Appendix A
Notice of Intent and Scoping Document

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Appendix A.1 – Notice of Intent

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Kerr Lake Regional Water System
P. O. Box 1434, Henderson, North Carolina 27536

Mr. Stephen Smith, Chairman
NC Environmental Management Commission
c/o EMC Recording Clerk
Directors Office – Division of Water Quality
1617 Mail Service Center
Raleigh, NC 27699-1617

Subject: Kerr Lake Regional Water System Resubmittal of Notice of Intent to Request an Interbasin Transfer Certificate

Dear Mr. Smith:

The Kerr Lake Regional Water System (KLRWS) is respectfully submitting this Letter of Intent to notify the Environmental Management Commission (EMC) of its plans to request an Interbasin Transfer (IBT) Certificate. This notice supersedes the notice of intent submitted on January 2, 2009 and provides some additional information.

The KLRWS wishes to increase its authorized transfer from the Roanoke River Basin (Kerr Lake) to the Tar and Fishing Creek River Basins from 10 million gallons per day (MGD) (the grandfathered amount) to approximately 24 MGD. In addition, we are requesting a transfer from the Roanoke to the Neuse River of 2.4 MGD. Of the transfer to the Tar River Basin, 1.6 MGD is a requested transfer to the Fishing Creek subbasin. These transfer amounts are based on water use projections to 2040.

The City of Henderson, City of Oxford, and Warren County are making this request as partners in the KLRWS and as the primary applicants. In addition, the KLRWS partners are submitting this notice on behalf of all the communities that are obtaining water through our system that require an IBT approval. The attached map (Exhibit 1) shows the KLRWS partners and other communities that are provided water from our system. Exhibits 2 and 3 depict present (2007) and future (2040) water use information and estimated IBT amounts by basin. The water use and IBT projections are based on population projections and the 2007 Local Water Supply Plans submitted by water purveyors. Exhibits 4 and 5 depict the timelines for water use information and IBTs.

The grandfathered IBT of 10 MGD was approved by NC Division of Water Resources (DWR) for KLRWS on April 22, 1998. This transfer is from the Roanoke River Basin to a combination of the Tar River and Fishing Creek basins. The KLRWS serves as a regional provider, with each of the Partners making water sales to nearby communities. Local sewer systems provide treatment but most do not discharge back to the Roanoke River basin. Some wastewater is returned to the Roanoke River Basin via the City of Henderson's wastewater treatment plant, but much of the water uses are transfers out of the basin (Exhibit 1).

The KLRWS has undertaken future water supply planning efforts and cooperated with the U.S. Army Corps of Engineers (USACE) to assess an increase in water withdrawal from Kerr Lake. The USACE determined in 2005 (Reallocation Report – John H. Kerr Reservoir Water Supply Storage Reallocation Request of the City of Henderson, North Carolina), that demand was warranted and that Kerr Lake could support a future increased withdrawal of 20 MGD without adversely affecting the other uses of Kerr Lake or its water quality.

The KLRWS is aware of the IBT Certificate process outlined in GS 143-215.22 as amended in 2007 with House Bill 820 and intends to comply with the components of the process outlined therein. The three partners of KLRWS are submitting this notice as the primary applicants with the support of the communities they provide water. These communities will be co-applicants during the petition process. The KLRWS will actively engage the public interests during this process and will work closely with the NC DWR to ensure compliance with the various steps of the process, including public notice, public scoping meetings, an alternatives analysis, and preparing an environmental document through the State Environmental Policy Act (SEPA) process.

Please direct any correspondence regarding this Letter of Intent and subsequent process to James "Pete" O'Geary, Mayor of the City of Henderson. Questions may also be directed to Bill Kreutzberger with CH2M HILL at 704-543-3269.

