity of each project as *Not Complex*, *Complex,* or *Very Complex* and generally justify the rating.

Public Benefits

The applicant will discuss any expected secondary public benefits such as recreation associated with each project. The applicant will summarize the expected public benefits as *None*, *Few*, or *Many*.

Consistency with Local Plans

The applicant will discuss each project's consistency with its local comprehensive land use plans, growth management plans, and capital improvement plans. The applicant may also discuss

the consistency of a given alternative with the community's stated economic development policies. The applicant should support its analysis with selected, relevant citations from its plans in an appendix in the application.

Costs of Alternatives

Applicants will calculate the costs associated with an alternative as the capital costs associated with implementing the components of an alternative. The cost will be expressed both as total capital costs and capital costs per million gallons per day of water provided. Applicants are not required to do a detailed cost analysis for alternatives that are analyzed as unfavorable (i.e., receive the least favorable rating) for five or more criteria.

The Division does not require applicants to calculate costs at the level of detail necessary to complete a facility design proposal. For example, the Division does not expect applicants to determine an exact route for a transmission pipeline. The Division requires applicants to address each of the elements discussed below and provide cost estimates for each element that is relevant for each alternative. For example, an applicant may estimate the cost of a transmission pipeline by determining an average cost per unit length based on previous projects, estimating the length based on a general route, and adding some factor for possible deviations from that general route.

Capital costs include the cost of facilities and equipment, to include the water supply, water supply intake, transmission to a water treatment plant, the water treatment plant, and transmission to the service area distribution system (but not the distribution system within the service area). Capital costs include construction costs, land acquisition costs, engineering costs, legal and administrative costs, the cost of meeting regulatory requirements, and a general contingency of 10%. Land acquisition costs include land acquisition and directly related costs. Applicants must include justification for the cost per acre they use for estimating land acquisition costs. The annual capital cost of a project will be computed in year 2010 dollars. For alternatives that include an interbasin transfer the applicant should include an estimate of the cost associated with getting approval for the transfer from the Environmental Management Commission.

O&M costs include the costs of labor, repair, power, chemicals, supplies, and administration. The annual O&M cost for each project computed in year 2010 dollars.

For alternatives that involve transferring treated wastewater to a different basin, the incremental difference in costs associated with building the same wastewater treatment capacity to discharge back to the source basin must be included. The incremental difference in costs will include the capital costs and O&M costs associated with transmission to the wastewater treatment plant, the wastewater treatment plant, and transmission to the receiving waters.

The a*nnual cost* of any project is the sum of yearly capital costs (i.e., the total capital cost of the project, divided by the life of the project), O&M costs, and the annual cost of capital recovery (i.e., the cost of repaying the debt associated with the capital costs). Applicants will use an interest rate of 3.225% for capital recovery.[13] Applicants will assume a 25-year life for equipment and a 50-year life for pipelines and structures for replacement costs and salvage

[13] The interest rate for repayment of the capital investment in B. Everett Jordan Lake

value. The applicant will add the replacement costs associated with a project if the replacement occurs before 2060.

Total present worth is calculated by summing the net present value of annual costs over the 2010-2060 planning period, assuming a discount rate of 1.295%, less the salvage value of facilities and equipment at 2060.[14]

Unit costs are expressed as an annual average. The average annual unit cost will be calculated by dividing the annual cost of each alternative in Year 2010 dollars by the related annual water demand and should be expressed in $/1000 gallons. The annual unit water costs will be calculated in 5-year increments according to expected annual deliveries for the life of the project.

For *Jordan Lake*, the costs of developing the proposed withdrawal should be estimated as described above. Costs will include an estimate of the required annual repayment for the allocation and costs related to developing water supply facilities such as intakes, treatment plants, transmission lines, etc. A summary of the annual costs and repayment requirements associated with an allocation of water supply storage in Jordan Lake is presented later in this document.

Supply Alternatives Summary

Applicants will summarize their analysis of alternatives in the "Supply Alternatives Summary" worksheet of the JLA-4 workbook. The total supply of an alternative is the sum of the available supplies of its constituent projects. Applicants will summarize surface water transfers for each alternative as the maximum amount that might be transferred during the planning horizon. Regional partnerships for a given alternative may be summarized as either *yes* or *no*. An alternative's consistency with plans may be summarized as either *yes* or *no*. The total cost of an alternative is the sum of the total present worth of its constituent projects. The unit cost of an alternative is the sum of the unit costs of its constituent projects.

Example of JLA4 – Supply Alternatives Summary worksheet

Alternatives	Summary Description
Alternative 1	
Alternative 2	
Alternative 3	
(etc.)	

[14] The discount rate is based on an average of the inflationary factors projected for water and sewer for the five fiscal years from 2009-10 by the Office of State Budget and Management (Instructions for Preparation of the 2009-2011 Recommended State Budget, July 2008, Section 5, Attachment 5-9).

	Alternatives				
	Example	1	2	3	4
Allocation Request (%)	24				
Estimated Supply (MGD)	24				
Environmental Impacts	Same				
Water Quality Classification	WS-III				
Interbasin Transfer (MGD)	3				
Regional Partnerships	Yes				
Technical Complexity	Complex				
Institutional Complexity	Not Complex				
Political Complexity	Very Complex				
Public Benefits	Few				
Consistency with Local Plans	Yes				
Total Cost ($ Millions)	12.7				
Unit Cost ($/1000 gallons)	2.12				

SECTION V – PLANS TO USE JORDAN LAKE

Applicants are required to explain their plans to use water from Jordan Lake if an allocation is approved. These plans will include the total Level I and Level II allocation requested as a percent of storage.

Level I allocations are based on projected water supply needs for a 20-year planning period and a stated intent to begin withdrawing water within 5 years. Level II allocations are assigned for water supply needs based on a 30-year planning period. For example, if an applicant determines that their 20-year total system deficit is 6 MGD and the 30-year total system deficit is 10 MGD, the Level I request could be for 6 MGD and the Level II request should be for the additional 4 MGD.

This section will include the location of any proposed intakes, water treatment plants and wastewater discharges. Also, details on any plans to enter into cooperative agreements in which the applicant would share facilities or the cost of facilities with another allocation holder or water system shall be described in the application. A discussion of the proposed schedule of development of the source shall also be addressed in this section.

Raw and Finished Water Quality Monitoring Plan

Applicants will explain their plans for monitoring the quality of the raw and finished water that would be withdrawn and produced from Jordan Lake. This monitoring will be in accordance with the requirements of the North Carolina Department of Environment and Natural Resources, Division of Water Resources – Public Water Supply Section, and the United States Environmental Protection Agency.

Costs of a Jordan Lake Allocation

Jordan Lake was financed and constructed by the federal government through the US Army Corps of Engineers. Storage space for municipal and industrial water supply was included at the request of state and local officials with the understanding that the costs associated with this water supply storage would be paid for by the actual users. The result of that arrangement is that the management plan for Jordan Lake dedicates 33 percent of the conservation pool, or 45,800 acre feet, for water supply storage.

North Carolina General Statute 143-215.38 authorized the State, acting through the Environmental Management Commission (EMC), to assume repayment responsibilities for the costs associated with providing water supply storage in Jordan Lake. These costs fall into three basic categories: capital costs including interest, operating costs, and administrative costs. The total cost for each percent of water supply allocated from Jordan Lake varies with a number of parameters, the key ones being when the allocation is granted and when water is expected to be withdrawn. The rules governing allocation of water supply storage require the state to recover the complete federal capital and interest costs associated with a Level I allocation by 2012. Thereafter, the cost of future Level I allocations will be based on the initial capital cost and accrued interest as well as the accrued operating expenses associated with the percent of storage.

Capital and Interest Costs

Capital costs are based on the Jordan Lake construction costs of approximately $89 million, excluding funds budgeted specifically for recreational lands and facilities. Since the project's cost is shared among several project purposes, the Corps estimated that 4.6% of the construction cost is attributable to water supply. Including interest accrued during project construction, $4.388 million represents the original investment cost for the water supply provided by the reservoir. Based on this figure, the initial capital cost is $43,880 for each one percent of water supply storage.

In 1992, the State began making interest payments at a rate of 3.225% on the unallocated portion of the Jordan Lake water supply. As stated above, all of these interest payments will be passed on to the eventual holders of the water supply storage.

The estimated cost for a new Level 1 allocation made in 2015 is $91,041 per percent of water supply storage. In future years entities that receive a new Level I allocation in this round of allocations will be billed for operation and maintenance expenses based on the percentage of storage in the allocation.

Holders of Level II allocations are required to make the annual interest payments on the capital costs associated with the allocation percentage, along with a similar proportion of operating expenses, until their allocation is converted to Level I.[15]

Operating Costs

In addition to the costs incurred to construct the project, there are continuing expenses for operation and maintenance (O&M), and periodic expenses for replacement and rehabilitation of facilities at the reservoir. Current and future allocation holders are required to pay a proportional share of these operating expenses. Allocation holders must also reimburse the State for payments made to cover operating expenses since the Corps started charging for these expenses in 1992. The estimated accrued operating expenses for a new Level I allocation of one percent made in 2014 is $13,034 which would be added to the capital and interest payment.

The water supply proportional share of operation and maintenance costs is estimated by the Corps to be 5.4% of the total expenses. For example, in 2011 $109,258 was attributed to annual operation and maintenance costs associated with water supply. Thus, $1,092.58 was attributed to each one percent of water supply storage. The average annual O&M cost for 2007-2011 is $777 per percent of storage. Since 1992, the Corps has been charging the State the full 5.4% of operation and maintenance costs associated with water supply storage. Future allocation holders must reimburse the State for the actual operation and maintenance charges for their allocations since 1992.

Replacement Costs

The proportional share of replacement costs attributed to water supply is estimated by the Corps to be 2.8% of the total expense. These costs are more difficult to budget because they are not incurred on a regular basis. The Corps estimated an annual equivalent project replacement expense of approximately $66,000.[16] The proportion of these annual replacement costs charged against water supply storage is approximately $1,800 in total, or $18 per percent of storage. Until the Corps starts incurring replacement costs and passing these costs on to the State (they have not

[15] Level I allocations are based on projected water supply needs for a 20-year planning period and the withdrawal must be initiated within 5 years. Level II allocations are based on projected water supply needs for a 30-year planning period.

[16] It is important to note that replacement costs will fluctuate from year to year based on actual expenses incurred by the Corps.

through 2011), allocation holders will not have any additional reimbursement costs associated with replacement costs.

Rehabilitation Costs

The proportional share of major rehabilitation costs attributed to water supply is also estimated by the Corps to be 2.8% of the total expense. Annual rehabilitation costs can be estimated at about $30,092.86 based on costs incurred in 1995 and 1996. At this rate the proportion of the annual rehabilitation costs charged against water supply storage amounts to approximately $843 or $8.43 per percent of storage. Future allocation holders must reimburse the State for the actual rehabilitation payments made on their allocations since 1992. The Corps has not billed the state for any rehabilitation expenses since 1996. When rehabilitation expenses are incurred in the future they will be distributed proportionally to allocation holders.

Cost Summary

Based in the figures presented in the discussions above a new one percent Level I allocation of water supply storage made in 2015 is estimated to cost the holder $91,041. This figure includes: $43,880 of capital cost, $32,548 in accrued interest, $13,775 in accrued O&M costs, $34 in accrued rehabilitation costs, and $26 estimated costs for annual rehabilitation and replacement costs. 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.

The cost of a new one percent Level II allocation made in 2015 is also estimated to be about $2,200 annually, based on the same figures. At the time a Level II allocation is converted to a Level I allocation the holder can expect to make a payment of at least $91,041 for each one percent of storage allocated. This covers the capital cost and accrued expense up to the time the Level II allocation is made. After that date the allocation holder will be paying the O&M and interest payments annually. These estimates are presented as a table below.

Table 1. Example of Payment Responsibilities for Allocation Holders (per percent of storage allocated).

Estimates for Year	2015		2015
	New 1% Level I		New 1% Level II
Allocation Level	I	I	II
	1st Year	Subsequent Years	1 st Year
Capital Cost [1]	$ 43,880.00	$ -	$ -
Accrued Interest on Capital [2]	$ 32,547.99	$ -	$ -
Total Capital Cost [3]	$ 76,427.99	$ -	$ -
Interest Portion of Capital Payments [4]	$ -	$ 1,415.13	$ 1,415.13
Annual O&M Cost [5]	$ 777.30	$ 777.30	$ 777.30
Accrued O&M Costs [6]	$ 13,775.07	$ -	
Annual Rehabilitation Cost [7]	$ 8.43	$ 8.43	$ 8.43
Accrued Rehabilitation Costs [8]	$ 33.98		
Replacement Cost [9]	$ 18.00	$18.00	$18.00
Total Cost per PERCENT [10]	$ 91,040.76	$ 2,218.85	$ 2,218.85
Additional Fixed Cost per Acct. [11]	$ 250.00	$ 250.00	$ 250.00

Notes:
1. $4,388,000 for 45,800 acre-feet of storage.
2. 3.225% interest paid annually on the original capital cost for the years 1992-2014, compounded annually.
3. Total Capital Cost = Capital Cost + Accrued Interest on Capital.
4. The interest on $43,880 at 3.225% interest rate.
5. The estimated annual O&M (operation and maintenance) cost, based on an average of actual O&M costs for the years 2007-2011.
6. The total of actual O&M costs for the years 1992-2011 and estimates for 2012, 2013 and 2014.
7. The estimated annual rehabilitation cost, based on an average of actual rehabilitation costs for the years 1995-1996.
8. The total of actual rehabilitation costs for the years 1992-1999. Payback assumes either a lump sum, or 20 equal annual payments at a 3.225% interest rate.

9. Replacement cost is based on the Corps estimate of the average annual replacement cost. Note that there is no accrued replacement cost, as the State has not been billed for such as of year 2011.

10. Total Cost per percent of storage = (Total Capital Cost or Interest Portion of Capital Payments) + Annual O&M Cost + Accrued O&M Cost + Annual Rehabilitation Cost + Accrued Rehabilitation Costs + Replacement Cost.

11. An additional administrative charge of $250 is added to each allocation holder's bill.

7 Appendix B Jordan Lake Water Supply Allocation Rules

Jordan Lake Water Supply Allocation Rules

STATE OF NORTH CAROLINA ADMINISTRATIVE CODE

TITLE 15A. DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES

CHAPTER 2. ENVIRONMENTAL MANAGEMENT

SUBCHAPTER 2G. WATER RESOURCES PROGRAMS

SECTION .0500. ALLOCATION OF JORDAN LAKE WATER SUPPLY STORAGE

.0501 INTRODUCTION

To increase the availability of municipal and industrial water supplies, the State of North Carolina requested the U.S. Army Corps of Engineers to designate 32.62 percent of the Jordan Lake conservation storage, between the elevations 202 mean sea level (msl) and 216 msl, as water supply storage.

The State, acting through the Environmental Management Commission, will assign to local governments having a need for water supply capacity any interest held by the State in such storage, with proportional payment by the user to the State for the state's associated capital, interest, administrative and operating costs.

Upon signing the water supply storage contract with the U.S. Army Corps of Engineers, the Commission will apply the following procedures in allocating Jordan Lake water supply storage.

History Note: Statutory Authority G.S. 143-215.3(a)(1); 143-215.38 through 143-215.43; 143-354(a)(11); 143B-282; Eff. March 1, 1988.

.0502 DEFINITIONS

As used throughout this Subchapter:

(1) "Capital costs" means initial costs of the project;

(2) "Commission" means Environmental Management Commission;

(3) "Department" means the North Carolina Department of Natural Resources and Community Development;

(4) “Division” means the Division of Water Resources;

(5) “Effective date of allocation” means the date the Commission approves the allocation;

(6) “Interest costs” means interest accrued on the unpaid balance;

(7) “Local government” means any city, county, authority, sanitary district, metropolitan water district, or other local unit;

(8) “Operating costs” means Jordan Lake’s state and federal operating, maintenance, replacement, and administrative costs associated with water supply storage;

(9) “State” means the state of North Carolina; and

(10) “Water supply storage” means storage of water for municipal or industrial use.

History Note: Statutory Authority G.S. 143-354(a)(11); Eff. March 1, 1988.

.0503 FORMAL APPLICATION

(a) The Commission may receive initial allocation requests from local governments beginning on this Section’s effective date. In order to be reviewed, applications must contain the following information:

(1) Projected population and water use, including a detailed map of the existing and projected water service areas;

(2) A listing of water sources presently available, including estimated yields of these sources;

(3) An analysis of the yield, quality, and cost of alternative sources of water supply other than Jordan Lake that could meet or partially meet projected needs, including regionalization of systems;

(4) A description of conservation and demand-management practices to be used;

(5) An outline of plans to use water from Jordan Lake, including proposed location of intake and water treatment plant(s), location of wastewater treatment plant(s), any proposed sharing of facilities or other cooperative arrangements with other local governments, and a proposed schedule of development;

(6) A plan for monitoring the quality of the raw and finished water in accordance with the requirements of North Carolina’s Department of Human Resources and the U.S. Environmental Protection Agency;

(7) The estimated cost of developing water supply facilities at Jordan Lake, also costs of alternative sources of supply; and

(8) A letter of intent to enter into a financial commitment for Jordan Lake water storage.

(b) The Commission or the department may request such additional information as may be reasonably necessary for a complete understanding of the allocation request.

(c) Local governments may apply for two levels of allocation: Level I allocations are for applicants which have demonstrated an immediate need and will commence withdrawals within five years of the effective date of allocation; Level II allocations are for applicants with documented longer range needs for water.

(d) The applicant should include in the application the assumptions and the methodology used to develop projections. The Commission will assist applicants by providing a copy of departmental procedures for projecting water supply demands and determining yields.

(e) Using departmental procedures for projecting water supply demands and determining yields, the department will provide the Commission an independent assessment of the applicant's water supply needs.

History Note: Statutory Authority G.S. 143-215.3(a)(1); 143-354(a)(11); 143B-282; Eff. March 1, 1988.

.0504 ALLOCATION OF WATER SUPPLY STORAGE

(a) The segment of Jordan Lake proposed for a water supply withdrawal must be classified by the Commission as a drinking water source prior to any allocation of Jordan Lake water supply storage. Prior to the first allocation of water supply storage at Jordan Lake, the Commission shall hold one or more public meetings on the amount(s) requested by each applicant, the suitability of Jordan Lake water for public water supply use, the availability of alternative water sources, and the best utilization of the water resources of the region. For future allocation decisions, additional public meetings may be held as determined by the Commission.

(b) The Commission will assign Level I allocations of Jordan Lake water supply storage based on an intent to begin withdrawing water within five years of the effective date of allocation, on consideration of projected water supply needs for a period not to exceed 20 years, and on the design capacity of the associated withdrawal and treatment facilities.

(c) The Commission will make Level II allocations of Jordan Lake water supply to applicants based on projected water supply needs for a period not to exceed 30 years.

(d) The Commission will initially keep 50 percent of the water supply storage unallocated to meet future water supply needs as they develop.

(e) If additional storage is requested by holders of Level II allocations, these parties must submit an application addendum to the Commission for review.

(f) When holders of Level II allocations have documented an immediate need and wish to commence withdrawals within five years, their Level II allocations will be changed to Level I upon review and approval by the Commission.

(g) The department will issue a notice that it has received applications for Level I and Level II allocations and requests for increases in allocations, with a 30-day period for comment. If there is significant public interest, the department may hold a public meeting to obtain comments and information, with appropriate notice.

(h) To protect the yield of Jordan Lake for water supply and water quality purposes, the Commission will limit water supply allocations that will result in diversions out of the lake's watershed to 50 percent of the total water supply yield. The Commission may review and revise this limit based on experience in managing the lake and on the effects of changes in the lake's watershed that will affect its yield. For applicants whose discharge or intake represents a diversion pursuant to G.S. 153A-285 or 162A-7, the Commission will coordinate the review of the diversion with the review of the allocation request.

(i) Where applications for allocations exceed storage capacity, the Commission will assign, reassign, or transfer allocations based on the applicants' or holders' need(s) and alternative water sources available (as defined in the application requirements), the existing or proposed average degree of utilization of the resource (relative to the total allocation application), the level of financial commitment (relative to the applicant's or holder's total costs in developing Jordan Lake as a water supply source), the effects on the lake's yield, and the level of sharing facilities or other cooperative arrangements with other local governments.

History Note: Statutory Authority G.S. 143-54(a)(11); 143-215.3(a)(1); 143B-282; 153A-285; 162A-7; Eff. March 1, 1988.

.0505 NOTIFICATION AND PAYMENT

(a) The Commission will notify applicants of the decisions made regarding their allocation requests.

(b) Recipients of Level I allocations are required to pay a proportional share of the state's total water supply storage capital and interest costs over a term suitable to the recipient and the Commission, but by 2012. Interest rates will vary with the payback term, and will be based on the state recovering the total federal capital and interest costs associated with water supply storage by 2012. After 2012, the Commission may review and adjust repayment requirements to assure equitable and efficient allocation of the resource. Level I recipients are also required to pay annually a proportional share of operating costs.

(c) Holders of Level II allocations are required to pay a proportional share of the project's water supply storage interest and operating costs.

History Note: Statutory Authority G.S. 143-215.3(a)(1); 143-354(a)(11); 143B-282; Eff. March 1, 1988.

.0506 RECIPIENTS' REQUIREMENTS

(a) Holders of Level I allocations must provide documentation meeting the requirements of the North Carolina Environmental Policy Act, G.S. 113A-1 thru 113A-10, at the time the holders propose to build facilities to use water from Jordan Lake. Such documentation shall include the environmental impacts of the proposed withdrawal, treatment, distribution, and disposal of the holders' allocated water.

(b) Local governments must install and maintain suitable meters for the measurement of water withdrawn, report these withdrawals to the department on a monthly basis, and obtain the department's approval for the design, location, and installation of associated withdrawal facilities.

(c) Holders of Level I and Level II allocations must pay the required capital, interest, and operating costs when due.

History Note: Statutory Authority G.S. 113A-1 through 113A-10; 143-215.3(a)(1); 143-354(a)(11); 143B-282; Eff. March 1, 1988.

.0507 LOSS OF ALLOCATION

(a) The Commission will review the Level I and Level II allocations at five year intervals, beginning on the effective date of the first allocation.

(b) Level I allocations will be reviewed for possible reassignment if the recipient does not begin to withdraw water within five years of the effective date of allocation or is not using and withdrawing the water as proposed in the application.

(c) Level I and Level II allocations will be rescinded upon failure by the local government to meet the regulation requirements in .0506 (a), (b), and (c).

(d) The Commission may adjust, reassign, or transfer interests in water supply storage held by local governments, if indicated by an investigation of needs or changes in the project's water supply storage capacity. Capital, interest, and operating costs will be equitably adjusted to reflect the allocation recipients' proportion of total capacity.

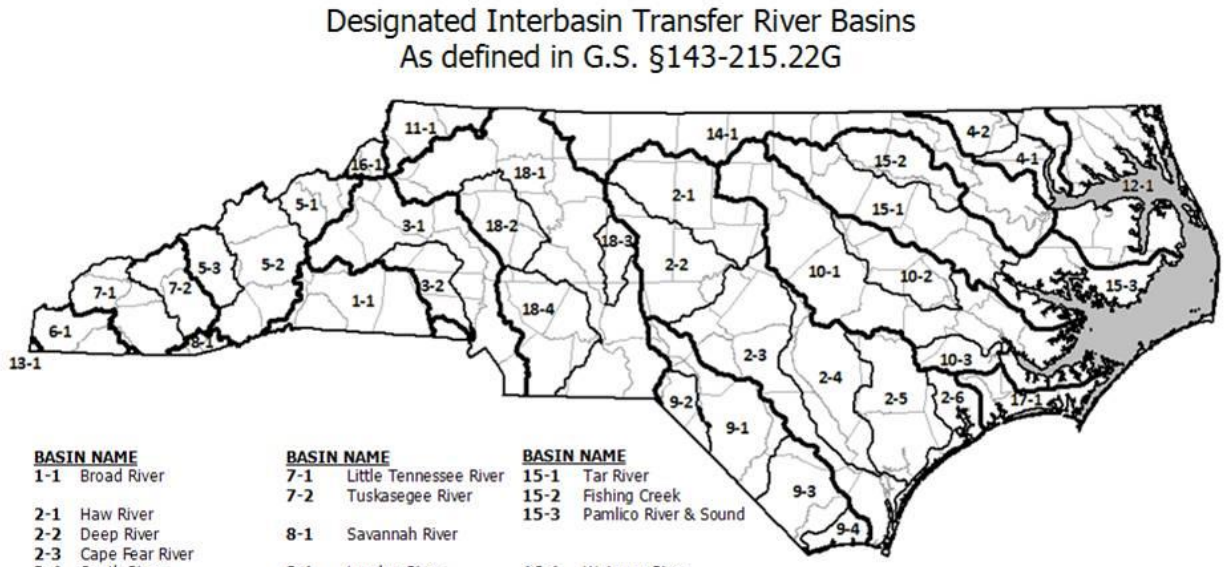
Holders of Level I and Level II allocations will receive appropriate refunds for any payments made if their allocations are adjusted, reassigned, or otherwise amended with the approval of the Commission. Rescinded allocations will not be refunded.

(e) The Commission shall hold a public meeting to obtain comments and information regarding the proposed loss of allocation.

History Note: Statutory Authority G.S. 143-215.3(a)(1); 143-354(a)(11); 143B-282; Eff. March 1, 1988.

8 Appendix C Regulation of Surface Water Transfers

Regulation of Surface Water Transfers



BASIN NAME		BASIN NAME		BASIN NAME	
1-1	Broad River	7-1	Little Tennessee River	15-1	Tar River
		7-2	Tuskasegee River	15-2	Fishing Creek
2-1	Haw River			15-3	Pamlico River & Sound
2-2	Deep River	8-1	Savannah River		
2-3	Cape Fear River				
2-4	South River	9-1	Lumber River	16-1	Watauga River
2-5	Northeast Cape Fear River	9-2	Big Shoe Heel Creek		
2-6	New River	9-3	Waccamaw River	17-1	White Oak River
		9-4	Shallotte River		
3-1	Catawba River			18-1	Yadkin River
3-2	South Fork Catawba River	10-1	Neuse River	18-2	South Yadkin River
		10-2	Contentnea Creek	18-3	Uwharrie River
4-1	Chowan River	10-3	Trent River	18-4	Rocky River
4-2	Meherrin River				
		11-1	New River		
5-1	Nolichucky River				
5-2	French Broad River	12-1	Albemarle Sound		
5-3	Pigeon River				
		13-1	Ocoee River		
6-1	Hiwassee River				
		14-1	Roanoke River		

Regulation of Surface Water Transfers copied from General Assembly website November 1, 2016

§ 143-215.22G. Definitions.

In addition to the definitions set forth in G.S. 143-212 and G.S. 143-213, the following definitions apply to this Part.

(1) "Mainstem" means that portion of a river having the same name as a river basin defined in subdivision (1b) of this section. "Mainstem" does not include named or unnamed tributaries.
(1a) "Public water system" means any unit of local government or large community water system subject to the requirements of G.S. 143-355(l).
(1b) "River basin" means any of the following river basins designated on the map entitled "Major River Basins and Sub-basins in North Carolina" and filed in the Office of the Secretary of State on 16 April 1991. The term "river basin" includes any portion of the river basin that extends into another state. Any area outside North Carolina that is not included in one of the river basins listed in this subdivision comprises a separate river basin.

a.	1-1	Broad River.
b.	2-1	Haw River.
c.	2-2	Deep River.
d.	2-3	Cape Fear River.
e.	2-4	South River.
f.	2-5	Northeast Cape Fear River.
g.	2-6	New River.
h.	3-1	Catawba River.
i.	3-2	South Fork Catawba River.
j.	4-1	Chowan River.
k.	4-2	Meherrin River.
l.	5-1	Nolichucky River.
m.	5-2	French Broad River.
n.	5-3	Pigeon River.
o.	6-1	Hiwassee River.
p.	7-1	Little Tennessee River.
q.	7-2	Tuskasegee (Tuckasegee) River.
r.	8-1	Savannah River.
s.	9-1	Lumber River.
t.	9-2	Big Shoe Heel Creek.
u.	9-3	Waccamaw River.
v.	9-4	Shallotte River.
w.	10-1	Neuse River.
x.	10-2	Contentnea Creek.
y.	10-3	Trent River.
z.	11-1	New River.
aa.	12-1	Albemarle Sound.
bb.	13-1	Ocoee River.
cc.	14-1	Roanoke River.
dd.	15-1	Tar River.
ee.	15-2	Fishing Creek.
ff.	15-3	Pamlico River and Sound.
gg.	16-1	Watauga River.
hh.	17-1	White Oak River.
ii.	18-1	Yadkin (Yadkin-Pee Dee) River.
jj.	18-2	South Yadkin River.
kk.	18-3	Uwharrie River.
ll.	18-4	Rocky River.

(2) "Surface water" means any of the waters of the State located on the land surface that are not derived by pumping from groundwater.

(3) "Transfer" means the withdrawal, diversion, or pumping of surface water from one river basin and discharge of all or any part of the water in a river basin different from the origin. However, notwithstanding the basin definitions in G.S. 143-215.22G(1b), the following are not transfers under this Part:

a. The discharge of water upstream from the point where it is withdrawn.

b. The discharge of water downstream from the point where it is withdrawn. (1991, c. 712, s. 1; 1993, c. 348, s. 1; 1997-443, s. 15.48(b); 2013-388, s. 1.)**§ 143-215.22L. Regulation of surface water transfers**.

(a) Certificate Required. - No person, without first obtaining a certificate from the Commission, may:

(1) Initiate a transfer of 2,000,000 gallons of water or more per day, calculated as a daily average of a calendar month and not to exceed 3,000,000 gallons per day in any one day, from one river basin to another.

(2) Increase the amount of an existing transfer of water from one river basin to another by twenty-five percent (25%) or more above the average daily amount transferred during the year ending 1 July 1993 if the total transfer including the increase is 2,000,000 gallons or more per day.

(3) Increase an existing transfer of water from one river basin to another above the amount approved by the Commission in a certificate issued under G.S. 162A-7 prior to 1 July 1993.

(b) Exception. - Notwithstanding the provisions of subsection (a) of this section, a certificate shall not be required to transfer water from one river basin to another up to the full capacity of a facility to transfer water from one basin to another if the facility was in existence or under construction on 1 July 1993.

(c) Notice of Intent to File a Petition. - An applicant shall prepare a notice of intent to file a petition that includes a nontechnical description of the applicant's request and an identification of the proposed water source. Within 90 days after the applicant files a notice of intent to file a petition, the applicant shall hold at least one public meeting in the source river basin upstream from the proposed point of withdrawal, at least one public meeting in the source river basin downstream from the proposed point of withdrawal, and at least one public meeting in the receiving river basin to provide information to interested parties and the public regarding the nature and extent of the proposed transfer and to receive comment on the scope of the environmental documents. Written notice of the public meetings shall be provided at least 30 days before the public meetings. At the time the applicant gives notice of the public meetings, the applicant shall request comment on the alternatives and issues that should be addressed in the environmental documents required by this section. The applicant shall accept written comment on the scope of the environmental documents for a minimum of 30 days following the last public meeting. Notice of the public meetings

and opportunity to comment on the scope of the environmental documents shall be provided as follows:

(1) By publishing notice in the North Carolina Register.

(2) By publishing notice in a newspaper of general circulation in:

a. Each county in this State located in whole or in part of the area of the source river basin upstream from the proposed point of withdrawal.

b. Each city or county located in a state located in whole or in part of the surface drainage basin area of the source river basin that also falls within, in whole or in part, the area denoted by one of the following eight-digit cataloging units as organized by the United States Geological Survey:

03050105 (Broad River: NC and SC);
03050106 (Broad River: SC);
03050107 (Broad River: SC);
03050108 (Broad River: SC);
05050001 (New River: NC and VA);
05050002 (New River: VA and WV);
03050101 (Catawba River: NC and SC);
03050103 (Catawba River: NC and SC);
03050104 (Catawba River: SC);
03010203 (Chowan River: NC and VA);
03010204 (Chowan River: NC and VA);
06010105 (French Broad River: NC and TN);
06010106 (French Broad River: NC and TN);
06010107 (French Broad River: TN);
06010108 (French Broad River: NC and TN);
06020001 (Hiwassee River: AL, GA, TN);
06020002 (Hiwassee River: GA, NC, TN);
06010201 (Little Tennessee River: TN);
06010202 (Little Tennessee River: TN, GA, and NC);
06010204 (Little Tennessee River: NC and TN);
03060101 (Savannah River: NC and SC);
03060102 (Savannah River: GA, NC, and SC);
03060103 (Savannah River: GA and SC);
03060104 (Savannah River: GA);
03060105 (Savannah River: GA);
03040203 (Lumber River: NC and SC);
03040204 (Lumber River: NC and SC);
03040206 (Lumber River: NC and SC);
03040207 (Lumber River: NC and SC);
03010205 (Albemarle Sound: NC and VA);
06020003 (Ocoee River: GA, NC, and TN);
03010101 (Roanoke River: VA);
03010102 (Roanoke River: NC and VA);
03010103 (Roanoke River: NC and VA);
03010104 (Roanoke River: NC and VA);

03010105 (Roanoke River: VA);
03010106 (Roanoke River: NC and VA);
06010102 (Watauga River: TN and VA);
06010103 (Watauga River: NC and TN);
03040101 (Yadkin River: VA and NC);
03040104 (Yadkin River: NC and SC);
03040105 (Yadkin River: NC and SC);
03040201 (Yadkin River: NC and SC);
03040202 (Yadkin River: NC and SC).

c. Each county in this State located in whole or in part of the area of the source river basin downstream from the proposed point of withdrawal.

d. Any area in the State in a river basin for which the source river basin has been identified as a future source of water in a local water supply plan prepared pursuant to G.S. 143-355(l).

e. Each county in the State located in whole or in part of the receiving river basin.

(3) By giving notice by first-class mail or electronic mail to each of the following:

a. The board of commissioners of each county in this State or the governing body of any county or city that is politically independent of a county in any state that is located entirely or partially within the source river basin of the proposed transfer and that also falls within, in whole or in part, the area denoted by one of the eight-digit cataloging units listed in sub-subdivision b. of subdivision (2) of this subsection.

b. The board of commissioners of each county in this State or the governing body of any county or city that is politically independent of a county in any state that is located entirely or partially within the receiving river basin of the proposed transfer and that also falls within, in whole or in part, the area denoted by one of the eight-digit cataloging units listed in sub-subdivision b. of subdivision (2) of this subsection.

c. The governing body of any public water system that withdraws water upstream or downstream from the withdrawal point of the proposed transfer.

d. If any portion of the source or receiving river basins is located in another state, all state water management or use agencies, environmental protection agencies, and the office of the governor in that state upstream or downstream from the withdrawal point of the proposed transfer.

e. All persons who have registered a water withdrawal or transfer from the proposed source river basin under this Part or under similar law in an another state.

f. All persons who hold a certificate for a transfer of water from the proposed source river basin under this Part or under similar law in an another state.

g. All persons who hold a National Pollutant Discharge Elimination System (NPDES) wastewater discharge permit for a discharge of 100,000 gallons per day or more upstream or downstream from the proposed point of withdrawal.

h. To any other person who submits to the applicant a written request to receive all notices relating to the petition.

(d) Environmental Documents. - Except as provided in this subsection, the definitions set out in G.S. 113A-9 apply to this section. Notwithstanding the thresholds for significant expenditure of public monies or use of public land set forth in G.S. 113A-9, the Department shall conduct a study of the environmental impacts of any proposed transfer of water for which a certificate is required under this section. The study shall meet all of the requirements set forth in G.S. 113A-4 and rules adopted pursuant to G.S. 113A-4. Notwithstanding G.S. 113A-4(2), the study shall include secondary and cumulative impacts. An environmental assessment shall be prepared for any petition for a certificate under this section. The determination of whether an environmental impact statement shall also be required shall be made in accordance with the provisions of Article 1 of Chapter 113A of the General Statutes; except that an environmental impact statement shall be prepared for every proposed transfer of water from one major river basin to another for which a certificate is required under this section. The applicant who petitions the Commission for a certificate under this section shall pay the cost of special studies necessary to comply with Article 1 of Chapter 113A of the General Statutes. An environmental impact statement prepared pursuant to this subsection shall include all of the following:

(1) A comprehensive analysis of the impacts that would occur in the source river basin and the receiving river basin if the petition for a certificate is granted.

(2) An evaluation of alternatives to the proposed interbasin transfer, including water supply sources that do not require an interbasin transfer and use of water conservation measures.

(3) A description of measures to mitigate any adverse impacts that may arise from the proposed interbasin transfer.

(e) Public Hearing on the Draft Environmental Document. - The Commission shall hold a public hearing on the draft environmental document for a proposed interbasin transfer after giving at least 30 days' written notice of the hearing in the Environmental Bulletin and as provided in subdivisions (2) and (3) of subsection (c) of this section. The notice shall indicate where a copy of the environmental document can be reviewed and the procedure to be followed by anyone wishing to submit written comments and questions on the environmental document. The Commission shall prepare a record of all comments and written responses to questions posed in writing. The record shall include complete copies of scientific or technical comments related to the potential impact of the interbasin transfer. The Commission shall accept written comment on the draft environmental document for a minimum of 30 days following the last public hearing. The applicant who petitions the

Commission for a certificate under this section shall pay the costs associated with the notice and public hearing on the draft environmental document.

(f) Determination of Adequacy of Environmental Document. - The Commission shall not act on any petition for an interbasin transfer until the Commission has determined that the environmental document is complete and adequate. A decision on the adequacy of the environmental document is subject to review in a contested case on the decision of the Commission to issue or deny a certificate under this section.

(g) Petition. - An applicant for a certificate shall petition the Commission for the certificate. The petition shall be in writing and shall include all of the following:

(1) A general description of the facilities to be used to transfer the water, including current and projected areas to be served by the transfer, current and projected capacities of intakes, and other relevant facilities.

(2) A description of all the proposed consumptive and nonconsumptive uses of the water to be transferred.

(3) A description of the water quality of the source river and receiving river, including information on aquatic habitat for rare, threatened, and endangered species; in-stream flow data for segments of the source and receiving rivers that may be affected by the transfer; and any waters that are impaired pursuant to section 303(d) of the federal Clean Water Act (33 U.S.C. § 1313(d)).

(4) A description of the water conservation measures used by the applicant at the time of the petition and any additional water conservation measures that the applicant will implement if the certificate is granted.

(5) A description of all sources of water within the receiving river basin, including surface water impoundments, groundwater wells, reinjection storage, and purchase of water from another source within the river basin, that is a practicable alternative to the proposed transfer that would meet the applicant's water supply needs. The description of water sources shall include sources available at the time of the petition for a certificate and any planned or potential water sources.

(6) A description of water transfers and withdrawals registered under G.S. 143-215.22H or included in a local water supply plan prepared pursuant to G.S. 143-355(l) from the source river basin, including transfers and withdrawals at the time of the petition for a certificate and any planned or reasonably foreseeable transfers or withdrawals by a public water system with service area located within the source river basin.

(7) A demonstration that the proposed transfer, if added to all other transfers and withdrawals required to be registered under G.S. 143-215.22H or included in any local water supply plan prepared by a public water system with service area located within the source basin pursuant to G.S. 143-355(l) from the source river basin at the time of the petition for a certificate, would not reduce the amount of water available for use in the

source river basin to a degree that would impair existing uses, pursuant to the antidegradation policy set out in 40 Code of Federal Regulation § 131.12 (Antidegradation Policy) (1 July 2006 Edition) and the statewide antidegradation policy adopted pursuant thereto, or existing and planned consumptive and nonconsumptive uses of the water in the source river basin. If the proposed transfer would impact a reservoir within the source river basin, the demonstration must include a finding that the transfer would not result in a water level in the reservoir that is inadequate to support existing uses of the reservoir, including recreational uses.

(8) The applicant's future water supply needs and the present and reasonably foreseeable future water supply needs for public water systems with service area located within the source river basin. The analysis of future water supply needs shall include agricultural, recreational, and industrial uses, and electric power generation. Local water supply plans prepared pursuant to G.S. 143-355(l) for water systems with service area located within the source river basin shall be used to evaluate the projected future water needs in the source river basin that will be met by public water systems.

(9) The applicant's water supply plan prepared pursuant to G.S. 143-355(l). If the applicant's water supply plan is more than two years old at the time of the petition, then the applicant shall include with the petition an updated water supply plan.

(10) Any other information deemed necessary by the Commission for review of the proposed water transfer.

(h) Settlement Discussions. - Upon the request of the applicant, any interested party, or the Department, or upon its own motion, the Commission may appoint a mediation officer. The mediation officer may be a member of the Commission, an employee of the Department, or a neutral third party but shall not be a hearing officer under subsections (e) or (j) of this section. The mediation officer shall make a reasonable effort to initiate settlement discussions between the applicant and all other interested parties. Evidence of statements made and conduct that occurs in a settlement discussion conducted under this subsection, whether attributable to a party, a mediation officer, or other person shall not be subject to discovery and shall be inadmissible in any subsequent proceeding on the petition for a certificate. The Commission may adopt rules to govern the conduct of the mediation process.

(i) Draft Determination. - Within 90 days after the Commission determines that the environmental document prepared in accordance with subsection (d) of this section is adequate or the applicant submits its petition for a certificate, whichever occurs later, the Commission shall issue a draft determination on whether to grant the certificate. The draft determination shall be based on the criteria set out in this section and shall include the conditions and limitations, findings of fact, and conclusions of law that would be required in a final determination. Notice of the draft determination shall be given as provided in subsection (c) of this section.

(j) Public Hearing on the Draft Determination. - Within 60 days of the issuance of the draft determination as provided in subsection (i) of this section, the Commission shall hold

public hearings on the draft determination. At least one hearing shall be held in the affected area of the source river basin, and at least one hearing shall be held in the affected area of the receiving river basin. In determining whether more than one public hearing should be held within either the source or receiving river basins, the Commission shall consider the differing or conflicting interests that may exist within the river basins, including the interests of both upstream and downstream parties potentially affected by the proposed transfer. The public hearings shall be conducted by one or more hearing officers appointed by the Chair of the Commission. The hearing officers may be members of the Commission or employees of the Department. The Commission shall give at least 30 days' written notice of the public hearing as provided in subsection (c) of this section. The Commission shall accept written comment on the draft determination for a minimum of 30 days following the last public hearing. The Commission shall prepare a record of all comments and written responses to questions posed in writing. The record shall include complete copies of scientific or technical comments related to the potential impact of the interbasin transfer. The applicant who petitions the Commission for a certificate under this section shall pay the costs associated with the notice and public hearing on the draft determination.

(k) Final Determination: Factors to be Considered. - In determining whether a certificate may be issued for the transfer, the Commission shall specifically consider each of the following items and state in writing its findings of fact and conclusions of law with regard to each item:

(1) The necessity and reasonableness of the amount of surface water proposed to be transferred and its proposed uses.

(2) The present and reasonably foreseeable future detrimental effects on the source river basin, including present and future effects on public, industrial, economic, recreational, and agricultural water supply needs, wastewater assimilation, water quality, fish and wildlife habitat, electric power generation, navigation, and recreation. Local water supply plans for public water systems with service area located within the source river basin prepared pursuant to G.S. 143-355(l) shall be used to evaluate the projected future water needs in the source river basin that will be met by public water systems. Information on projected future water needs for public water systems with service area located within the source river basin that is more recent than the local water supply plans may be used if the Commission finds the information to be reliable. The determination shall include a specific finding as to measures that are necessary or advisable to mitigate or avoid detrimental impacts on the source river basin.

(3) The cumulative effect on the source major river basin of any water transfer or consumptive water use that, at the time the Commission considers the petition for a certificate is occurring, is authorized under this section, or is projected in any local water supply plan for public water systems with service area located within the source river basin that has been submitted to the Department in accordance with G.S. 143-355(l).

(4) The present and reasonably foreseeable future beneficial and detrimental effects on the receiving river basin, including present and future effects on public, industrial, economic, recreational, and agricultural water supply needs, wastewater assimilation, water

quality, fish and wildlife habitat, electric power generation, navigation, and recreation. Local water supply plans prepared pursuant to G.S. 143-355(l) that affect the receiving river basin shall be used to evaluate the projected future water needs in the receiving river basin that will be met by public water systems. Information on projected future water needs that is more recent than the local water supply plans may be used if the Commission finds the information to be reliable. The determination shall include a specific finding as to measures that are necessary or advisable to mitigate or avoid detrimental impacts on the receiving river basin.

(5) The availability of reasonable alternatives to the proposed transfer, including the potential capacity of alternative sources of water, the potential of each alternative to reduce the amount of or avoid the proposed transfer, probable costs, and environmental impacts. In considering alternatives, the Commission is not limited to consideration of alternatives that have been proposed, studied, or considered by the applicant. The determination shall include a specific finding as to why the applicant's need for water cannot be satisfied by alternatives within the receiving basin, including unused capacity under a transfer for which a certificate is in effect or that is otherwise authorized by law at the time the applicant submits the petition. The determination shall consider the extent to which access to potential sources of surface water or groundwater within the receiving river basin is no longer available due to depletion, contamination, or the declaration of a capacity use area under Part 2 of Article 21 of Chapter 143 of the General Statutes. The determination shall consider the feasibility of the applicant's purchase of water from other water suppliers within the receiving basin and of the transfer of water from another sub-basin within the receiving major river basin. Except in circumstances of technical or economic infeasibility or adverse environmental impact, the Commission's determination as to reasonable alternatives shall give preference to alternatives that would involve a transfer from one sub-basin to another within the major receiving river basin over alternatives that would involve a transfer from one major river basin to another major river basin.

(6) If applicable to the proposed project, the applicant's present and proposed use of impoundment storage capacity to store water during high-flow periods for use during low-flow periods and the applicant's right of withdrawal under G.S. 143-215.44 through G.S. 143-215.50.

(7) If the water to be withdrawn or transferred is stored in a multipurpose reservoir constructed by the United States Army Corps of Engineers, the purposes and water storage allocations established for the reservoir at the time the reservoir was authorized by the Congress of the United States.

(8) Whether the service area of the applicant is located in both the source river basin and the receiving river basin.

(9) Any other facts and circumstances that are reasonably necessary to carry out the purposes of this Part.

(l) Final Determination: Information to be Considered. - In determining whether a certificate may be issued for the transfer, the Commission shall consider all of the following sources of information:

(1) The petition.

(2) The environmental document prepared pursuant to subsection (d) of this section.

(3) All oral and written comment and all accompanying materials or evidence submitted pursuant to subsections (e) and (j) of this section.

(4) Information developed by or available to the Department on the water quality of the source river basin and the receiving river basin, including waters that are identified as impaired pursuant to section 303(d) of the federal Clean Water Act (33 U.S.C. § 1313(d)), that are subject to a total maximum daily load (TMDL) limit under subsections (d) and (e) of section 303 of the federal Clean Water Act, or that would have their assimilative capacity impaired if the certificate is issued.

(5) Any other information that the Commission determines to be relevant and useful.

(m) Final Determination: Burden and Standard of Proof; Specific Findings. - The Commission shall grant a certificate for a water transfer if the Commission finds that the applicant has established by a preponderance of the evidence all of the following:

(1) The benefits of the proposed transfer outweigh the detriments of the proposed transfer. In making this determination, the Commission shall be guided by the approved environmental document and the policy set out in subsection (t) of this section.

(2) The detriments have been or will be mitigated to the maximum degree practicable.

(3) The amount of the transfer does not exceed the amount of the projected shortfall under the applicant's water supply plan after first taking into account all other sources of water that are available to the applicant.

(4) There are no reasonable alternatives to the proposed transfer.

(n) Final Determination: Certificate Conditions and Limitations. - The Commission may grant the certificate in whole or in part, or deny the certificate. The Commission may impose any conditions or limitations on a certificate that the Commission finds necessary to achieve the purposes of this Part including a limit on the period for which the certificate is valid. The conditions and limitations shall include any mitigation measures proposed by the applicant to minimize any detrimental effects within the source and receiving river basins. In addition, the certificate shall require all of the following conditions and limitations:

(1) A water conservation plan that specifies the water conservation measures that will be implemented by the applicant in the receiving river basin to ensure the efficient use of

the transferred water. Except in circumstances of technical or economic infeasibility or adverse environmental impact, the water conservation plan shall provide for the mandatory implementation of water conservation measures by the applicant that equal or exceed the most stringent water conservation plan implemented by a public water system that withdraws water from the source river basin.

(2) A drought management plan that specifies how the transfer shall be managed to protect the source river basin during drought conditions or other emergencies that occur within the source river basin. Except in circumstances of technical or economic infeasibility or adverse environmental impact, this drought management plan shall include mandatory reductions in the permitted amount of the transfer based on the severity and duration of a drought occurring within the source river basin and shall provide for the mandatory implementation of a drought management plan by the applicant that equals or exceeds the most stringent water conservation plan implemented by a public water system that withdraws water from the source river basin.