Sincerely,

City of Henderson	City of Oxford	Warren County
James D. O'Geary, Mayor	Al Woodlief, Mayor	Linda Worth, Manager

c: Mr. Tom Reeder, Director, NC DENR Division of Water Resources
Mr. Tom Fransen, Deputy Director, NC DENR Division of Water Resources
CH2M HILL

Appendix A.2 – Notice of Intent Exhibits

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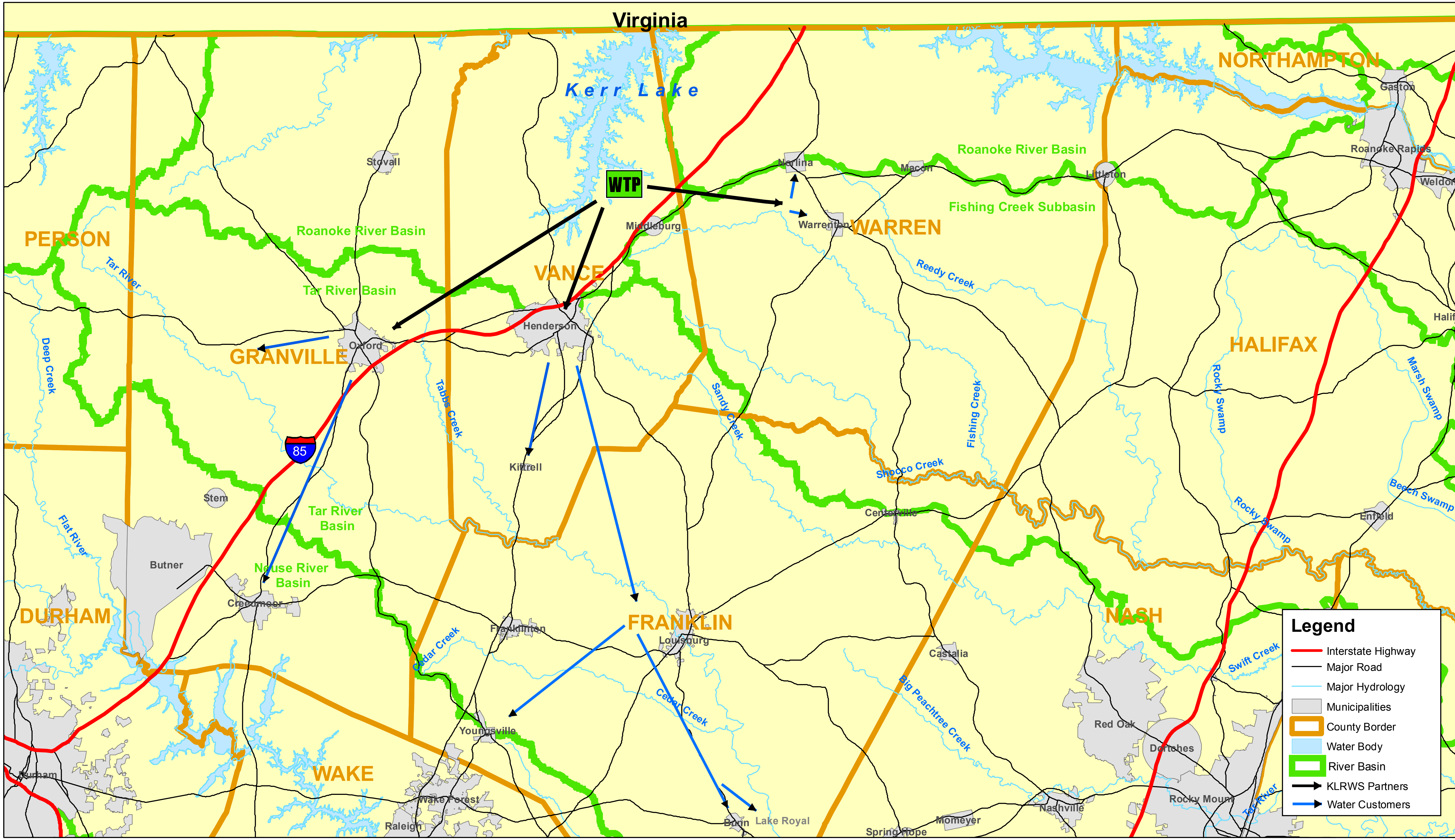