(3) The maximum amount of water that may be transferred, calculated as a daily average of a calendar month, and methods or devices required to be installed and operated that measure the amount of water that is transferred.

(4) A provision that the Commission may amend a certificate to reduce the maximum amount of water authorized to be transferred whenever it appears that an alternative source of water is available to the certificate holder from within the receiving river basin, including, but not limited to, the purchase of water from another water supplier within the receiving basin or to the transfer of water from another sub-basin within the receiving major river basin.

(5) A provision that the Commission shall amend the certificate to reduce the maximum amount of water authorized to be transferred if the Commission finds that the applicant's current projected water needs are significantly less than the applicant's projected water needs at the time the certificate was granted.

(6) A requirement that the certificate holder report the quantity of water transferred during each calendar quarter. The report required by this subdivision shall be submitted to the Commission no later than 30 days after the end of the quarter.

(7) Except as provided in this subdivision, a provision that the applicant will not resell the water that would be transferred pursuant to the certificate to another public water system. This limitation shall not apply in the case of a proposed resale or transfer among public water systems within the receiving river basin as part of an interlocal agreement or other regional water supply arrangement, provided that each participant in the interlocal agreement or regional water supply arrangement is a co-applicant for the certificate and will be subject to all the terms, conditions, and limitations made applicable to any lead or primary applicant.

(o) Administrative and Judicial Review. - Administrative and judicial review of a final decision on a petition for a certificate under this section shall be governed by Chapter 150B of the General Statutes.

(p) Certain Preexisting Transfers. - In cases where an applicant requests approval to increase a transfer that existed on 1 July 1993, the Commission may approve or disapprove only the amount of the increase. If the Commission approves the increase, the certificate shall be issued for the amount of the preexisting transfer plus any increase approved by the Commission. A certificate for a transfer approved by the Commission under G.S. 162A-7 shall remain in effect as approved by the Commission and shall have the same effect as a certificate issued under this Part. A certificate for the increase of a preexisting transfer shall contain all of the conditions and limitations required by subsection (m) of this section.

(q) Emergency Transfers. - In the case of water supply problems caused by drought, a pollution incident, temporary failure of a water plant, or any other temporary condition in which the public health, safety, or welfare requires a transfer of water, the Secretary of Environmental Quality may grant approval for a temporary transfer. Prior to approving a temporary transfer, the Secretary shall consult with those parties listed in subdivision (3) of subsection (c) of this section that are likely to be affected by the proposed transfer. However, the Secretary shall not be required to satisfy the public notice requirements of this section or make written findings of fact and conclusions of law in approving a temporary transfer under this subsection. If the Secretary approves a temporary transfer under this subsection, the Secretary shall specify conditions to protect other water users. A temporary transfer shall not exceed six months in duration, but the approval may be renewed for a period of six months by the Secretary based on demonstrated need as set forth in this subsection.

(r) Relationship to Federal Law. - The substantive restrictions, conditions, and limitations upon surface water transfers authorized in this section may be imposed pursuant to any federal law that permits the State to certify, restrict, or condition any new or continuing transfers or related activities licensed, relicensed, or otherwise authorized by the federal government. This section shall govern the transfer of water from one river basin to another unless preempted by federal law.

(s) Planning Requirements. - When any transfer for which a certificate was issued under this section equals or exceeds eighty percent (80%) of the maximum amount authorized in the certificate, the applicant shall submit to the Department a detailed plan that specifies how the applicant intends to address future foreseeable water needs. If the applicant is required to have a local water supply plan, then this plan shall be an amendment to the local water supply plan required by G.S.143-355(l). When the transfer equals or exceeds ninety percent (90%) of the maximum amount authorized in the certificate, the applicant shall begin implementation of the plan submitted to the Department.

(t) Statement of Policy. - It is the public policy of the State to maintain, protect, and enhance water quality within North Carolina. It is the public policy of this State that the reasonably foreseeable future water needs of a public water system with its service area

located primarily in the receiving river basin are subordinate to the reasonably foreseeable future water needs of a public water system with its service area located primarily in the source river basin. Further, it is the public policy of the State that the cumulative impact of transfers from a source river basin shall not result in a violation of the antidegradation policy set out in 40 Code of Federal Regulations § 131.12 (1 July 2006 Edition) and the statewide antidegradation policy adopted pursuant thereto.

(u) Repealed by Session Laws 2013-388, s. 2, effective August 23, 2013.

(v) Modification of Certificate. - A certificate may be modified as provided in this subsection:

(1) The Commission or the Department may make any of the following modifications to a certificate after providing electronic notice to persons who have identified themselves in writing as interested parties:

a. Correction of typographical errors.

b. Clarification of existing conditions or language.

c. Updates, requested by the certificate holder, to a conservation plan, drought management plan, or compliance and monitoring plan.

d. Modifications requested by the certificate holder to reflect altered requirements due to the amendment of this section.

(2) A person who holds a certificate for an interbasin transfer of water may request that the Commission modify the certificate. The request shall be considered and a determination made according to the following procedures:

a. The certificate must have been issued pursuant to G.S. 162A-7, 143-215.22I, or 143-215.22L and the certificate holder must be in substantial compliance with the certificate.

b. The certificate holder shall file a notice of intent to file a request for modification that includes a nontechnical description of the certificate holder's request and identification of the proposed water source.

c. The certificate holder shall prepare an environmental document pursuant to subsection (d) of this section, except that an environmental impact statement shall not be required for the modification of a certificate unless it would otherwise be required by Article 1 of Chapter 113A of the General Statutes.

d. Upon determining that the documentation submitted by the certificate holder is adequate to satisfy the requirements of this subsection, the Department shall publish a notice of the request for modification in the North Carolina Register and shall hold a public hearing at a location convenient to both the source and receiving river basins. The

Department shall provide written notice of the request for the modification and the public hearing in the Environmental Bulletin, a newspaper of general circulation in the source river basin, a newspaper of general circulation in the receiving river basin, and as provided in subdivision (3) of subsection (c) of this section. The certificate holder who petitions the Commission for a modification under this subdivision shall pay the costs associated with the notice and public hearing.

e. The Department shall accept comments on the requested modification for a minimum of 30 days following the public hearing.

f. The Commission or the Department may require the certificate holder to provide any additional information or documentation it deems reasonably necessary in order to make a final determination.

g. The Commission shall make a final determination whether to grant the requested modification based on the factors set out in subsection (k) of this section, information provided by the certificate holder, and any other information the Commission deems relevant. The Commission shall state in writing its findings of fact and conclusions of law with regard to each factor.

h. The Commission shall grant the requested modification if it finds that the certificate holder has established by a preponderance of the evidence that the requested modification satisfies the requirements of subsection (m) of this section. The Commission may grant the requested modification in whole or in part, or deny the request, and may impose such limitations and conditions on the modified certificate as it deems necessary and relevant to the modification.

i. The Commission shall not grant a request for modification if the modification would result in the transfer of water to an additional major river basin.

j. The Commission shall not grant a request for modification if the modification would be inconsistent with the December 3, 2010 Settlement Agreement entered into between the State of North Carolina, the State of South Carolina, Duke Energy Carolinas, and the Catawba River Water Supply Project.

(w) Requirements for Coastal Counties and Reservoirs Constructed by the United States Army Corps of Engineers. - A petition for a certificate (i) to transfer surface water to supplement ground water supplies in the 15 counties designated as the Central Capacity Use Area under 15A NCAC 2E.0501, (ii) to transfer surface water withdrawn from the mainstem of a river to provide service to one of the coastal area counties designated pursuant to G.S. 113A-103, or (iii) to withdraw or transfer water stored in any multipurpose reservoir constructed by the United States Army Corps of Engineers and partially located in a state adjacent to North Carolina, provided the United States Army Corps of Engineers approved the withdrawal or transfer on or before July 1, 2014, shall be considered and a determination made according to the following procedures:

(1) The applicant shall file a notice of intent that includes a nontechnical description of the applicant's request and identification of the proposed water source.

(2) The applicant shall prepare an environmental document pursuant to subsection (d) of this section, except that an environmental impact statement shall not be required unless it would otherwise be required by Article 1 of Chapter 113A of the General Statutes.

(3) Upon determining that the documentation submitted by the applicant is adequate to satisfy the requirements of this subsection, the Department shall publish a notice of the petition in the North Carolina Register and shall hold a public hearing at a location convenient to both the source and receiving river basins. The Department shall provide written notice of the petition and the public hearing in the Environmental Bulletin, a newspaper of general circulation in the source river basin, a newspaper of general circulation in the receiving river basin, and as provided in subdivision (3) of subsection (c) of this section. The applicant who petitions the Commission for a certificate under this subdivision shall pay the costs associated with the notice and public hearing.

(4) The Department shall accept comments on the petition for a minimum of 30 days following the public hearing.

(5) The Commission or the Department may require the applicant to provide any additional information or documentation it deems reasonably necessary in order to make a final determination.

(6) The Commission shall make a final determination whether to grant the certificate based on the factors set out in subsection (k) of this section, information provided by the applicant, and any other information the Commission deems relevant. The Commission shall state in writing its findings of fact and conclusions of law with regard to each factor.

(7) The Commission shall grant the certificate if it finds that the applicant has established by a preponderance of the evidence that the petition satisfies the requirements of subsection (m) of this section. The Commission may grant the certificate in whole or in part, or deny the request, and may impose such limitations and conditions on the certificate as it deems necessary and relevant. (1993, c. 348, s. 1; 1997-443, ss. 11A.119(a), 15.48(c); 1997-524, s. 1; 1998-168, s. 4; 2001-474, s. 28; 2007-484, s. 43.7C; 2007-518, s. 3; 2008-125, s. 1; 2008-198, s. 11.5; 2010-155, ss. 2, 3; 2011-398, s. 50; 2013-388, s. 2; 2014-120, s. 37; 2015-90, s. 7; 2015-241, s. 14.30(v).)

9 Appendix D Drought Contingency Plan

B. Everett Jordan Dam and Lake

Cape Fear River Basin, NC

DROUGHT CONTINGENCY PLAN
Updated May 2008

B. EVERETT JORDAN LAKE
CAPE FEAR RIVER BASIN, NORTH CAROLINA
DROUGHT CONTINGENCY PLAN Updated May 2008

INTRODUCTION

The purpose of this report is to (1) provide a platform from which to make decisions on implementation of water conservation measures during future droughts, (2) review the operational flexibility of the Jordan Water Control Plan in a drought, and (3) address the potential problems associated with an extreme drought. A severe drought in the Cape Fear River basin develops over a fairly long period of time and may have a typical duration of 6-12 months. However, the severe drought which climaxed in 2002 may have begun as early as 1996. Adequate time will be available to plan specific details of a drought operation. Therefore, this plan is an outline of water management measures and coordination actions to be considered when a severe drought occurs. Details of particular water management measures and the timing of their application will be determined as the drought progresses. This plan is part of the Water Control Manual for B. Everett Jordan Dam and Lake.

BACKGROUND

Usually, the demand for water is the greatest when the natural supply is the least. Jordan Lake has been drawn below elevation 210 feet, MSL on four separate occasions since completion of permanent impoundment on February 4, 1982. (Normal level is 216 ft, MSL). During this time period, no water supply withdrawals were made. The only releases were for water quality needs downstream. Table 1 shows the minimum lake elevation for each year since inception of the project.

These elevations indicate that the 1980's decade was a dry period. The potential for a serious drought did exist in 1983, 1986, and 1988 due to the time of year and the minimum elevation that occurred.

TABLE 1

Minimum Elevation at Jordan Lake since Permanent Impoundment

Calendar Year	Date	Elevation (ft. MSL)
1982	September 28	213.95
1983	October 23	208.85
1984	November 28	212.55
1985	November 3	213.25
1986	November 12	207.85
1987	November 26	210.60
1988	August 29	210.23
1989	September 16	215.63
1990	October 10	209.59
1991	December 26	212.69
1992	October 29	213.80
1993	November 26	210.80
1994	October 13	214.75
1995	August 26	214.87
1996	July 23	215.18
1997	October 18	213.65
1998	December 8	210.31
1999	August 24	212.56
2000	December 15	212.95
2001	December 31	210.89
2002	August 24	209.87
2003	September 14	215.88
2004	March 22	215.76
2005	November 20	212.13
2006	August 30	215.34
2007	October 24	210.19

Historical surface water use(in 1987) by municipalities and industries downstream of Jordan Dam as tabulated by the U. S. Geological Survey is provided in table 2. This table illustrates that the required water supply is signifigant and will likely continue to increase.

Cape Fear River Basin Water Supply Users below Jordan Dam

Municipality	Source of Supply	Amount of Withdrawal MGD	Population (1987) Served
Vass	Little River	0.14	900
Carthage	Nicks Creek	0.26	1,500
Sanford	Cape Fear River	3.34	18,000
Northeast Metro Water District (Harnett Co.)	Cape Fear River	0.75	5,000
Dunn	Cape Fear River	2.35	9,450
Fayetteville	Cape Fear River	16.25	118,604
Fort Bragg	Little River	7.94	121,828
Wilmington	Cape Fear River	9.72	52,000

Industry	Source of Supply	Average Annual Withdrawal in MGD(1987)
Chembond Corp.	Haw River	0.22
Honeywell	Haw River	0.32
Moncure Fiberboard Plant	Shaddox Creek	0.34
Sanford Group	Several Ponds	0.08
Elliott Gravel Pit	Several Ponds	0.20
Burlington Industries Erwin Plant	Cape Fear River	2.0
Dupont (Cumberland Co.)	Cape Fear River	9.0
Monsanto (Cumberland Co.)	Cape Fear River	1.3
Cape Fear Feed Products	Cape Fear River	0.05
Federal Paper Board Co.	Cape Fear River	43.25
Wright Chemical Corp	Livingston Creek	0.2
Dupont (Brunswick Co.)	Cape Fear River	7.3
Occidental Chemical Corp.	Cape Fear River	0.29
Dixie Cement	Cape Fear River (2 intakes)	1.2

Lake access is available during periods of low lake levels. This is illustrated in table 3 which gives the bottom elevation of boat ramps at current and future access areas. The top elevation of boat ramps at Jordan Lake is approximately 227 feet MSL. However, operational experience during this period showed that recreational use of the lake began to suffer once the elevation fell below 212-213 feet MSL. Numerous complaints were received at both the Resource Manager's Office and Crosswinds Marina during low elevation periods primarily regarding shoals and navigational hazards within the lake. While the facilities at Crosswinds Marina were designed to function at elevations lower than what occurred, there was very little recreational use observed when Jordan Lake fell below elevation 212 feet MSL. While recreational use of the lake is significantly impacted at elevation 212 feet MSL and below, serious problems are also encountered at Crosswinds Marina once the elevation drops to 205.0 MSL. The problem at Crosswinds Marina is the bracings on the finger pier system which require

approximately 6 feet of water to remain in place.

TABLE 3
Bottom Elevation of Public Boat Ramps at Jordan Lake
May 2008

Location	Lanes	Bottom of Ramp Elevation (ft. MSL)
Access Currently Available:		
Ebenezer	2 Lanes	202.0
	4 Lanes	206.0
Vista Point	2 Lanes	202.0
	2 Lanes	206.0
Parkers Creek	2 Lanes	210.0
Farrington	2 Lanes	202.0
	2 Lanes	206.0
	2 Lanes	208.0
Crosswinds Ramp	4 Lanes	212.0
	2 Lanes	202.0
Crosswinds Marina	2 Lanes	202.0
	2 Lanes	208.0
Poes Ridge	4 Lanes	210.0
Poplar Point	4 Lanes	210.0
Seaforth	3 Lanes	205.0
	3 Lanes	210.0
Crosswinds Campground	2 Lanes	207.0
Robeson Creek	2 Lanes	202.0
New Hope Overlook	2 Lanes	202.0
	4 Lanes	208.0

Note: All boat ramps were constructed prior to impoundment of Jordan Lake. The top elevation of all ramps is approximately 227 feet, MSL.

SUMMARY OF EXISTING WATER CONTROL PLAN

The authorized purposes of Jordan Lake are to provide for flood control, water supply, water quality control, recreation, and fish and wildlife conservation. The top of the conservation pool is at elevation 216.0 feet MSL. At that elevation, the mean depth of the lake is 15 feet and the maximum depth is about 66 feet. Allocated storages for Jordan Lake are shown in table 4.

Storage Allocation

	Elevation (Ft. MSL)	Area (Ac.)	Capacity/Jun85 (Ac-Ft)
Top of flood control pool	240	31,811	753,560
Flood control storage	216-240		538,430
Top of conservation pool	216	13,942	215,130
Bottom of conservation pool	202	6,658	74,700
Conservation pool storage	202-216		140,430
Water Supply			45,810
Water Quality (Low Flow)			94,620
Sediment storage	155-202		74,700

The plan of operation for Jordan Lake project provides for maintaining a normal pool at elevation 216 feet MSL on a year round basis. This is accomplished during periods of normal flow by releasing inflow. During flood periods, releases are based on a combination of downstream flow conditions and lake levels to minimize flood damages downstream. During normal and low-flow conditions, flows are released to maintain a minimum target flow of 600 cubic feet per second (c.f.s.) at the Lillington gage with an allowable range of 550 to 650 c.f.s.. A minimum instantaneous flow of 40 c.f.s. is maintained immediately below the dam. The conservation pool storage is divided with 67.38 percent allocated for water quality releases downstream and 32.62 percent contracted by the State of North Carolina for water supply.

Regulation flexibility is very limited under existing authority. When the lake elevation is in the conservation pool, the project will be operated to meet water supply requirements and water quality low flow releases. The only available flexibility from a regulation viewpoint in this situation would be that the State of North Carolina water quality release requirements and/or water supply withdrawals.

Storage-use flexibility between the conservation and flood control pools is not a viable option within the guidelines authorizing the project. Flexibility within the conservation pool between water supply and water quality would have to be initiated and addressed by the State of North Carolina.

ANALYSIS OF DROUGHT OPERATION

Dry periods occur randomly during any time period. There is no major indicator to distinguish "normal" dry periods from severe droughts during the early stages. Conditions may vary depending on the time of year, length of time the lake is below elevation 216 feet MSL, and water supply and water quality requirements. However, a water budget (which will be generated and maintained by the Wilmington District) outlining water quality and water supply storage remaining will be used to initiate action.

The Drought Management Committee shall consist of the Wilmington District and other Federal agencies as required. Advisors to the committee will be representatives from the State of North Carolina and local governments. Coordination activities shall include but not be limited to initiation of the Drought Contingency Plan, alerting recreation interests within the lake, issuing forecasts of water supply and water quality storage remaining, implementing conservation measures, and making public information releases.

The Division of Water Resources with the Department of Environment and Natural Resources will act as the point of contact for the State of North Carolina, and as the responsible party for notifying all related concerned interests. The Operations Manager for Jordan Lake will be responsible for notifying all related concerned interests within the lake (marina operation, recreation use areas, etc.) of the current status, forecast of drawdown and for performing duties in conjunction with state agencies as described in the "Operational Management Plan" for B. Everett Jordan Lake. Wilmington District Water Management personnel shall prepare a water budget consisting of water supply, water quality storage remaining and a forecast of time remaining at the current usage rate for water quality and water supply. This forecast and water budget shall be updated as needed and furnished to the Operations Manager at Jordan Lake and the Director of Water Resources with the State.

Public press releases shall be made on an "as-needed" basis through the Public Affairs Office (PAO) in the Wilmington District. These statements shall provide the public with a full explanation of drought operations and forecasts of expected conditions in an effort to reduce inquiries from recreation and concerned interests.

A drought situation report for Jordan and other projects within the Wilmington District shall be prepared as appropriate by the Reservoir Regulation Section of the Wilmington District. This report shall provide detailed information on current and forecast situations for informational purposes of District and South Atlantic Division elements.

DROUGHT MANAGEMENT PLAN

This plan may be initiated by the Chief, Coastal, Hydrology and Hydraulics Section of the Wilmington District Corps of Engineers when the elevation at Jordan is below 216 ft., MSL. The Drought Management Plan focuses on waters contained in the conservation pool (202-216 ft, MSL) of Jordan Lake. The said conservation pool contains water to meet congressionally approved water supply and water quality purposes. The Drought Management Plan emphasizes increased coordination and consultation with stakeholders when either water supply or water quality pool storage declines to 80 percent remaining. Due to capacity and outflow requirements, the water quality pool is the controlling entity in management of drought releases.

The Drought Management Committee shall consist of the Wilmington District and other

The drought release schedule from Jordan Dam is listed in table 5 below.

Table 5: Drought Release Schedule

Drought Level	Water Quality Storage Remaining (%)	Jordan Dam Minimum Release* (cfs)	Jordan Dam Maximum Release (cfs)	Lillington Daily Average Flow Target (cfs)
0	>= 80	40+	600	600 +/- 50
1	60 – 80	40+	Lillington target	450 - 600 +/- 50
2	40 – 60	40+	Lillington target	300 - 450 +/- 50
3	20 – 40	40+	200+ *	None**
4	0 – 20	40+	100-200+ *	None**

* Water quality release plus any required downstream water supply releases.
** Lillington flow will be total of Jordan Dam release plus local inflow.

1. A water budget shall be initiated by the Wilmington District (retroactive to the date that the lake first dropped below elevation 216.0 feet MSL). The State of North Carolina shall be updated by the Wilmington District, U.S. Army Corps of Engineers, on a weekly basis regarding water quality and water supply storage remaining. Based on the budget and storage remaining the following operations from BE Jordan Dam and Lake will be taken:

A. Drought level 0: flow target at Lillington remains at 600 +/- 50 cfs
B. Drought level 1: flow target at Lillington ranges from 450 – 600 +/- 50 cfs
C. Drought level 2: flow target at Lillington ranges from 300 – 450 +/- 50 cfs
D. Drought level 3: no flow target set at Lillington. A maximum release rate of 200 cfs from BE Jordan Dam and Lake, plus any required downstream water supply releases.
E. Drought level 4: no flow target set at Lillington. A maximum release rate of 100-200 cfs from BE Jordan Dam and Lake, plus any required downstream water supply releases

Note that for drought levels 0-2, the flow target is a range of flow targets at Lillington. The range of flows result from collaboration and coordination on a variety of parameters such as stakeholder input, short and long term weather outlook, project gate status, influences on stream flows downstream, and local inflows to both Jordan Lake and reaches below the dam. In addition the minimal flows immediately below B. Everett Jordan Dam and Lake is 40 cfs for all drought levels.

Note that for drought level 3 – 4, no flow target is set for Lillington. The flow rate is a mostly constant release set from B. Everett Jordan Dam and Lake. Level 4 releases between 100-200 c.f.s. will be set based on consultation with the state of NC and other stakeholders. Temporary reductions can be made as long as flows at Lillington can be maintained at 300 c.f.s. or greater.

For all release modes listed, in table 5 above, the release operation will be made for a minimum of seven (7) days in conjunction with the monitoring of the river system, made by NCDWQ and other agencies.

Conversely, with increasing water quality storage, the sequence of operation will generally be reversed; however, consideration of limited watershed inflows, precipitation forecasts, or other factors with appropriate stakeholder consultation may warrant continued reduced flow targets at Lillington.

2. Once drought level 4 has passed and no water quality storage remains, the plan of action will depend on decisions that must be made by the State of North Carolina, since all storage within the conservation pool at Jordan Lake has been allocated to water supply and water quality. Potential alternatives available to the State of North Carolina once drought level 4 of the management plan has been met include, but are not limited to, the following:

a. Implement restrictive water use measures for personal and emergency use only (no water for lawns, gardens, pools, car washes, etc.)

b. Temporarily relax State standards for water quality requirements in the river below Jordan Lake to permit continued operation of industrial and municipal waste treatment facilities, and conserve remaining water quality storage.

c. Reallocate any surplus water supply storage for the duration of the drought to supplement water quality storage and/or provide relief in those areas of greatest need.

3. Should the elevation of Jordan Lake fall below lake elevation 202 ft, MSL or all water supply or water quality storage become depleted, potential alternatives include but are not limited to:

a. Emergency reallocation(s) by the Corps under PL 78-534 of remaining storage volume within the Sediment Pool.

b. Declaration by the State of North Carolina of a water emergency as authorized by G.S. 143-355.3. After a water emergency has been declared by the Governor, State of North Carolina, the Secretary, Department of Environmental and Natural Resources, can order emergency diversions to meet the essential water uses of water systems experiencing water shortage emergencies. The Division of Water Resources along with other agencies within the Department of Environmental and Natural Resources will assess water supply problems and recommend actions to the Secretary under this statute.

SELECTED FEDERAL EMERGENCY AUTHORITIES PROVIDING DROUGHT ASSISTANCE

The responsibility for providing an adequate supply of water to inhabitants of any area is basically non-Federal. Corps assistance to provide emergency water supplies will only be considered when non-Federal interests have exhausted reasonable means for securing necessary water supplies, including assistance and support from other Federal agencies.

Assistance may be available from the Corps through PL 84-99 as amended by PL 95-51. Before Corps assistance is considered under PL 95-51, the applicability of other Federal assistance authorities should be evaluated. If these programs cannot provide the needed assistance, then maximum coordination should be made with appropriate agencies in implementing Corps assistance. The applicability of programs administered by the following Federal agencies, as a minimum, will be determined prior to consideration of Corps assistance.

1. Small Business Administration (SBA).

2. Farmers Home Administration (FmHA).

3. Economic Development Administration (EDA).

Corps Authority for Drought Assistance

The Corps authority for Drought Assistance is contained in Chapter 6, "Emergency Water Supplies and Drought Assistance" of Engineering Regulation 500-1-1 Natural Disaster Procedures (1983). Under this authority, the Chief of Engineers, acting for the Secretary of the Army, can construct wells and transport water to farmers, ranchers, and political subdivisions within areas he determines to be drought-distressed.

10 Appendix E Flow Variations as Percent of Mean Annual Flow

Flow Variations as Percent of Mean Annual Flow

With increasing withdrawals from surface water in the Cape Fear Basin the potential changes to streamflow patterns become a question of concern. Comparing streamflow data from the various model scenarios can provide an indication of the changes in flow regimes that may occur in the future. Changes in flow regimes can affect ecological integrity of water courses.

This review of changes in streamflow patterns provides information for general planning purposes. When comparing the potential impacts of various water withdrawal and reservoir operation options it can be informative to consider how flows of different levels in the Cape River Basin vary between scenarios. The flow record used in the Cape Fear – Neuse River Basins Hydrologic Model is a reconstruction of naturalized flow based on observed hydrologic conditions using stream gage data for the period from January 1, 1930 to September 30, 2011.

Because the streamflow records are incomplete certain assumptions and adjustments must be made to produce a useful set of data to create an historic record. Therefore, the flows and flow statistics produced by the model cannot be directly compared to stream gage data. Details of how the synthetic flow records were produced for the Cape Fear River and Neuse River portions of the model are available on the Division of Water Resources' website by clicking here.[i]

DWR is not advocating the use of this method to establish instream flow requirements. DWR does not have sufficient data to determine optimal conditions to protect ecological integrity. Without site specific information, determining the ability of existing flow regimes to support ecological integrity is not possible. Therefore, the modeling results will not be able to determine if existing instream flows are adequate or not. Like the hydrologic model, this analysis of trends is intended only as a planning tool to inform water withdrawers and resource management agencies if potential future conditions might impact aquatic organism populations structured on 2010 conditions.

The model data presented shows the potential differences between alternative scenarios at thirteen locations in the Cape Fear Basin. This analysis is a desktop application of a variation of the method proposed by D. L. Tennant[ii] that describes a stream flow regime as percentages of the mean annual flow (MAF).

Tennant's original flow classifications and associated habitat descriptions have been modified to better reflect hydrologic and habitat characteristics in North Carolina. Table 1 shows the percentage groupings and a narrative description of habitat quality for three seasons chosen to reflect habitat needs for fish, mussels, other aquatic organisms and channel maintenance in North Carolina.

A table for each location shows model scenario descriptions and the estimated MAF for each. There are four graphs presented for each location. The first in each series shows data for the calendar year, January through December. The other three graphs present data for March through

May (Spring), June through November (Summer/Fall) and December through February (Winter). These graphs show how the distribution of flows during particular times of the year vary under the different model scenarios.

On the graphs, the bars in each grouping indicate how the percent of the 29,858 days in the flow record vary under the different model scenarios. The order and color of the graph bars are consistent for all the graphs. The first bar in each group represents existing conditions based on the "Simbase_Current" model scenario labeled as "1Sim2010" on graphs. This scenario reflects the water sources, management protocols and water withdrawals present in 2010. Comparing the plots for alternative model scenarios to the plots for the 1Sim2010 scenario suggests how conditions may vary between model scenarios.

The third bar from the left in each group shows conditions meeting expected 2045 demands if the allocations recommended by DWR in the Round4 Jordan Lake Water Supply Allocation Recommendations document are approved by the Environmental Management Commission. The fifth bar in each group shows conditions when meeting expected 2060 demands if the recommended allocations are approved.

The eight-digit number in the label of each graph indicates the specific arc in the hydrologic model that was analyzed. Water flows through each arc from an upstream node indicated by the first four digits to a downstream node indicated by the second four digits.

Table 1: Modified Tennant Method Guidelines for Evaluating Flow Deviations by Season.

% Mean Annual Flow	March to May	June to Nov.	Dec. to Feb.
< 10%	**Severe Degradation**	**Severe Degradation**	**Severe Degradation**
10 - 20%	**Poor or Minimum**	**Fair/Degrading**	**Fair/Degrading**
20 - 30%	**Fair or Degrading**	**Good**	**Good**
30 - 40%	**Good**	**Excellent**	**Excellent**
40 - 50%	**Excellent**	**Outstanding**	**Outstanding**
50 - 60%	**Outstanding**	**Outstanding**	**Outstanding**
60 - 100%	**Optimum**	**Optimum**	**Optimum**
100 - 200%	**Optimum/Flushing**	**Optimum/Flushing**	**Optimum/Flushing**
>200%	**Flushing/Max. Flow**	**Flushing/Max. Flow**	**Flushing/Max. Flow**

The following map shows the nodes of interest that were identified for this evaluation.

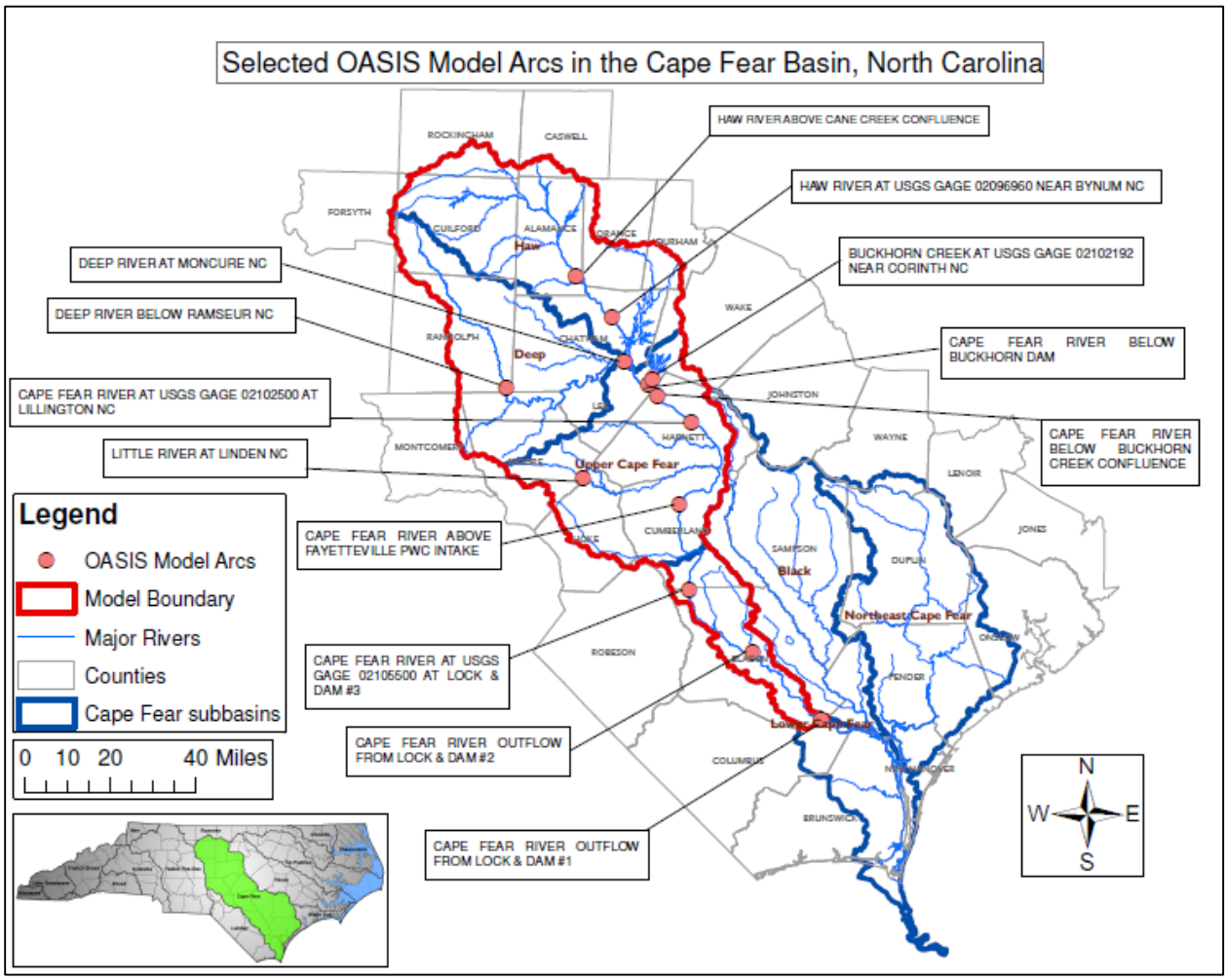


Table E-1. Haw River above confluence with Cane Creek.

Model Scenario	Description	MAF (cfs)
1Sim2010	basecase conditions in 2010	754
2Sim2045	2010 available supplies and 2045 demands	753
3JLA2045	recommended Jordan Lake allocations added to 2010 available supplies and 2045 demands	762
4JLA2045_C	same as 3JLA2045 with daily data in the flow record reduced 10%	686
5JLA2060	recommended Jordan Lake allocations and 2060 demands	761
6JLA2060_M	full allocation of Jordan Lake water supply pool and 106mgd withdrawals during peak month at L&D#1	761

Figure E-1. Haw River above confluence with Cane Creek. Percent of POR by deviation class when compared to MAF, all months (January-December).

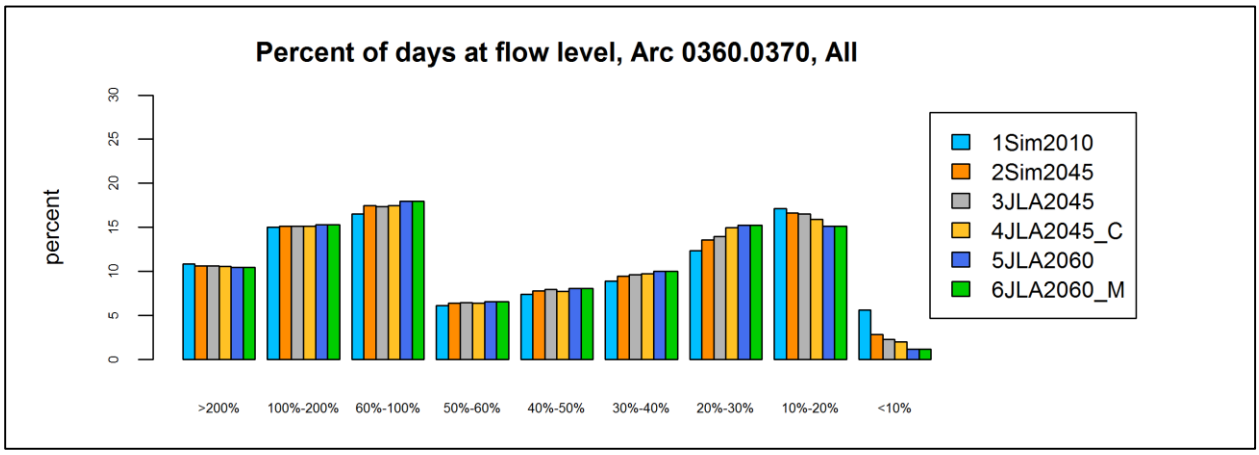


Figure E-2. Haw River above confluence with Cane Creek. Percent of POR by deviation class when compared to MAF, Spring (March-May).

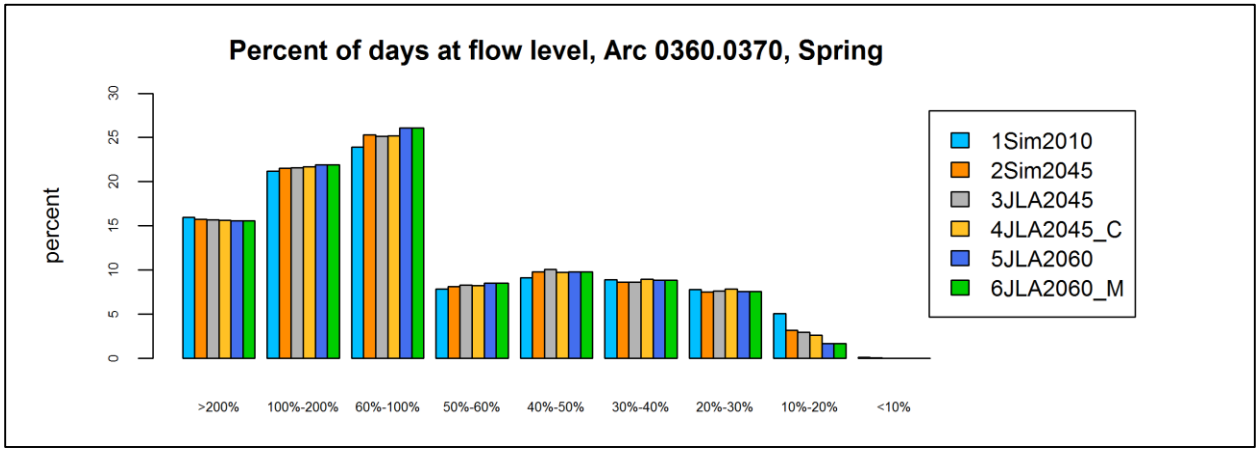


Figure E-3. Haw River above confluence with Cane Creek. Percent of POR by deviation class when compared to MAF, Summer-Fall (June-November).

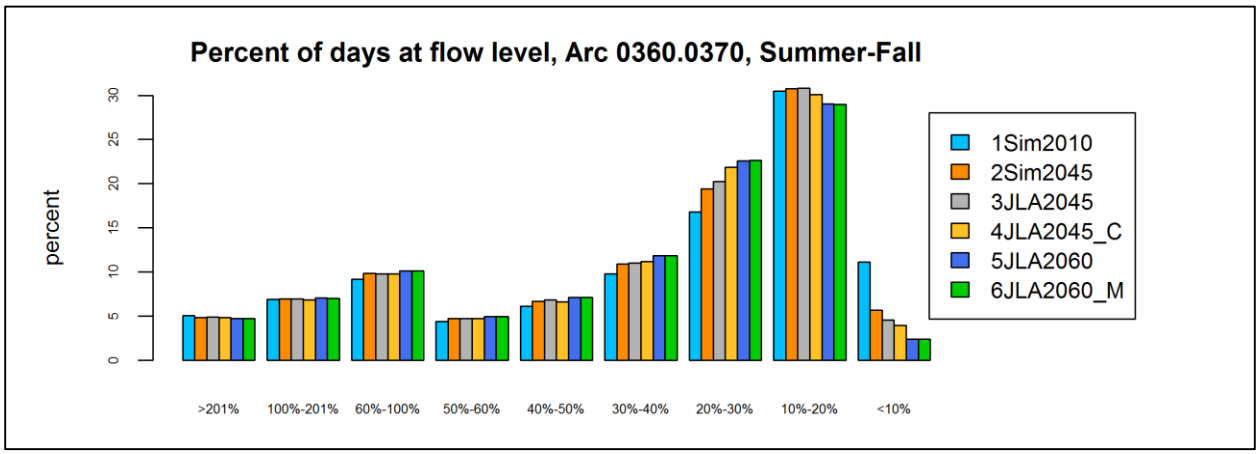


Figure E-4. Haw River above confluence with Cane Creek. Percent of POR by deviation class when compared to MAF, Winter (December-February).

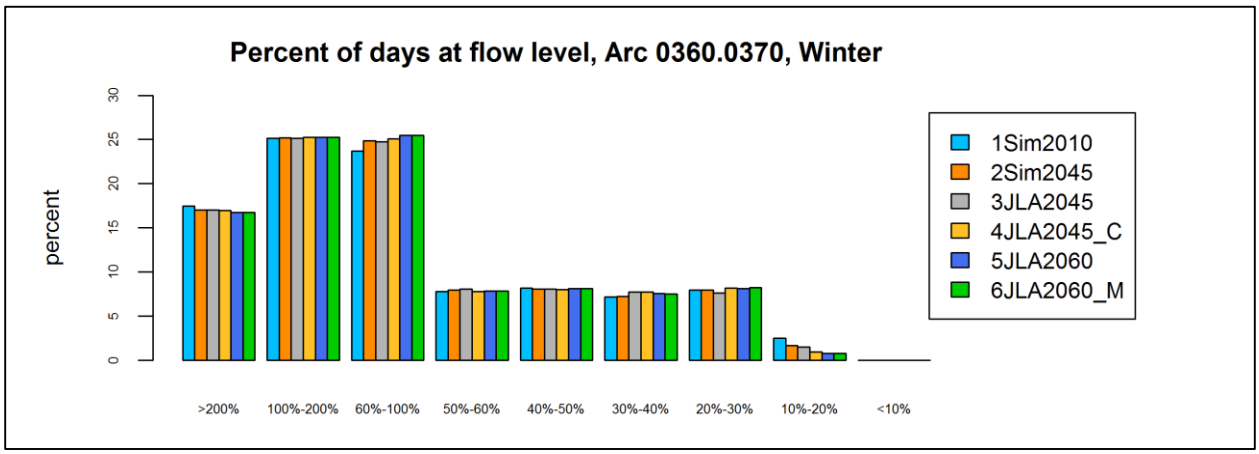


Table E-2. Haw River at USGS Gage 02096960 near Bynum, NC.		
Model Scenario	**Description**	**MAF (cfs)**
1Sim2010	basecase conditions in 2010	1196
2Sim2045	2010 available supplies and 2045 demands	1176
3JLA2045	recommended Jordan Lake allocations added to 2010 available supplies and 2045 demands	1199
4JLA2045_C	same as 3JLA2045 with daily data in the flow record reduced 10%	1077
5JLA2060	recommended Jordan Lake allocations and 2060 demands	1195
6JLA2060_M	full allocation of Jordan Lake water supply pool and 106mgd withdrawals during peak month at L&D#1	1195

Figure E-5. Haw River at USGS Gage 02096960 near Bynum, NC. Percent of POR by deviation class when compared to MAF, all months (January-December).

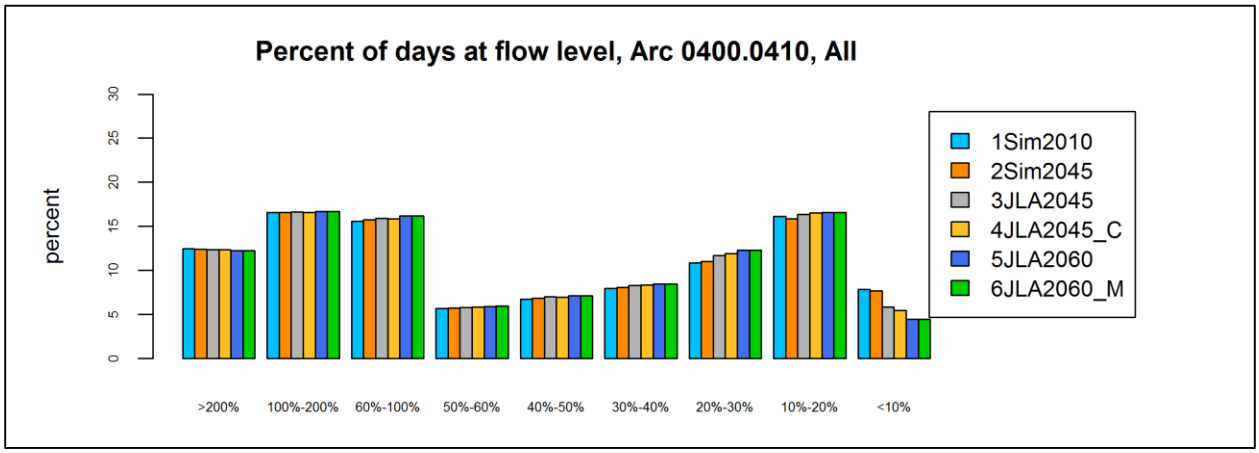


Figure E-6. Haw River at USGS Gage 02096960 near Bynum, NC. Percent of POR by deviation class when compared to MAF, Spring (March-May).

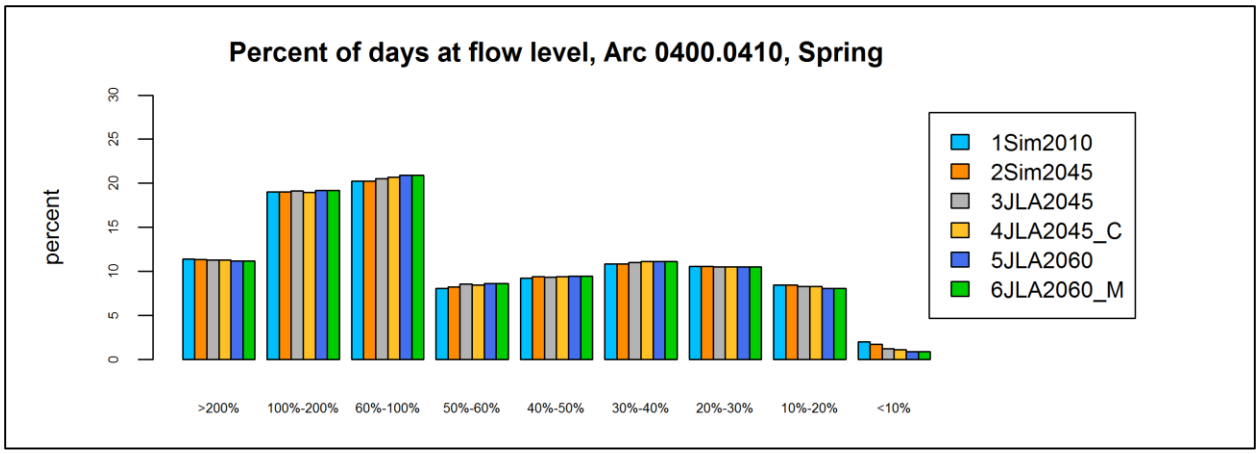


Figure E-7. Haw River at USGS Gage 02096960 near Bynum, NC. Percent of POR by deviation class when compared to MAF, Summer-Fall (June-November).

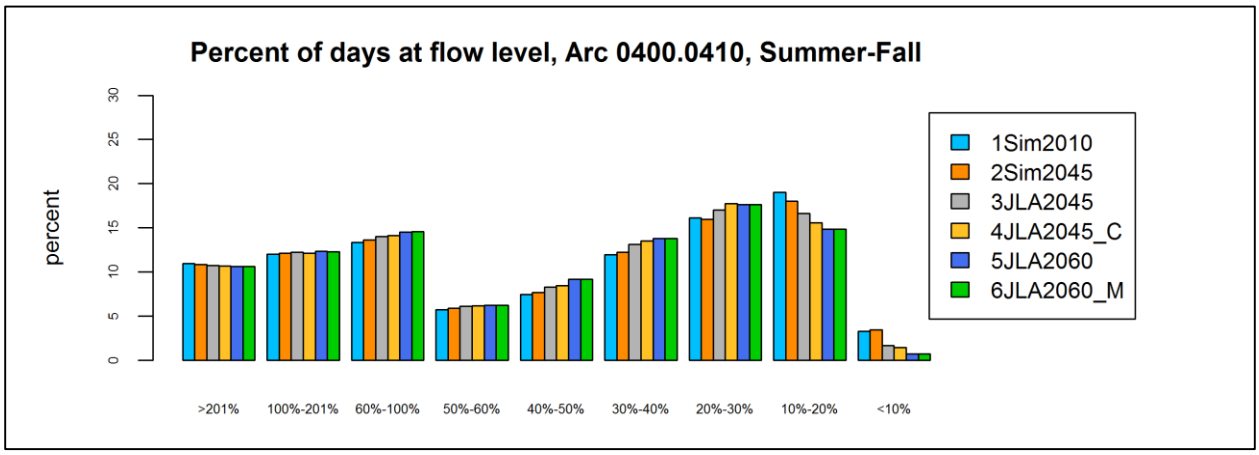


Figure E-8. Haw River at USGS Gage 02096960 near Bynum, NC. Percent of POR by deviation class when compared to MAF, Winter (December-February).