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Exhibit 1
Interbasin Transfer from
Roanoke River Basin

Kerr Lake Regional Water System

EXHIBIT 2
KERR LAKE REGIONAL WATER SYSTEM
SUMMARY OF INTERBASIN TRANSFERS
YEAR 2007

LEGEND

- KERR LAKE REGIONAL WATER SUPPLY
- KERR LAKE PARTNERS
- WATER SALES BY PARTNERS

ABBREVIATIONS

ADD	AVERAGE DAILY DEMAND
Con.	CONSUMPTIVE
IBT	INTERBASIN TRANSFER
KLRWS	KERR LAKE REGIONAL WATER SYSTEM
MDD	MAXIMUM DAILY DEMAND
WW	WASTEWATER

GRANVILLE COUNTY

ROANOKE RIVER BASIN — TAR RIVER BASIN — NEUSE RIVER BASIN

ADD	Stovall	MDD	
0.035	check OK	0.05	
0.035		0.05	
0.035	Con. Loss	0.05	to Roanoke
0.000	W.W.	0.00	to Roanoke

ADD	Kerr-Tar HUB	MDD	
0.00	check OK	0.00	
0.00	Sum Below	0.00	
0.00	Con. Loss	0.00	to Tar
0.00	W.W.	0.00	to Tar

ADD	OXFORD	MDD	
1.25	IBT	1.62	
1.28	check OK	1.67	
1.28	Sum Below	1.67	
0.02	Con. Loss	0.03	to Tar
1.22	W.W.	1.59	to Tar
0.00	Sale	0.00	to Creedmoor
0.04	Sale	0.05	to Stovall
0.00	Sale	0.00	to Granville Co.
0.00	Sale	0.00	to Kerr Tar Hub

ADD	Granville Co.	MDD	
0.00	check OK	0.00	
0.00		0.00	
0.00	Con. Loss	0.00	to Roanoke
0.00	Con. Loss	0.00	to Tar
0.00	Con Loss	0.00	to Neuse
0.00	W.W.	0.00	to Tar

ADD	Creedmoor	MDD	
0.00	check OK	0.00	
0.00	Sum Below	0.00	
0.00	Con. Loss	0.00	to Tar
0.00	W.W.	0.00	to Tar

TAR RIVER BASIN

VANCE COUNTY

ADD	KLRWS	MDD	
3.84	IBT	5.00	
6.54	Totals	8.52	
	Peaking Factor	1.302	
6.54	Sum Below	8.52	from Roanoke
6.42	SALE	8.36	
0.12	WW PROCESS	0.15	to Roanoke

ROANOKE RIVER BASIN

ADD	HENDERSON	MDD	
1.75	IBT	2.28	
4.102	check OK	5.34	
4.102	Sum Below	5.34	
-0.083	Con. Loss	-0.11	to Roanoke
-0.036	Con. Loss	-0.05	to Tar
2.436	W.W.	3.17	to Roanoke
0.000	Sale	0.00	to Kerr-Tar
0.074	Sale	0.10	to Kittrell
1.711	Sale	2.23	to Franklin Co.
0.000	Sale	0.00	to Vance Co.

ADD	Kerr-Tar HUB	MDD	
0.00	check OK	0.00	
0.00	Sum Below	0.00	
0.00	Con. Loss	0.00	to Tar
0.00	W.W.	0.00	to Tar

ADD	Vance Co	MDD	
0.00	check OK	0.00	
0.00	Sum Below	0.00	
0.00	Con. Loss	0.00	to Roanoke
0.00	Con. Loss	0.00	to Tar
0.00	WW.	0.00	to Roanoke

ADD	Kittrell	MDD	
0.074	check OK	0.10	
0.074	Sum Below	0.10	
0.074	Con. Loss	0.10	to Tar
0.000	WW.	0.00	to Tar