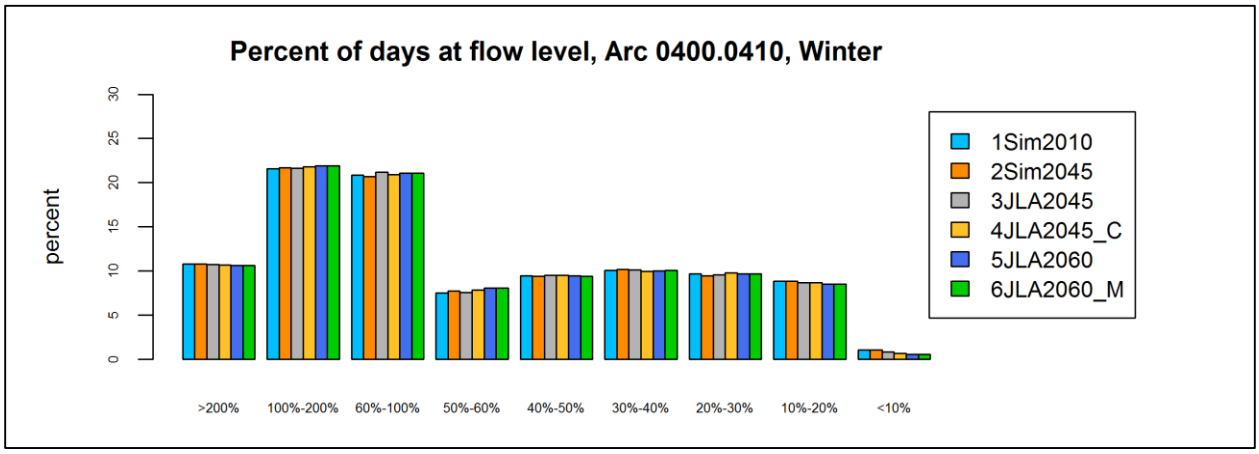


Table E-3. Cape Fear River below Buckhorn Dam.		
Model Scenario	**Description**	**MAF (cfs)**
1Sim2010	basecase conditions in 2010	2901
2Sim2045	2010 available supplies and 2045 demands	2847
3JLA2045	recommended Jordan Lake allocations added to 2010 available supplies and 2045 demands	2812
4JLA2045_C	same as 3JLA2045 with daily data in the flow record reduced 10%	2521
5JLA2060	recommended Jordan Lake allocations and 2060 demands	2798
6JLA2060_M	full allocation of Jordan Lake water supply pool and 106mgd withdrawals during peak month at L&D#1	2783

Figure E-9. Cape Fear River below Buckhorn Dam. Percent of POR by deviation class when compared to MAF, all months (January-December**).**

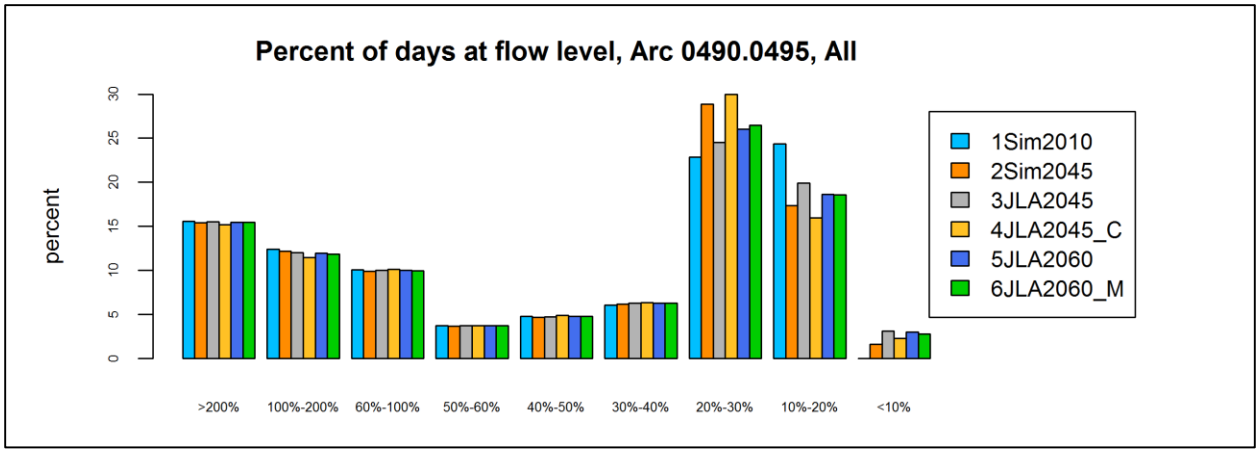


Figure E-10. Cape Fear River below Buckhorn Dam. Percent of POR by deviation class when compared to MAF, Spring (March-May**).**

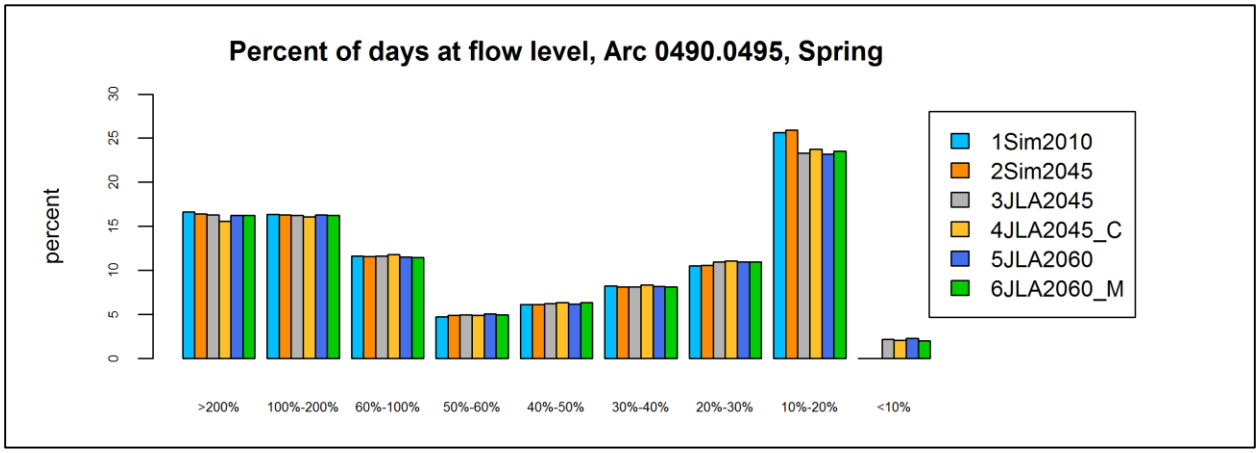


Figure E-11. Cape Fear River below Buckhorn Dam. Percent of POR by deviation class when compared to MAF, Summer-Fall (June-November**).**

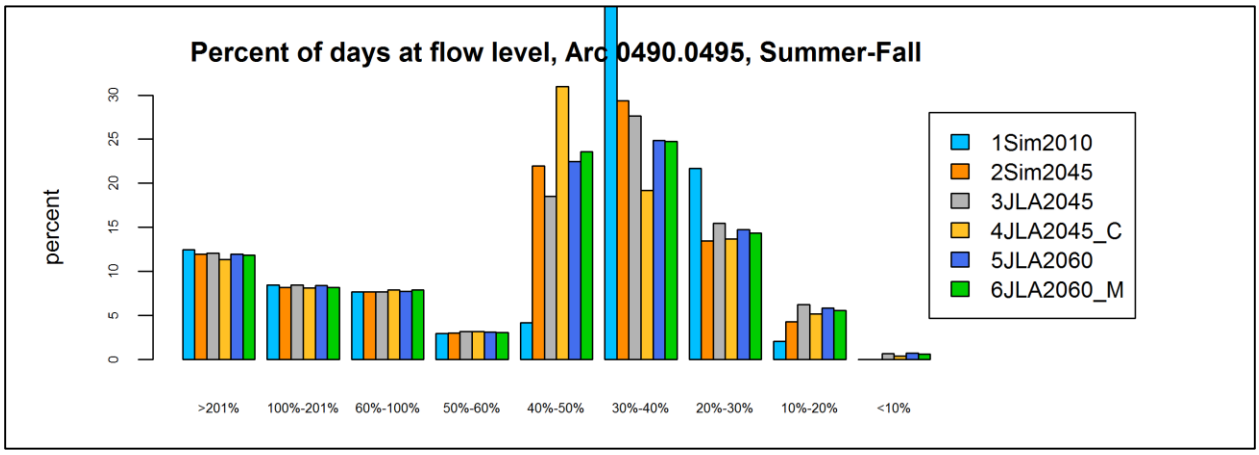


Figure E-12. Cape Fear River below Buckhorn Dam. Percent of POR by deviation class when compared to MAF, Winter (December-February**).**

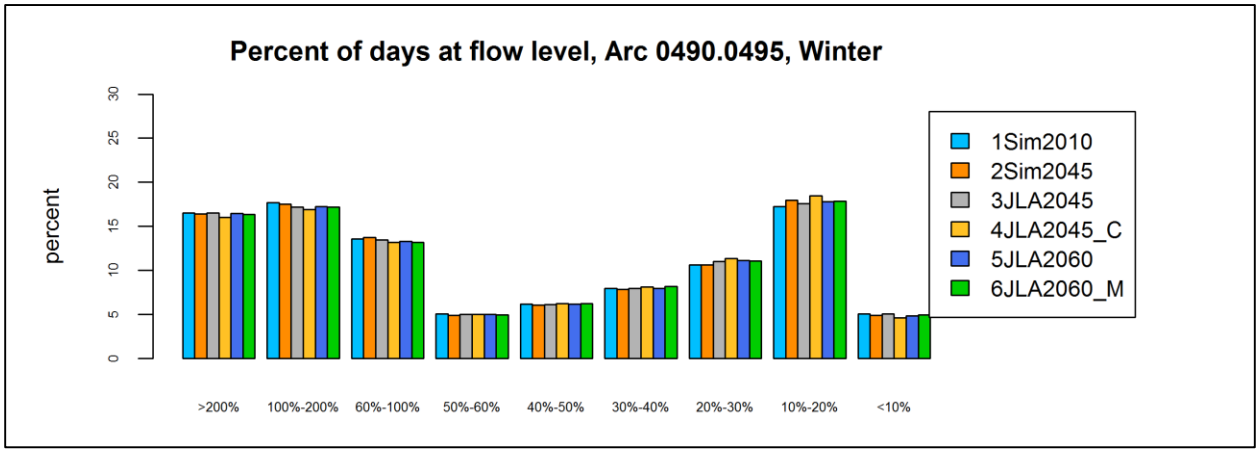


Table E-4. Buckhorn Creek at USGS Gage 02102192 near Corinth, NC.		
Model Scenario	**Description**	**MAF (cfs)**
1Sim2010	basecase conditions in 2010	45
2Sim2045	2010 available supplies and 2045 demands	12
3JLA2045	recommended Jordan Lake allocations added to 2010 available supplies and 2045 demands	61
4JLA2045_C	same as 3JLA2045 with daily data in the flow record reduced 10%	54
5JLA2060	recommended Jordan Lake allocations and 2060 demands	62
6JLA2060_M	full allocation of Jordan Lake water supply pool and 106mgd withdrawals during peak month at L&D#1	61

Figure E-13. Buckhorn Creek at USGS Gage 02102192 near Corinth, NC. Percent of POR by deviation class when compared to MAF, all months (January-December**).**

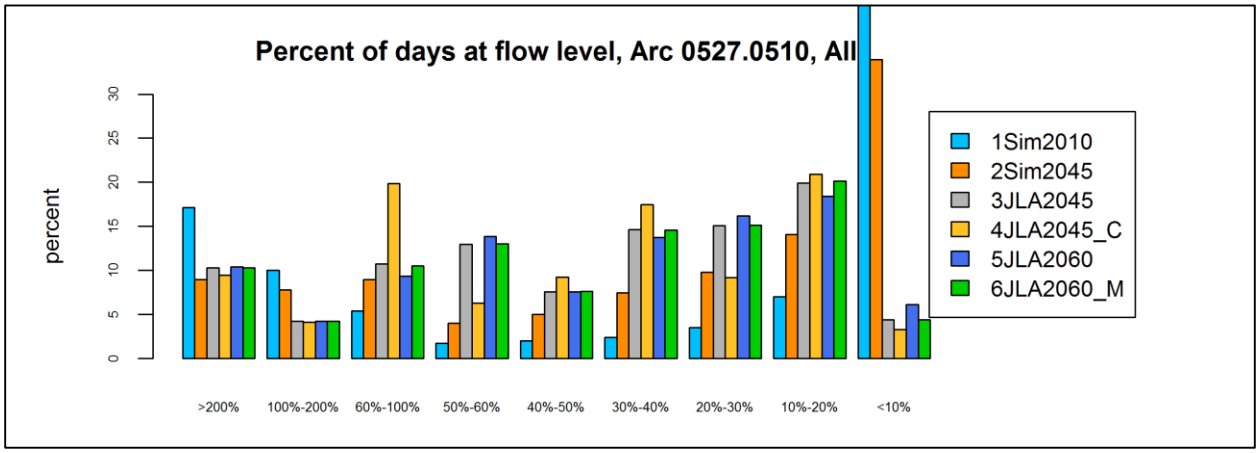


Figure E-14. Buckhorn Creek at USGS Gage 02102192 near Corinth, NC. Percent of POR by deviation class when compared to MAF, Spring (March-May).

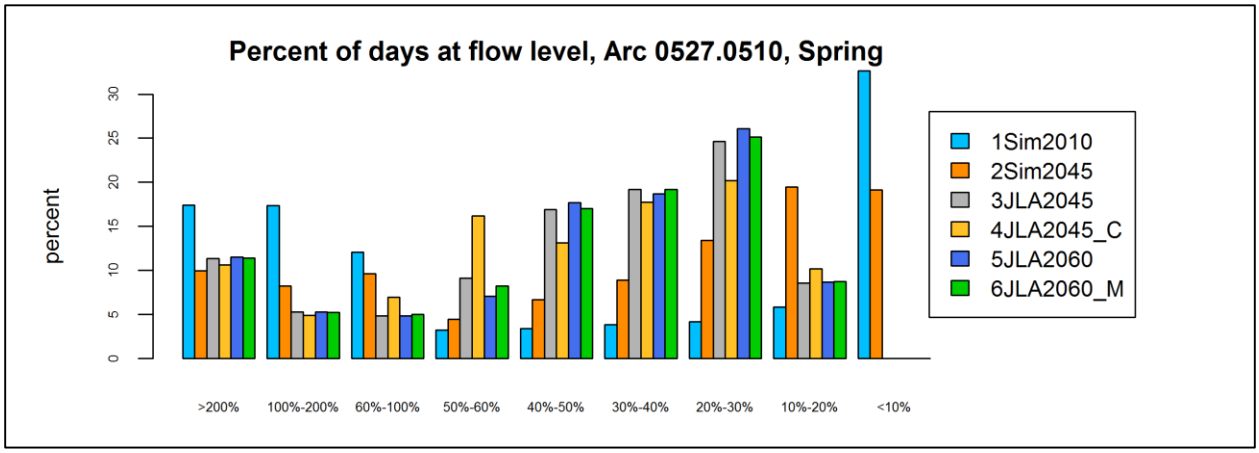


Figure E-15. Buckhorn Creek at USGS Gage 02102192 near Corinth, NC. Percent of POR by deviation class when compared to MAF, Summer-Fall (June-November).

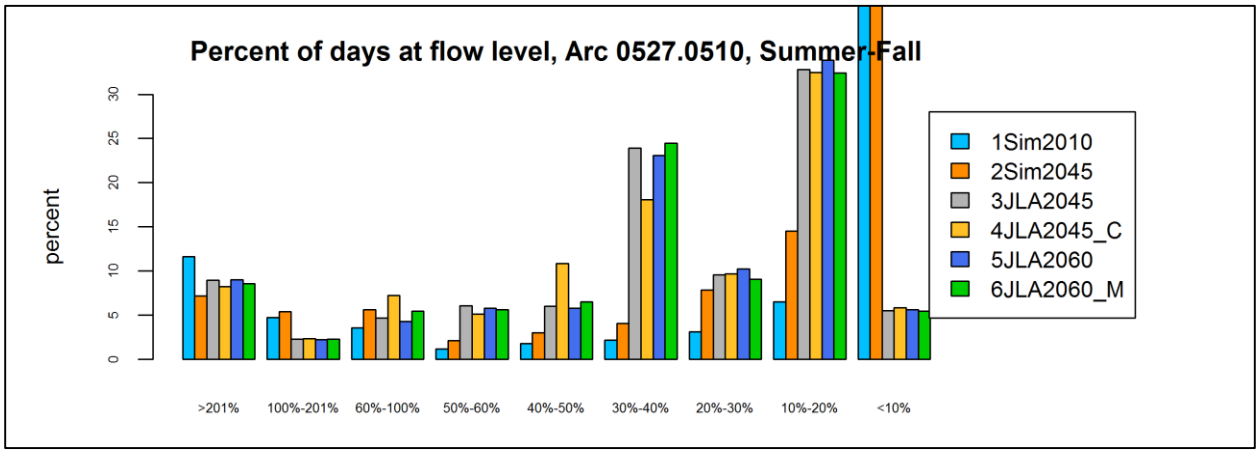


Figure E-16. Buckhorn Creek at USGS Gage 02102192 near Corinth, NC. Percent of POR by deviation class when compared to MAF, Winter (December-February).

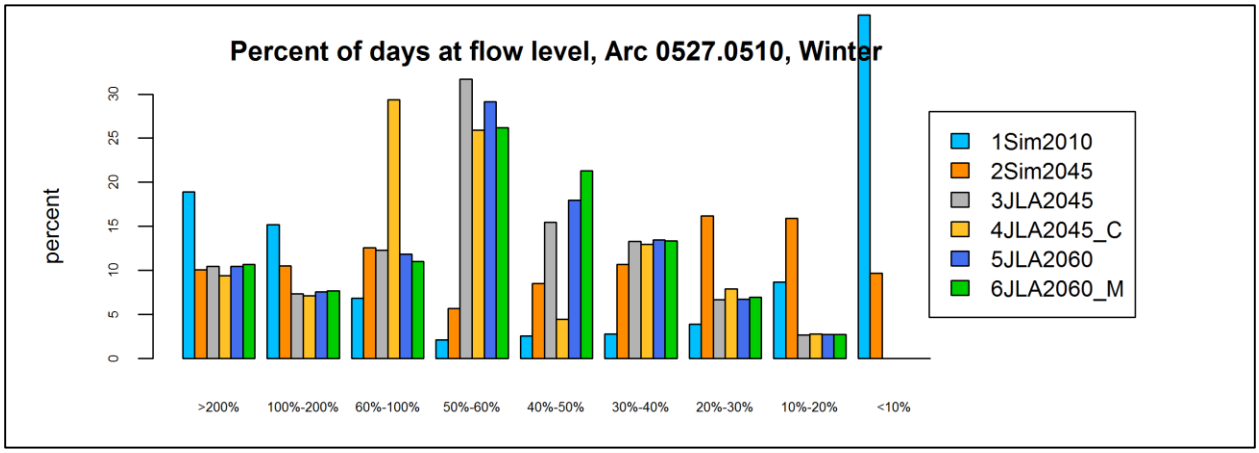


Table E-5. Cape Fear River below confluence with Buckhorn Creek.		
Model Scenario	**Description**	**MAF (cfs)**
1Sim2010	basecase conditions in 2010	3141
2Sim2045	2010 available supplies and 2045 demands	3054
3JLA2045	recommended Jordan Lake allocations added to 2010 available supplies and 2045 demands	3025
4JLA2045_C	same as 3JLA2045 with daily data in the flow record reduced 10%	2707
5JLA2060	recommended Jordan Lake allocations and 2060 demands	3015
6JLA2060_M	full allocation of Jordan Lake water supply pool and 106mgd withdrawals during peak month at L&D#1	3000

Figure E-17. Cape Fear River below confluence with Buckhorn Creek. Percent of POR by deviation class when compared to MAF, all months (January-December).

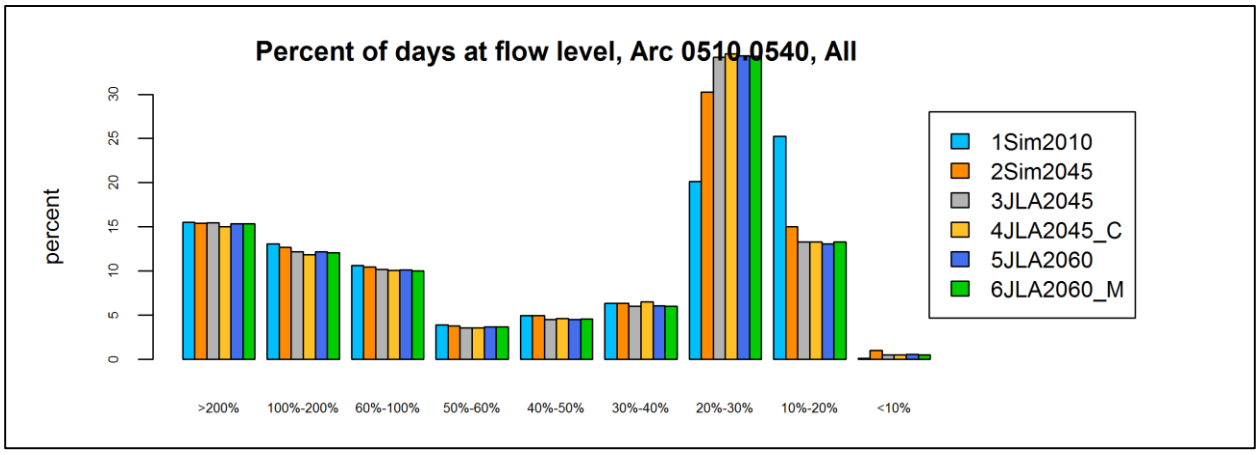


Figure E-18. Cape Fear River below confluence with Buckhorn Creek. Percent of POR by deviation class when compared to MAF, Spring (March-May).

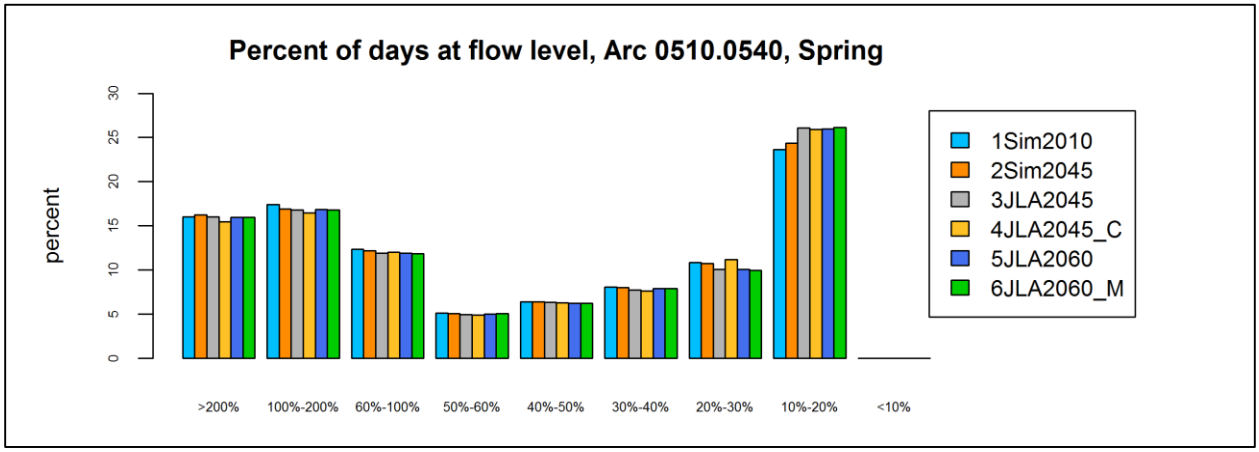


Figure E-19. Cape Fear River below confluence with Buckhorn Creek. Percent of POR by deviation class when compared to MAF, Summer-Fall (June-November).

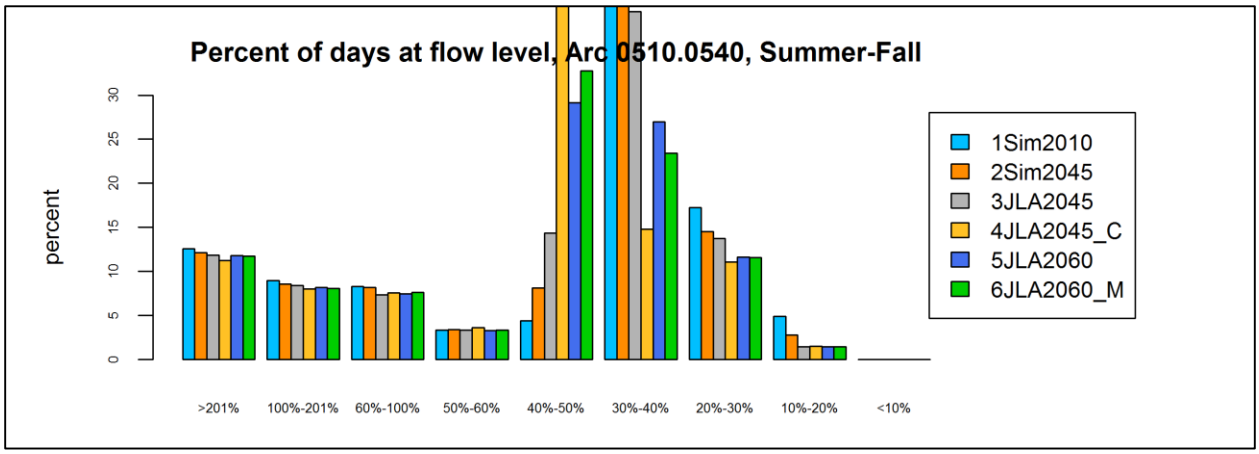


Figure E-20. Cape Fear River below confluence with Buckhorn Creek. Percent of POR by deviation class when compared to MAF, Winter (December-February).

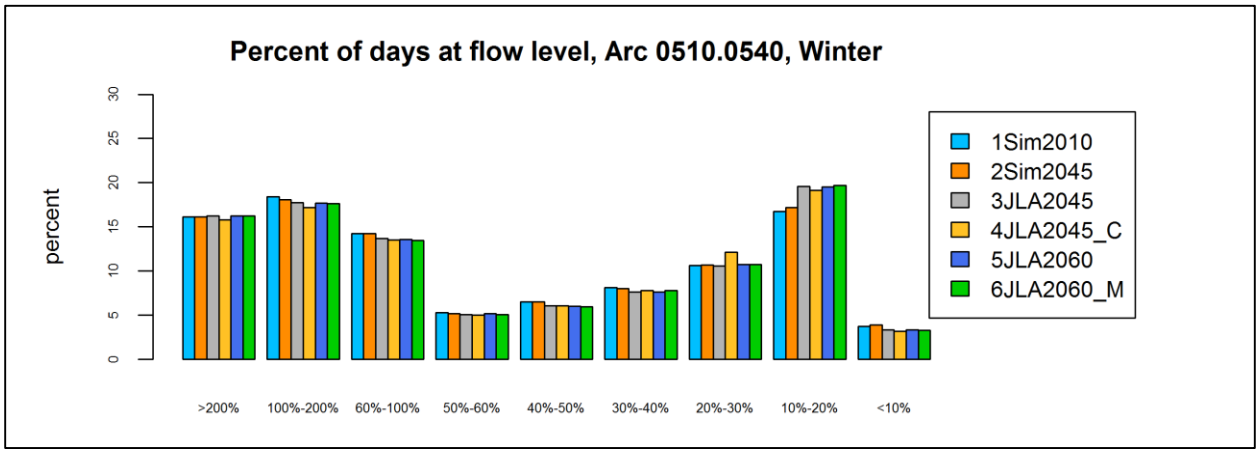


Table E-6. Cape Fear River at USGS Gage 02102500 at Lillington, NC.		
Model Scenario	**Description**	**MAF (cfs)**
1Sim2010	**basecase conditions in 2010**	**3150**
2Sim2045	**2010 available supplies and 2045 demands**	**3022**
3JLA2045	**recommended Jordan Lake allocations added to 2010 available supplies and 2045 demands**	**2998**
4JLA2045_C	**same as 3JLA2045 with daily data in the flow record reduced 10%**	**2676**
5JLA2060	**recommended Jordan Lake allocations and 2060 demands**	**2973**
6JLA2060_M	**full allocation of Jordan Lake water supply pool and 106mgd withdrawals during peak month at L&D#1**	**2959**

Figure E-21. Cape Fear River at USGS Gage 02102500 at Lillington, NC. Percent of POR by deviation class when compared to MAF, all months (January-December).

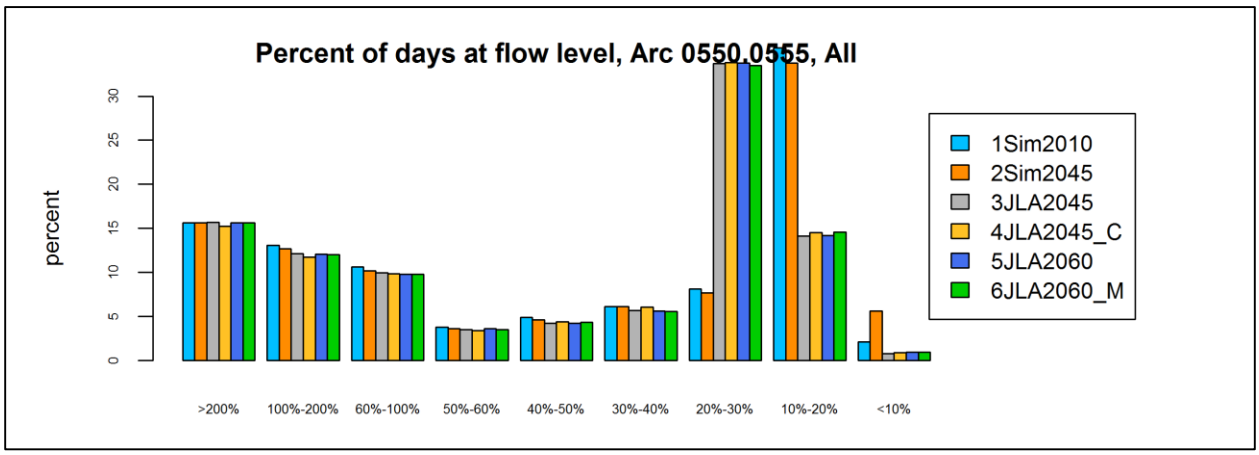


Figure E-22. Cape Fear River at USGS Gage 02102500 at Lillington, NC. Percent of POR by deviation class when compared to MAF, Spring (March-May).

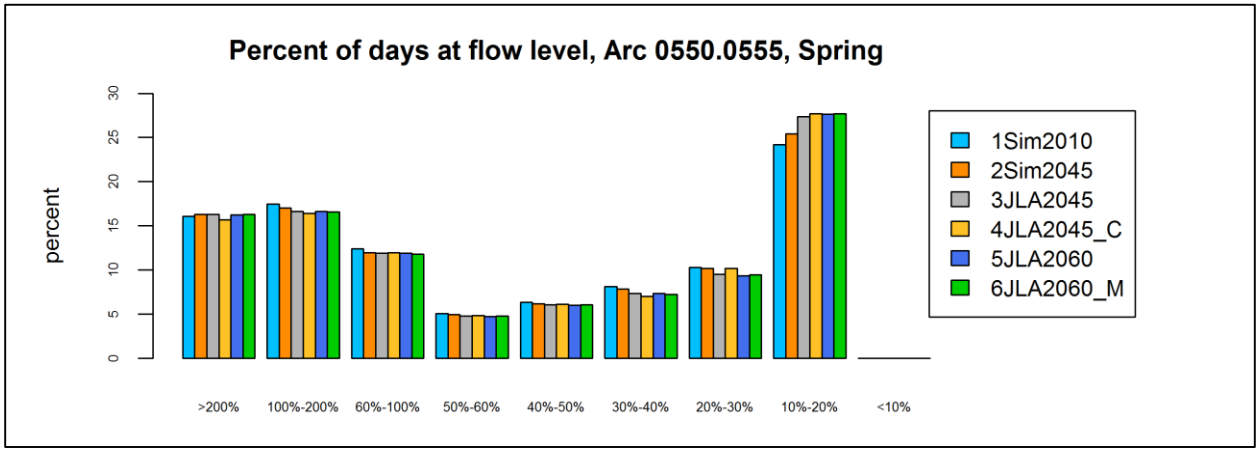


Figure E-23. Cape Fear River at USGS Gage 02102500 at Lillington, NC. Percent of POR by deviation class when compared to MAF, Summer-Fall (June-November**).**

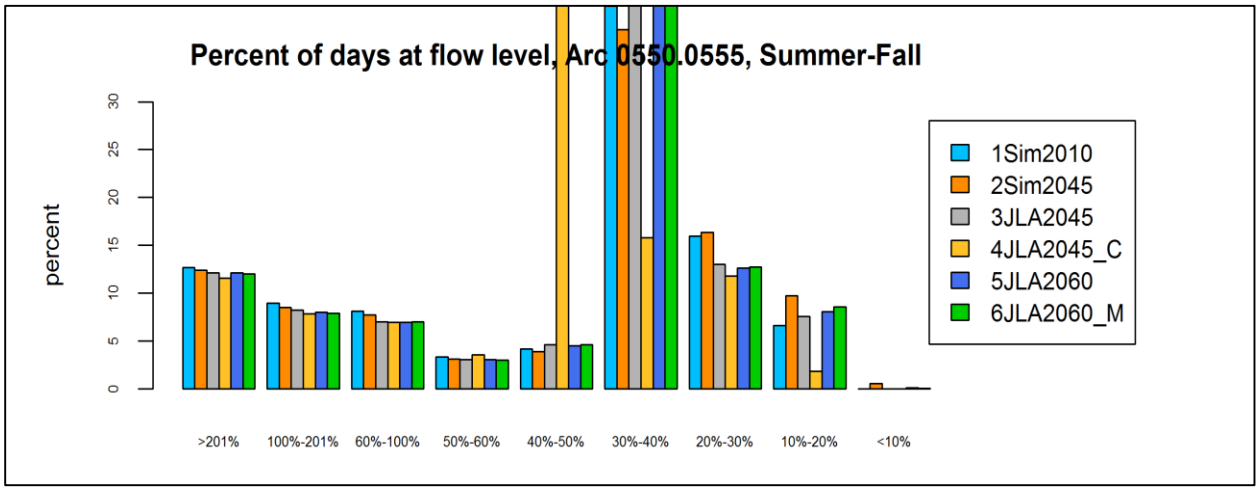


Figure E-24. Cape Fear River at USGS Gage 02102500 at Lillington, NC. Percent of POR by deviation class when compared to MAF, Winter (December-February).

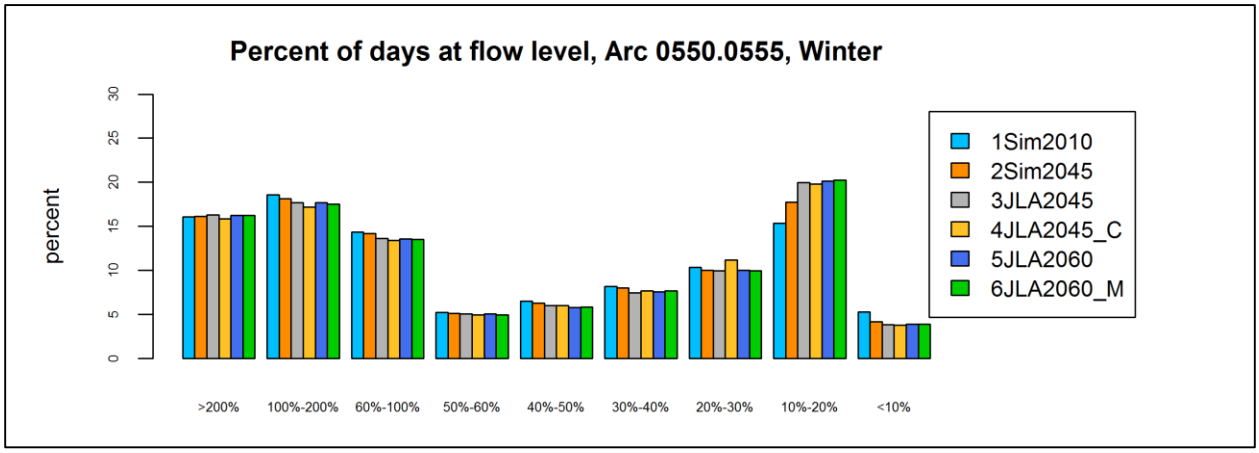


Table E-7. Cape Fear River above Fayetteville PWC Intake		
Model Scenario	**Description**	**MAF (cfs)**
1Sim2010	**basecase conditions in 2010**	**4031**
2Sim2045	**2010 available supplies and 2045 demands**	**3911**
3JLA2045	**recommended Jordan Lake allocations added to 2010 available supplies and 2045 demands**	**3881**
4JLA2045_C	**same as 3JLA2045 with daily data in the flow record reduced 10%**	**3470**
5JLA2060	**recommended Jordan Lake allocations and 2060 demands**	**3859**
6JLA2060_M	**full allocation of Jordan Lake water supply pool and 106mgd withdrawals during peak month at L&D#1**	**3844**

Figure E-25. Cape Fear River above Fayetteville PWC intake. Percent of POR by deviation class when compared to MAF, all months (January-December).

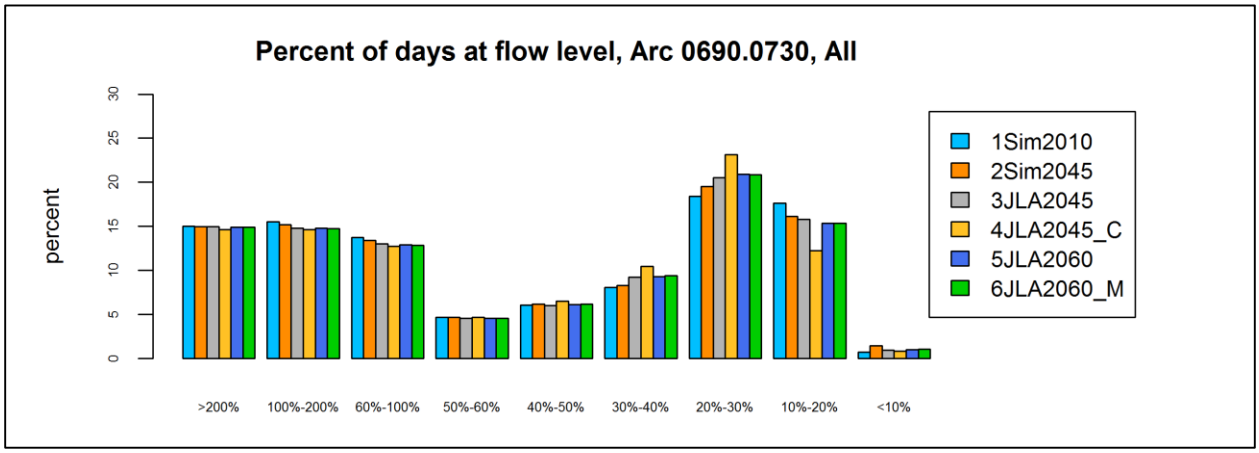


Figure E-26. Cape Fear River above Fayetteville PWC intake. Percent of POR by deviation class when compared to MAF, Spring (March-May).

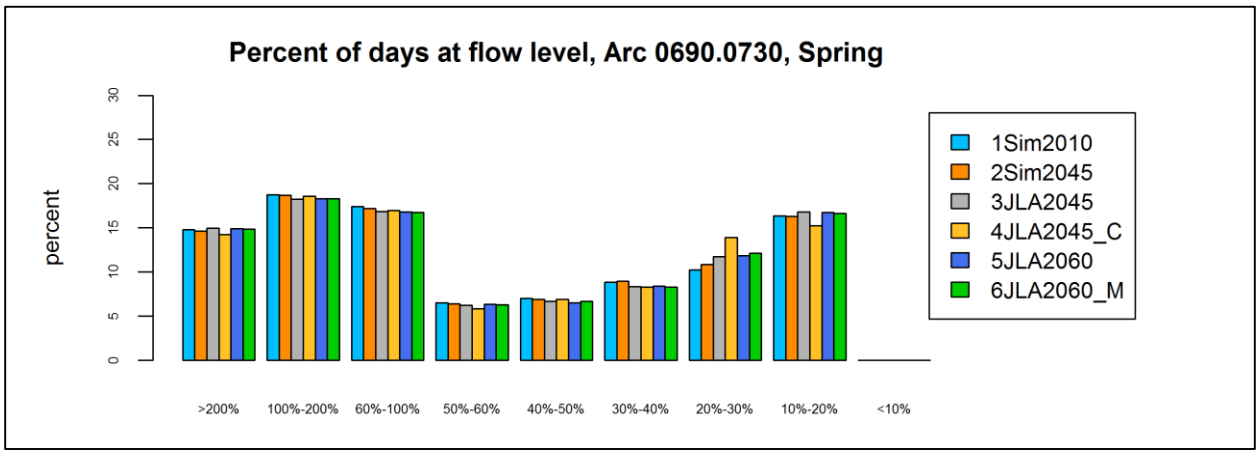


Figure E-27. Cape Fear River above Fayetteville PWC intake. Percent of POR by deviation class when compared to MAF, Summer-Fall (June-November).

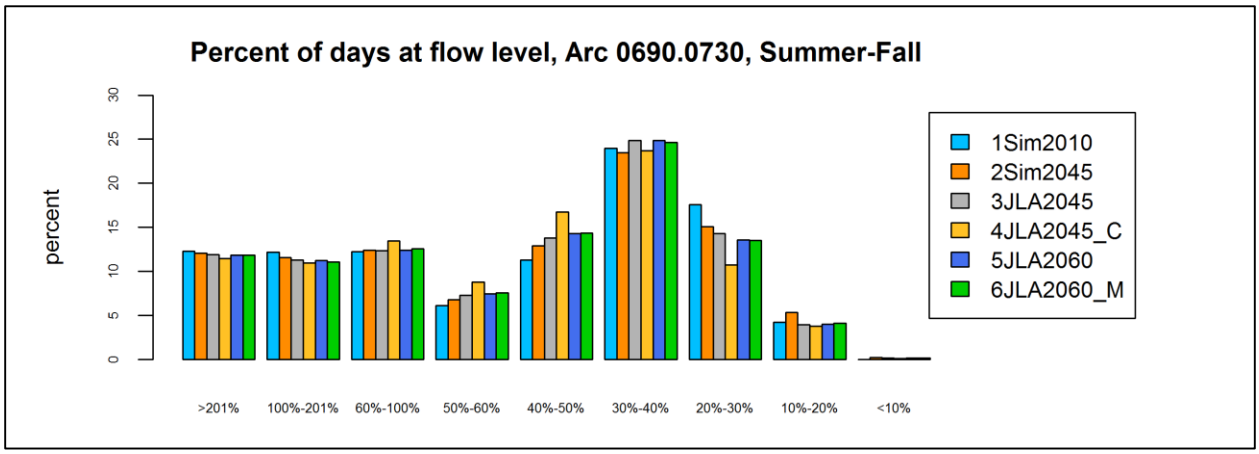


Figure E-28. Cape Fear River above Fayetteville PWC intake. Percent of POR by deviation class when compared to MAF, Winter (December-February).

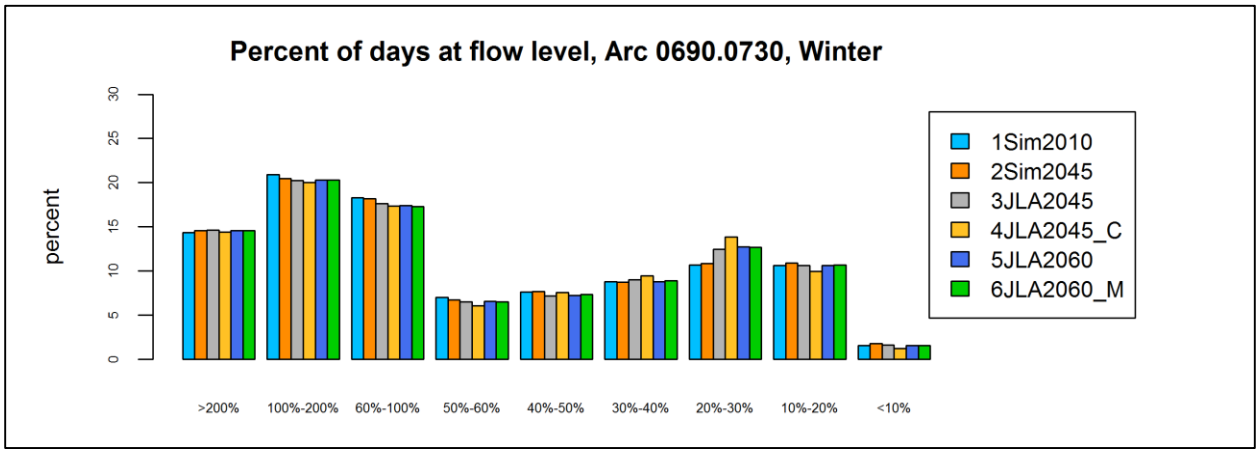


Table E-8. Cape Fear River at USGS Gage 02105500 at Lock and Dam #3.		
Model Scenario	**Description**	**MAF (cfs)**
1Sim2010	basecase conditions in 2010	4488
2Sim2045	2010 available supplies and 2045 demands	4367
3JLA2045	recommended Jordan Lake allocations added to 2010 available supplies and 2045 demands	4322
4JLA2045_C	same as 3JLA2045 with daily data in the flow record reduced 10%	3864
5JLA2060	recommended Jordan Lake allocations and 2060 demands	4299
6JLA2060_M	full allocation of Jordan Lake water supply pool and 106mgd withdrawals during peak month at L&D#1	4285

Figure E-29. Cape Fear River at USGS Gage 02100500 at Lock and Dam #3. Percent of POR by deviation class when compared to MAF, all months (January-December).

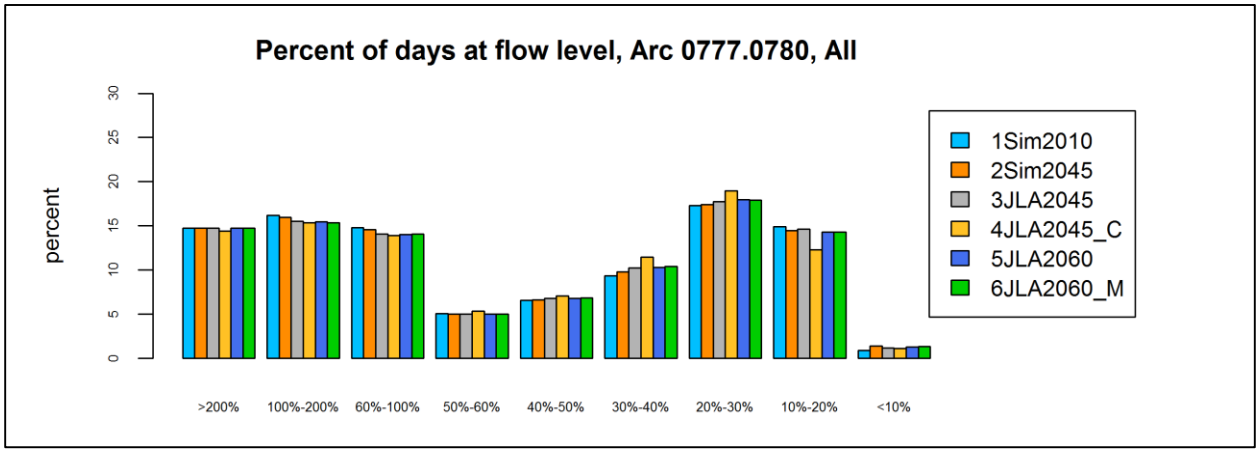


Figure E-30. Cape Fear River at USGS Gage 02100500 at Lock and Dam #3. Percent of POR by deviation class when compared to MAF, Spring (March-May).