TAR RIVER BASIN

WARREN COUNTY

ADD	WARREN CO	MDD	
0.85	IBT	1.10	
1.04	check OK	1.36	
1.04	Sum Below	1.36	
0.17	Con. Loss	0.22	to Roanoke
0.28	Con. Loss	0.36	to Fishing Crk
0.14	W.W.	0.18	to Fishing Crk
0.00	Sale	0.00	to Kerr-Tar
0.15	Sale	0.20	to Norlina
0.30	Sale	0.39	to Warrenton

ADD	Kerr-Tar	MDD	
0.00	check OK	0.00	
0.00	Sum Below	0.00	
0.00	Con. Loss	0.00	to Fishing Crk
0.00	W.W.	0.00	to Fishing Crk

ADD	Norlina	MDD	
0.154	check OK	0.20	
0.154	Sum Below	0.20	
0.023	Con. Loss	0.03	to Roanoke
0.023	Con. Loss	0.03	to Fishing Crk
0.108	WW.	0.14	to Fishing Crk

ADD	Warrenton	MDD	
0.300	check OK	0.39	
0.300	Sum Below	0.39	
0.032	Con. Loss	0.04	to Fishing Crk
0.268	WW	0.35	to Fishing Crk

FISHING CREEK (SUB-BASIN TO TAR)

FRANKLIN COUNTY

NEUSE RIVER BASIN

ADD	Franklin Co.	MDD	
1.711	check OK	2.23	
1.711	Sum Below	2.23	
0.921	Con. Loss	1.20	to Tar
0.163	Con. Loss	0.21	to Neuse
0.294	W.W.	0.38	to Tar
0.058	Sale	0.08	to Youngsville
0.120	Sale	0.16	to Bunn
0.155	Sale	0.20	to Lake Royale
0.00	Sale	0.00	to Kerr-Tar

ADD	Youngsville	MDD	
0.058	check OK	0.08	
0.058	Sum Below	0.08	
0.000	Con. Loss	0.00	to Tar
0.034	Con. Loss	0.04	to Neuse
0.024	W.W.	0.03	to Tar

ADD	Bunn	MDD	
0.120	check OK	0.16	
0.120	Sum Below	0.16	
0.021	Con. Loss	0.03	to Tar
0.099	WW.	0.13	to Tar

ADD	Lake Royal	MDD	
0.155	check OK	0.202	
0.155	Sum Below	0.202	
0.153	Con. Loss	0.199	to Tar
0.002	WW.	0.002	to Tar

Franklinton Contract	
0.258	From Tar

Louisburg Contract	
0.229	From Tar

ADD	Kerr-Tar HUB	MDD	
0.000	check OK	0.00	
0.000	Sum Below	0.00	
0.000	Con. Loss	0.00	to Tar
0.000	W.W.	0.00	to Tar

IBT SUMMARY FOR KLRWS

		ADD	MDD
Withdrawal	ROANOKE	6.54	8.52
Consumptive Loss	ROANOKE	0.15	0.19
	TAR	1.16	1.51
	FISHING CREEK (sub-basin to Tar)	0.333	0.43
	NEUSE	0.20	0.26
Waterwater Discharge	ROANOKE	2.55	3.33
	TAR	1.64	2.14
	FISHING CREEK (sub-basin to Tar)	0.515	0.67
	NEUSE	0	0
Total Return to	ROANOKE	2.70	3.52
	IBT TAR	**2.80**	**3.64**
	IBT FISHING CREEK	**0.85**	**1.10**
	TOTAL IBT TO TAR	**3.65**	**4.75**
	IBT NEUSE	0.20	0.26
	check	6.54	8.52

NOTES:

1. MDD values were determined using a 1.305 Peak Day Value, based on 2007 water production data.
2. Water from Franklinton and Louisburg subtracted from Franklin County totals since non KLRWS water.
3. Consumptive use dispersement based on % of system in each basin and # of septic connections within each system.
4. Consumptive use includes wastewater to septic tanks, water used for irrigation and other consumptive uses.
5. Water from Creedmoor and South Granville subtracted from Creedmoor's totals since non KLRWS water.