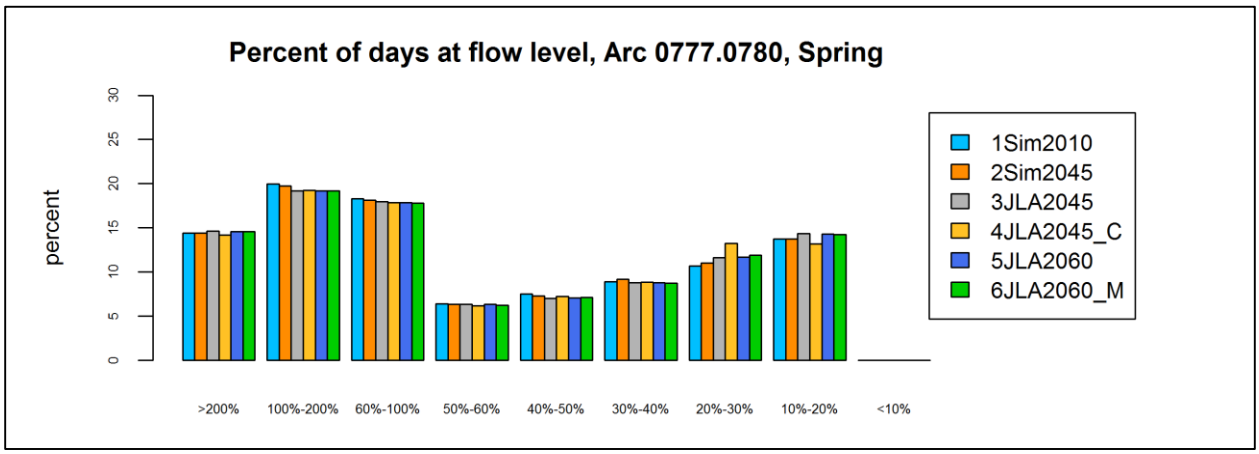


Figure E-31. Cape Fear River at USGS Gage 02100500 at Lock and Dam #3. Percent of POR by deviation class when compared to MAF, Summer-Fall (June-November).

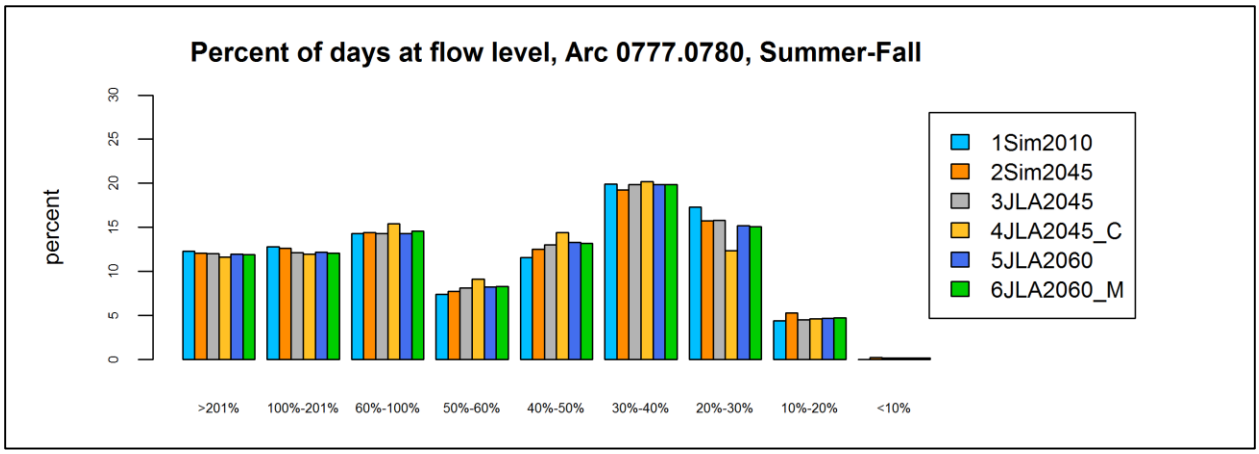


Figure E-32. Cape Fear River at USGS Gage 02100500 at Lock and Dam #3. Percent of POR by deviation class when compared to MAF, Winter (December-February).

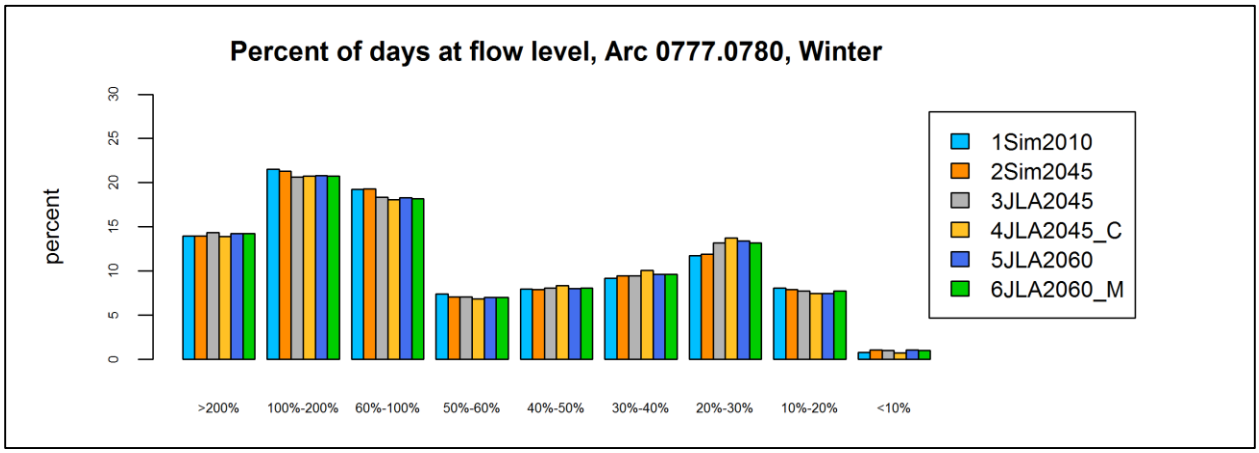


Table E-9. Cape Fear River Outflow from Lock and Dam #2.		
Model Scenario	**Description**	**MAF (cfs)**
1Sim2010	basecase conditions in 2010	5069
2Sim2045	2010 available supplies and 2045 demands	4949
3JLA2045	recommended Jordan Lake allocations added to 2010 available supplies and 2045 demands	4906
4JLA2045_C	same as 3JLA2045 with daily data in the flow record reduced 10%	4389
5JLA2060	recommended Jordan Lake allocations and 2060 demands	4883
6JLA2060_M	full allocation of Jordan Lake water supply pool and 106mgd withdrawals during peak month at L&D#1	4868

Figure E-33. Cape Fear River outflow from Lock and Dam #2. Percent of POR by deviation class when compared to MAF, all months (January-December**).**

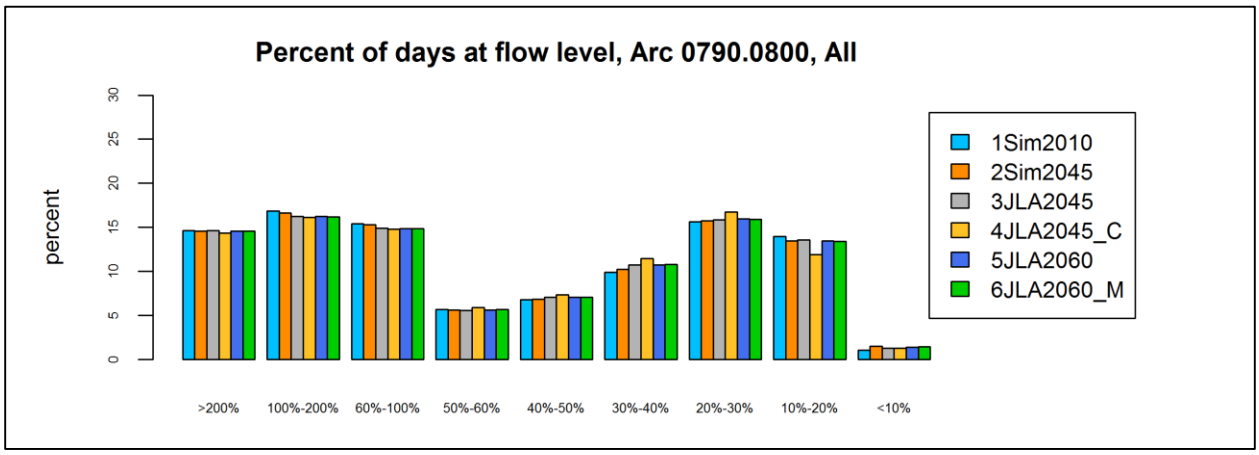


Figure E-34. Cape Fear River outflow from Lock and Dam #2. Percent of POR by deviation class when compared to MAF, Spring (March-May).

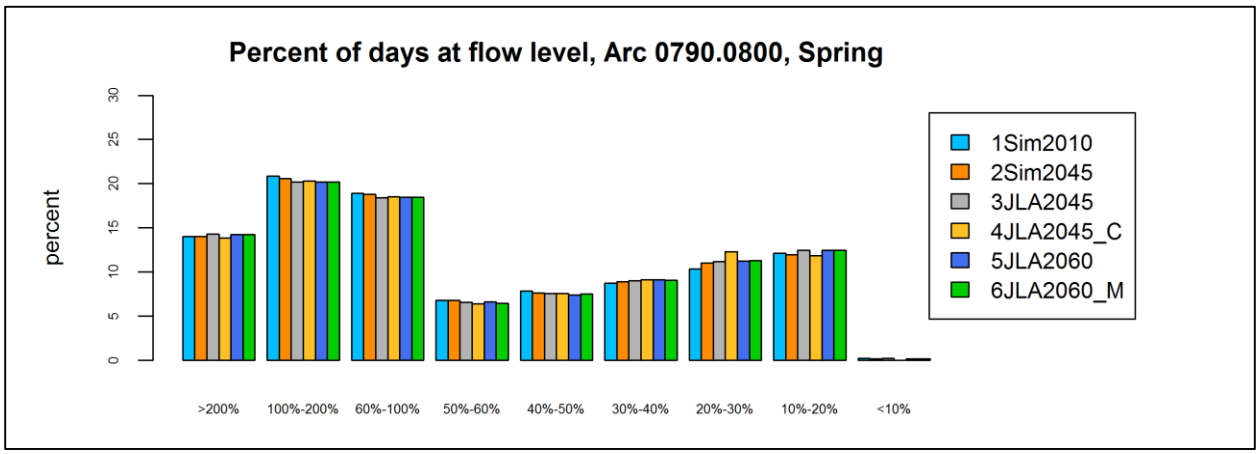


Figure E-35. Cape Fear River outflow from Lock and Dam #2. Percent of POR by deviation class when compared to MAF, Summer-Fall (June-November).

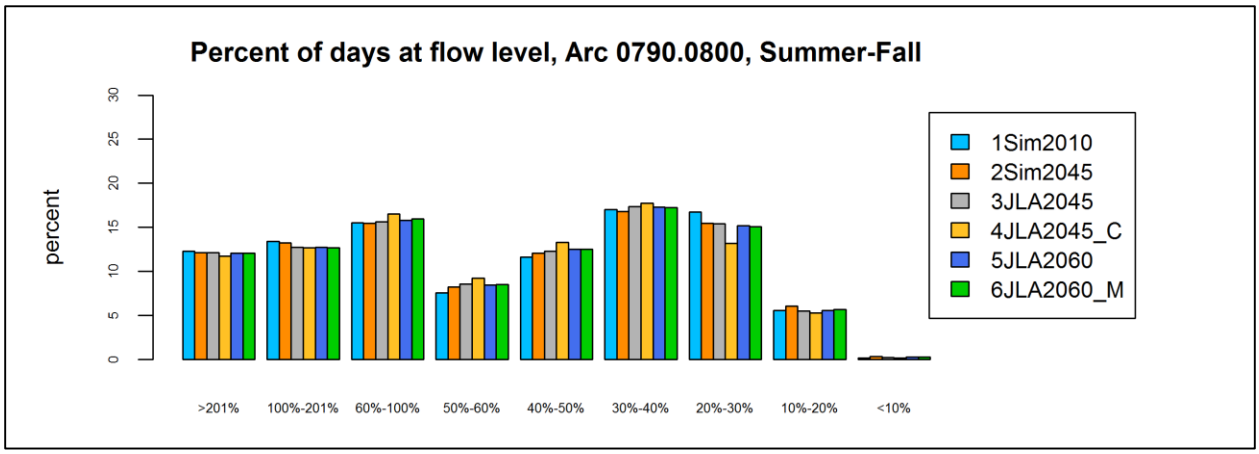


Figure E-36. Cape Fear River outflow from Lock and Dam #2. Percent of POR by deviation class when compared to MAF, Winter (December-February).

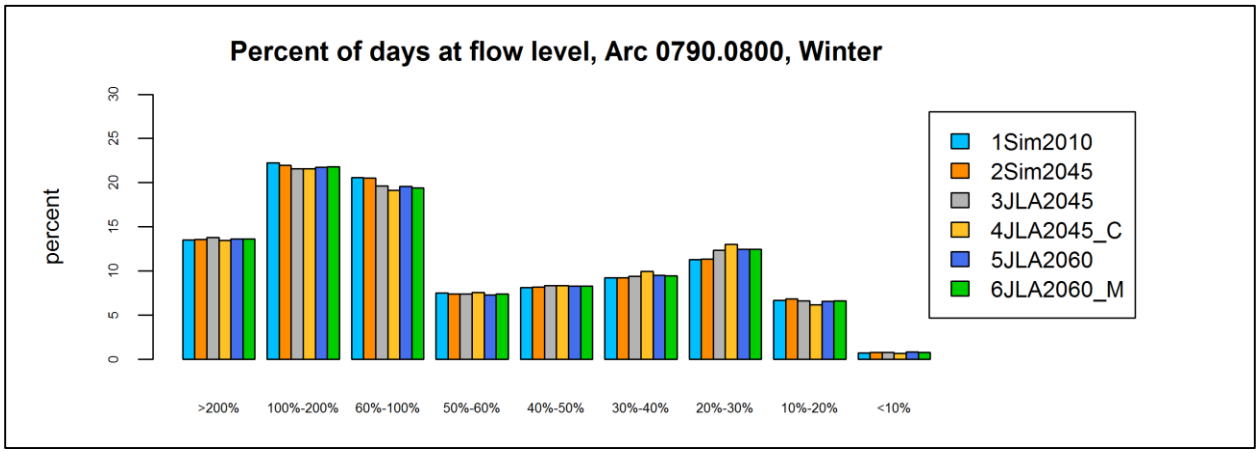


Table E-10. Cape Fear River outflow from Lock and Dam #1.		
Model Scenario	**Description**	**MAF (cfs)**
1Sim2010	basecase conditions in 2010	5367
2Sim2045	2010 available supplies and 2045 demands	5214
3JLA2045	recommended Jordan Lake allocations added to 2010 available supplies and 2045 demands	5170
4JLA2045_C	same as 3JLA2045 with daily data in the flow record reduced 10%	4613
5JLA2060	recommended Jordan Lake allocations and 2060 demands	5129
6JLA2060_M	full allocation of Jordan Lake water supply pool and 106mgd withdrawals during peak month at L&D#1	5087

Figure E-37. Cape Fear River outflow from Lock and Dam #1. Percent of POR by deviation class when compared to MAF, all months (January-December).

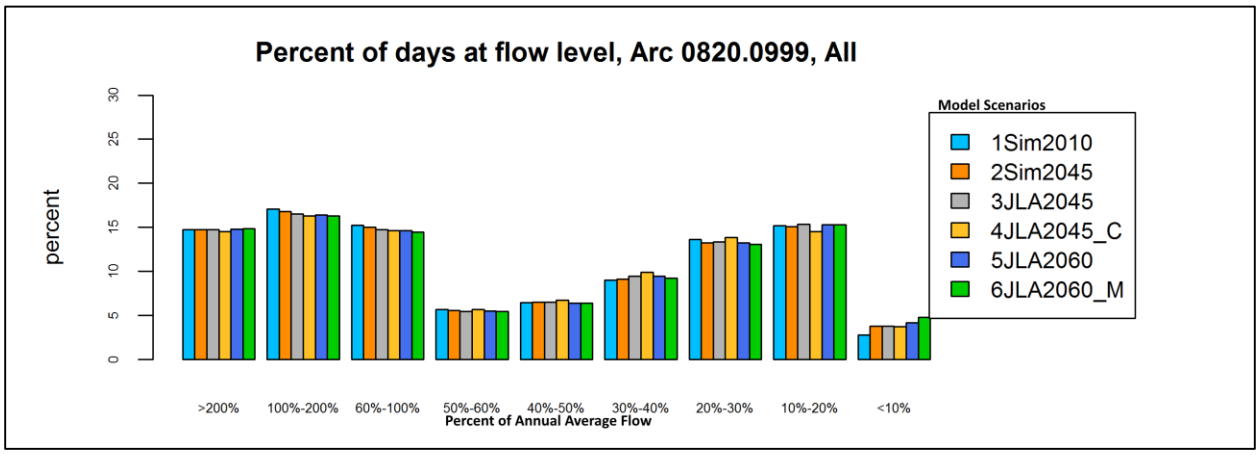


Figure E-38. Cape Fear River outflow from Lock and Dam #1. Percent of POR by deviation class when compared to MAF, Spring (March-May).

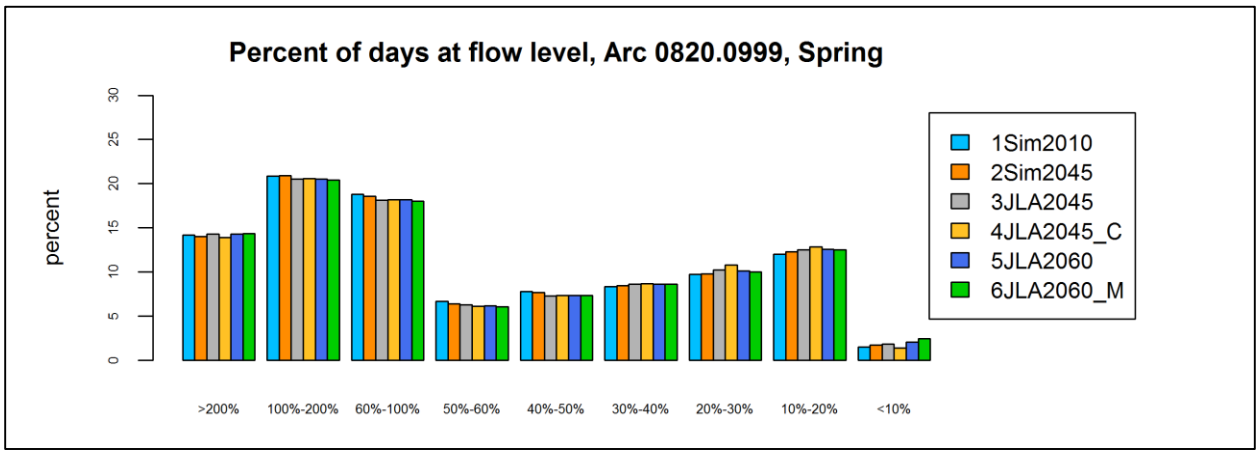


Figure E-39. Cape Fear River outflow from Lock and Dam #1. Percent of POR by deviation class when compared to MAF, Summer-Fall (June-November).

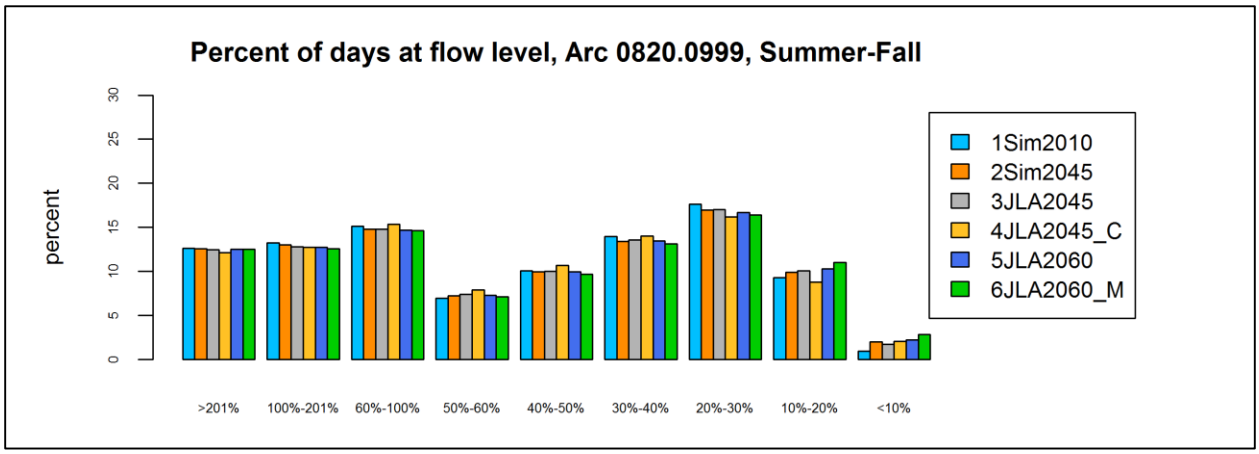


Figure E-40. Cape Fear River outflow from Lock and Dam #1. Percent of POR by deviation class when compared to MAF, Winter (December-February).

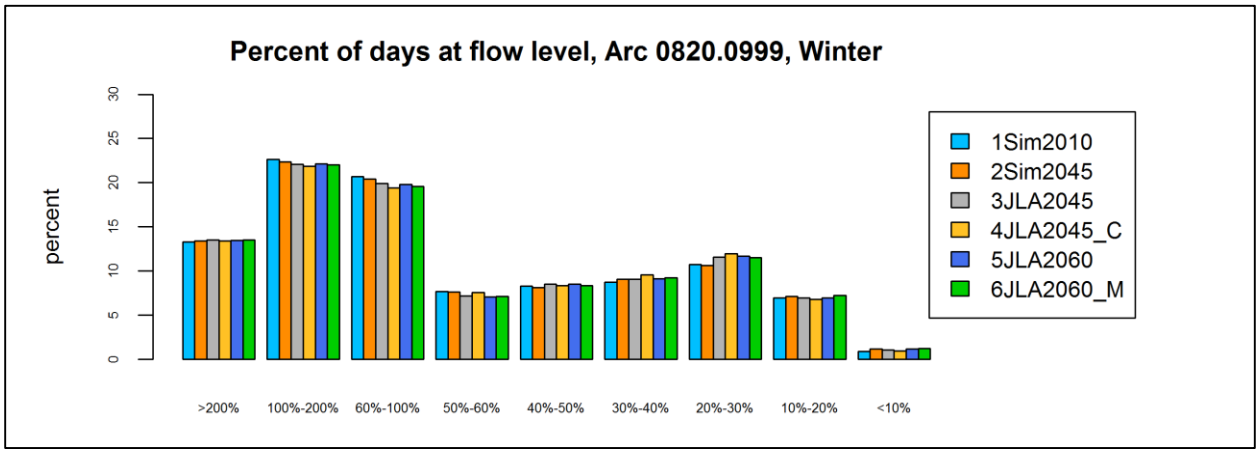


Table E-11. Deep River at USGS Gage 02100500 near Ramseur, NC		
Model Scenario	**Description**	**MAF (cfs)**
1Sim2010	basecase conditions in 2010	335
2Sim2045	2010 available supplies and 2045 demands	334
3JLA2045	recommended Jordan Lake allocations added to 2010 available supplies and 2045 demands	333
4JLA2045_C	same as 3JLA2045 with daily data in the flow record reduced 10%	300
5JLA2060	recommended Jordan Lake allocations and 2060 demands	334
6JLA2060_M	full allocation of Jordan Lake water supply pool and 106mgd withdrawals during peak month at L&D#1	334

Figure E-41. Deep River below Ramseur, NC. Percent of POR by deviation class when compared to MAF, all months (January-December).

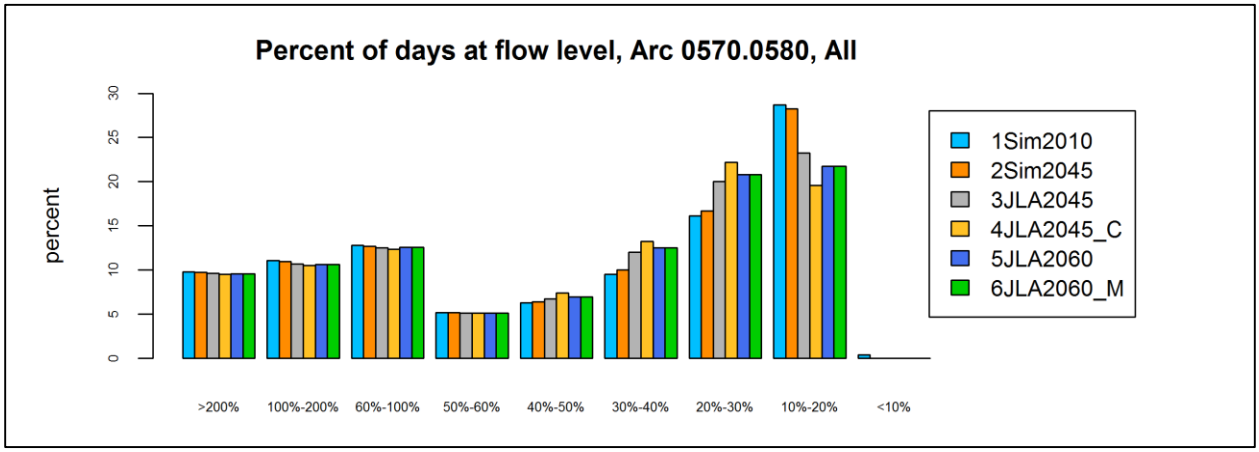


Figure E-42. Deep River below Ramseur, NC. Percent of POR by deviation class when compared to MAF, Spring (March-May).

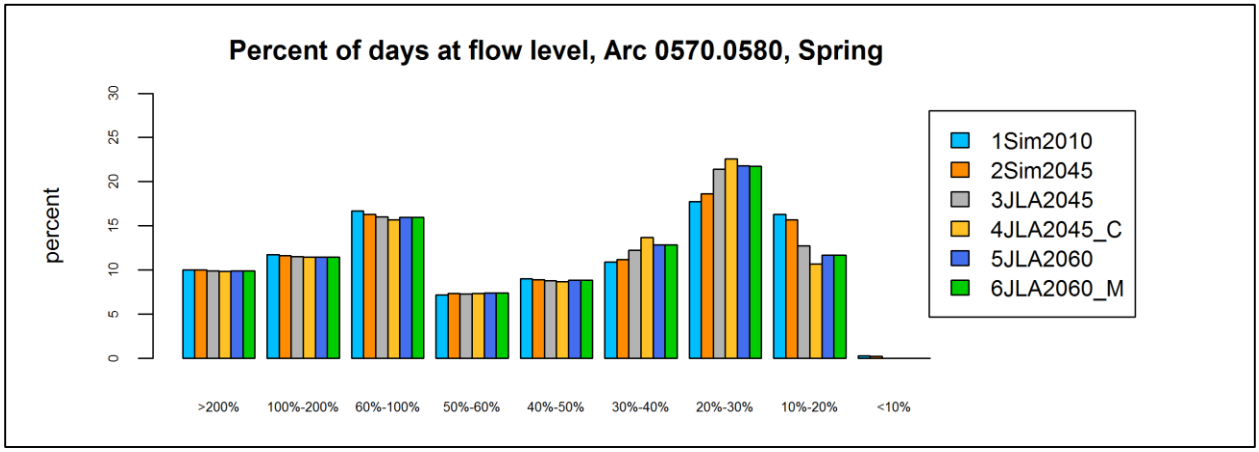


Figure E-43. Deep River below Ramseur, NC. Percent of POR by deviation class when compared to MAF, Summer-Fall (June-November).

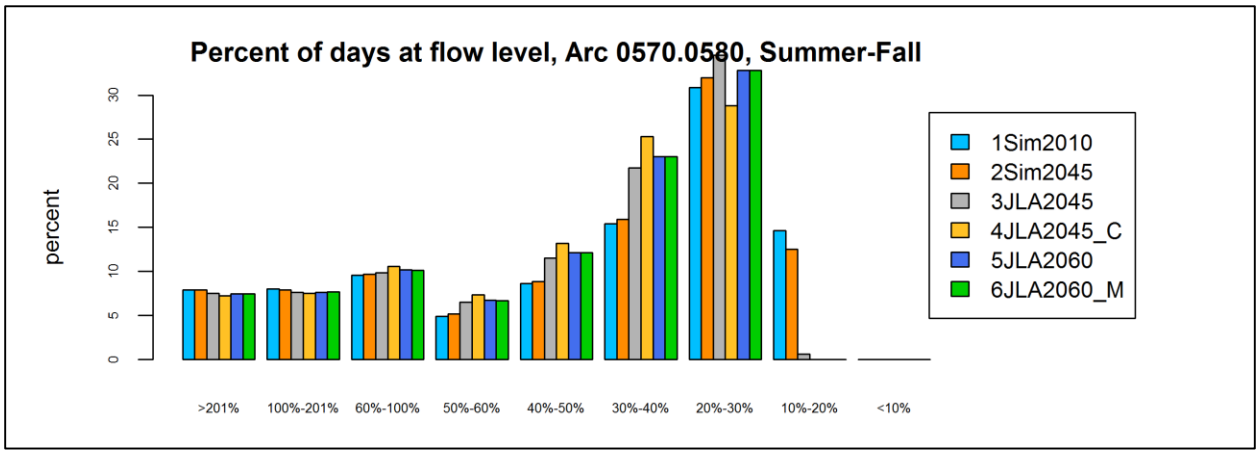


Figure E-44. Deep River below Ramseur, NC. Percent of POR by deviation class when compared to MAF, Winter (December-February).

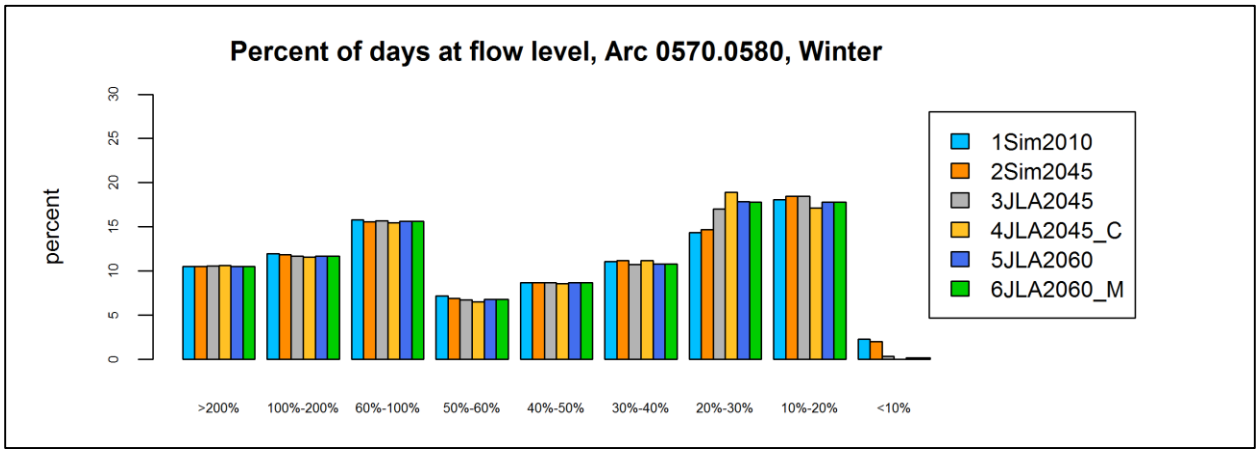


Table E-12. Deep River at USGS Gage 02102000 at Moncure, NC		
Model Scenario	**Description**	**MAF (cfs)**
1Sim2010	basecase conditions in 2010	1371
2Sim2045	2010 available supplies and 2045 demands	1381
3JLA2045	recommended Jordan Lake allocations added to 2010 available supplies and 2045 demands	1380
4JLA2045_C	same as 3JLA2045 with daily data in the flow record reduced 10%	1243
5JLA2060	recommended Jordan Lake allocations and 2060 demands	1387
6JLA2060_M	full allocation of Jordan Lake water supply pool and 106mgd withdrawals during peak month at L&D#1	1387

Figure E-45. Deep River at Moncure, NC. Percent of POR by deviation class when compared to MAF, all months (January-December).

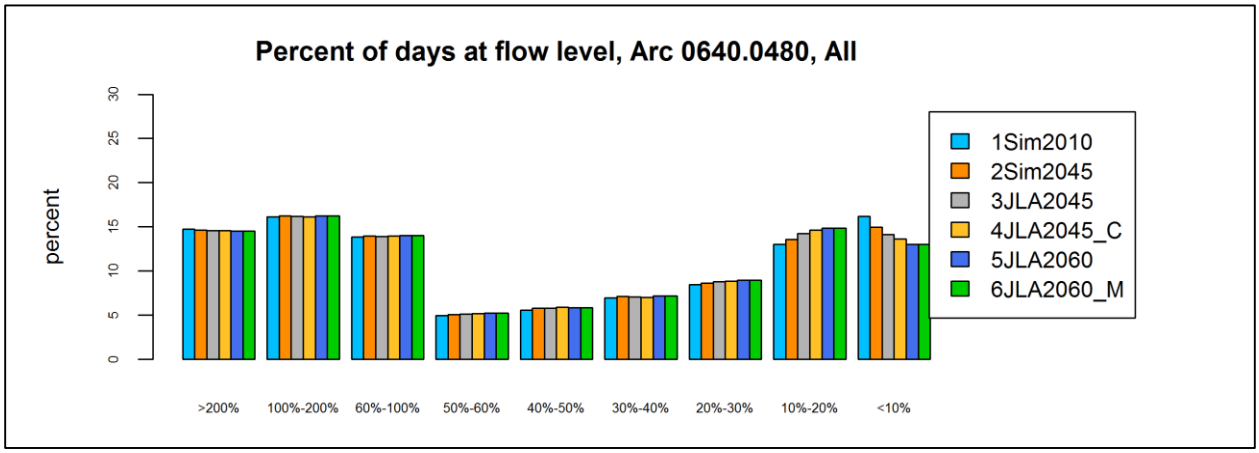


Figure E-46. Deep River at Moncure, NC. Percent of POR by deviation class when compared to MAF, Spring (March-May).

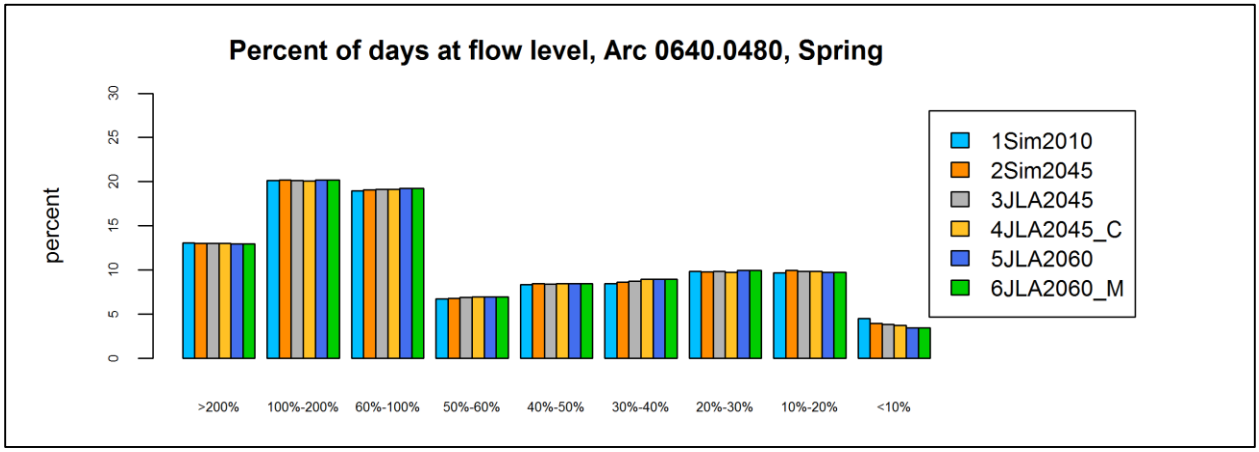


Figure E-47. Deep River at Moncure, NC. Percent of POR by deviation class when compared to MAF, Summer-Fall (June-November).

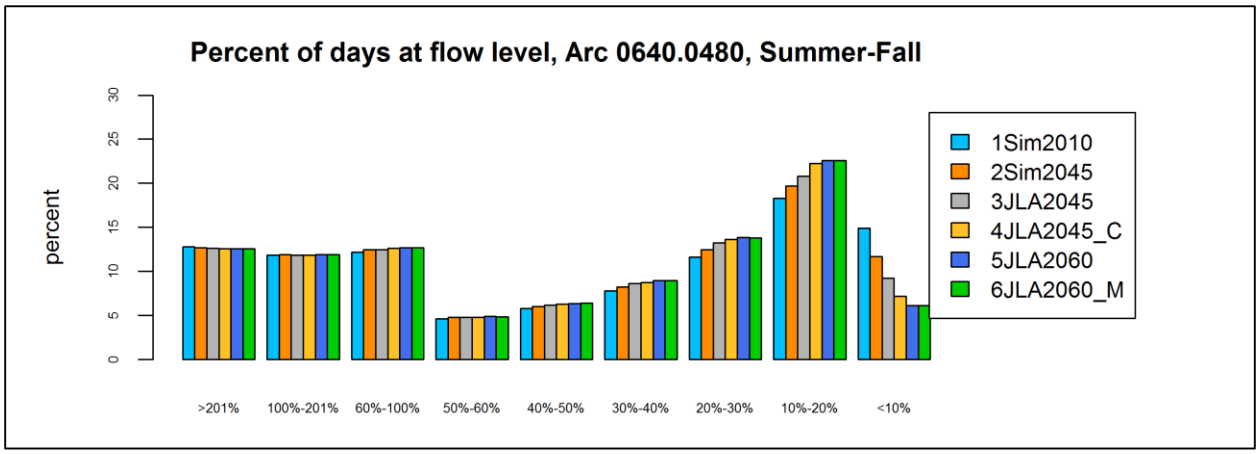


Figure E-48. Deep River at Moncure, NC. Percent of POR by deviation class when compared to MAF, Winter (December-February).

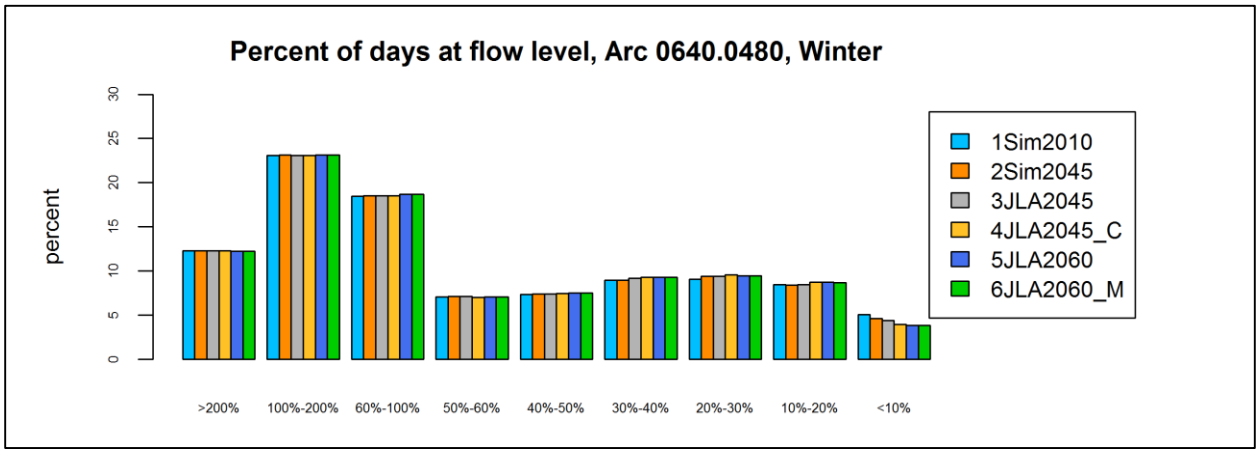


Table E-13. Little River at Linden, NC.		
Model Scenario	**Description**	**MAF (cfs)**
1Sim2010	basecase conditions in 2010	574
2Sim2045	2010 available supplies and 2045 demands	573
3JLA2045	recommended Jordan Lake allocations added to 2010 available supplies and 2045 demands	573
4JLA2045_C	same as 3JLA2045 with daily data in the flow record reduced 10%	516
5JLA2060	recommended Jordan Lake allocations and 2060 demands	572
6JLA2060_M	full allocation of Jordan Lake water supply pool and 106mgd withdrawals during peak month at L&D#1	572

Figure E-49. Little River at Linden, NC. Percent of POR by deviation class when compared to MAF, all months (January-December).

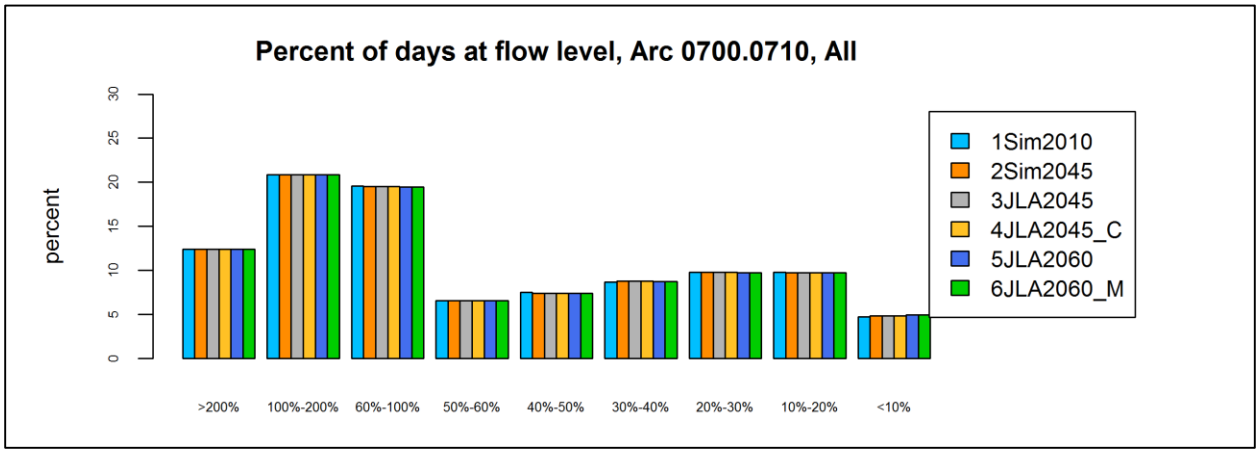


Figure E-50. Little River at Linden, NC. Percent of POR by deviation class when compared to MAF, Spring (March-May).

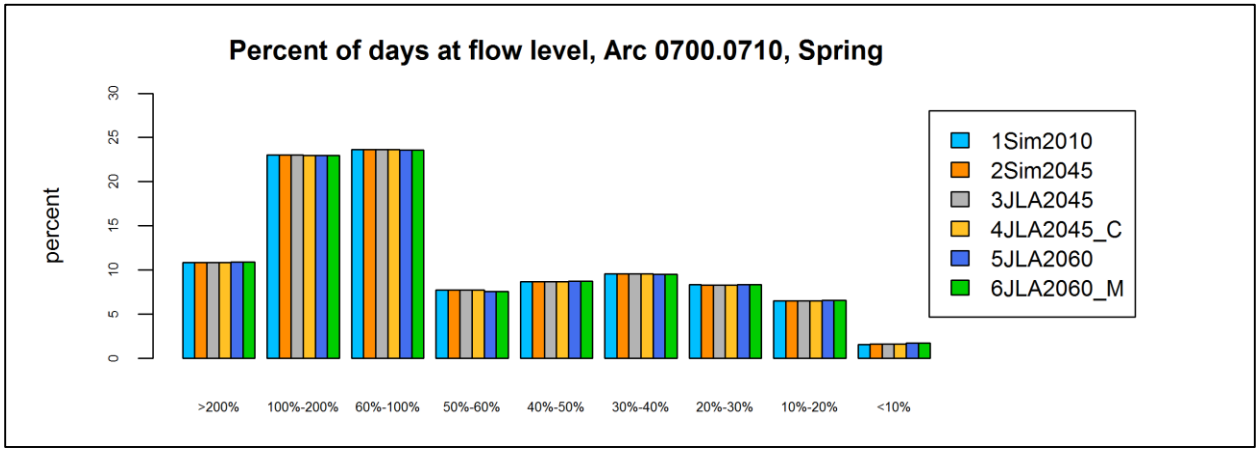


Figure E-51. Little River at Linden, NC. Percent of POR by deviation class when compared to MAF, Summer-Fall (June-November).

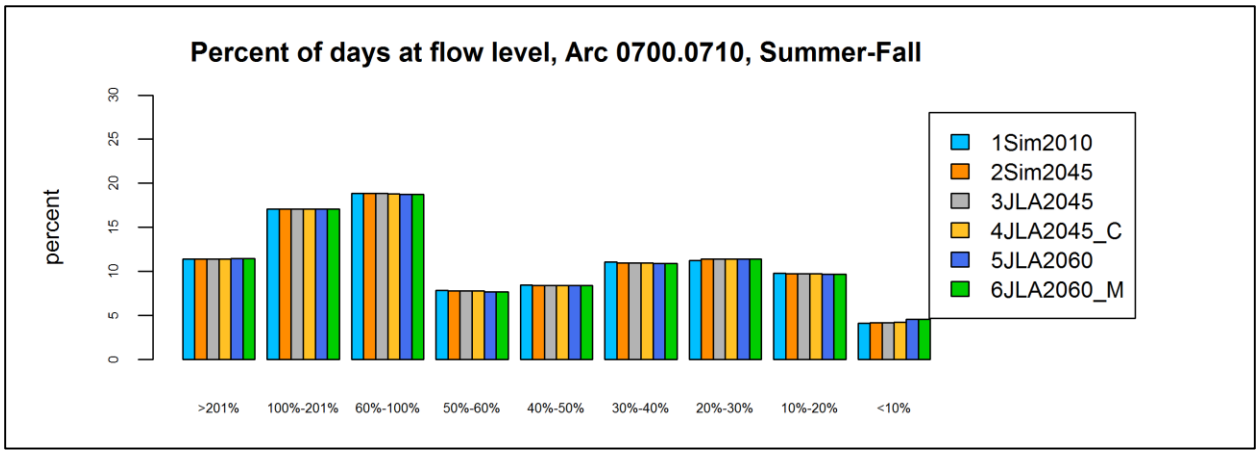
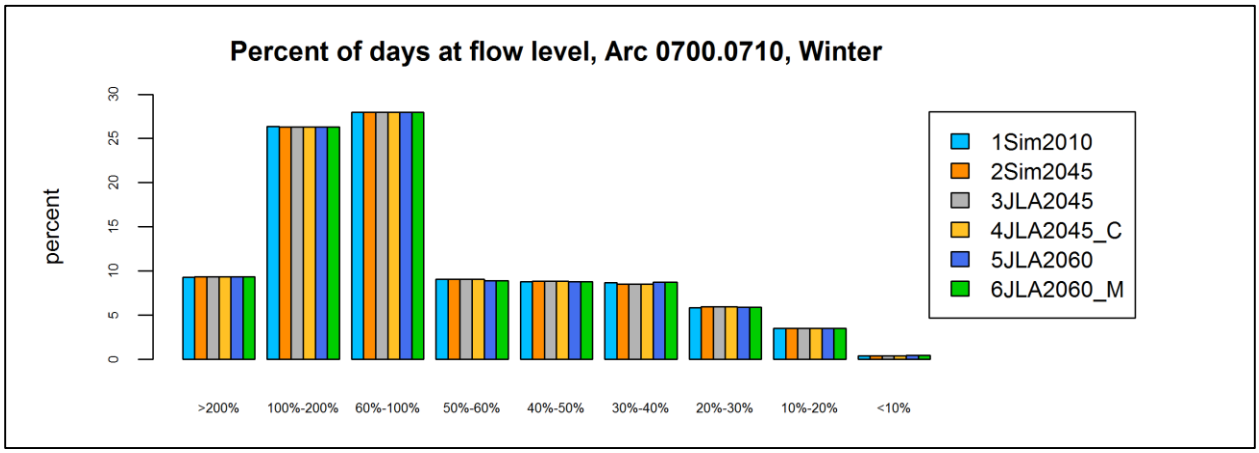


Figure E-52. Little River at Linden, NC. Percent of POR by deviation class when compared to MAF, Winter (December-February).



[i] https://deq.nc.gov/about/divisions/water-resources/planning/basin-planning/map-page/cape-fear-river-basin-landing/cape-fear-neuse-combined-river-basin-model

[ii] Tennant, D. L. 1976. "Instream flow regimens for fish, wildlife, recreation, and related environmental resources", in Orsborn, J. F. and Allman, C. H. (Eds), *Proceedings of the Symposium and Specialty Conference on Instream Flow Needs II.* American Fisheries Society, Bethesda, Maryland. PP. 359-373.