EXHIBIT 3
KERR LAKE REGIONAL WATER SYSTEM
SUMMARY OF INTERBASIN TRANSFERS
YEAR 2040

LEGEND

- KERR LAKE REGIONAL WATER SUPPLY
- KERR LAKE PARTNERS
- WATER SALES BY PARTNERS
- DATA FROM PREVIOUS IBT STUDY 2035

ABBREVIATIONS

ADD	AVERAGE DAILY DEMAND
Con.	CONSUMPTIVE
IBT	INTERBASIN TRANSFER
KLRWS	KERR LAKE REGIONAL WATER SYSTEM
MDD	MAXIMUM DAILY DEMAND
WW	WASTEWATER

ROANOKE RIVER BASIN

TAR RIVER BASIN

NEUSE RIVER BASIN

GRANVILLE COUNTY

ADD	Stovall	MDD	
0.050	check OK	0.07	
0.050		0.07	
0.050	Con. Loss	0.07	to Roanoke
0.000	W.W.	0.00	to Roanoke

ADD	Kerr-Tar HUB	MDD	
0.16	check OK	0.20	
0.16	Sum Below	0.21	
0.02	Con. Loss	0.03	to Tar
0.13	W.W.	0.17	to Tar

ADD	Granville Co.	MDD	
5.03	check OK	6.55	
5.03		6.55	
0.18	Con. Loss	0.23	to Roanoke
0.66	Con. Loss	0.86	to Tar
0.36	Con Loss	0.47	to Neuse
3.83	W.W.	4.99	to Tar

ADD	OXFORD	MDD	
8.51	IBT	11.08	
8.74	check OK	11.38	
8.74	Sum Below	11.38	
0.05	Con. Loss	0.06	to Tar
2.50	W.W.	3.26	to Tar
0.95	Sale	1.24	to Creedmoor
0.05	Sale	0.07	to Stovall
5.03	Sale	6.55	to Granville Co.
0.16	Sale	0.20	to Kerr Tar Hub

ADD	Creedmoor	MDD	
0.95	check OK	1.24	
0.95	Sum Below	1.24	
0.03	Con. Loss	0.04	to Tar
0.92	W.W.	1.20	to Tar

TAR RIVER BASIN

ADD	KLRWS	MDD	
20.13	IBT	26.21	
24.66	Totals	32.12	
	Peaking Factor	1.30	
24.66	Sum Below	32.12	from Roanoke
24.22	SALE	31.53	
0.45	WW PROCESS	0.58	to Roanoke

ADD	HENDERSON	MDD	
10.37	IBT	13.50	
13.976	check OK	18.20	
13.976	Sum Below	18.20	
-0.116	Con. Loss	-0.15	to Roanoke
-0.050	Con. Loss	-0.07	to Tar
3.409	W.W.	4.44	to Roanoke
0.124	Sale	0.16	to Kerr-Tar
0.082	Sale	0.11	to Kittrell
9.793	Sale	12.75	to Franklin Co.
0.734	Sale	0.96	to Vance Co.

ADD	Kittrell	MDD	
0.082	check OK	0.11	
0.082	Sum Below	0.11	
0.082	Con. Loss	0.11	to Tar
0.000	WW.	0.00	to Tar

ROANOKE RIVER BASIN

ADD	Kerr-Tar HUB	MDD	
0.12	check OK	0.16	
0.12	Sum Below	0.16	
0.02	Con. Loss	0.02	to Tar
0.11	W.W.	0.14	to Tar

VANCE COUNTY

ADD	Vance Co	MDD	
0.73	check OK	0.96	
0.73		0.96	
0.32	Con. Loss	0.41	to Roanoke
0.42	Con. Loss	0.54	to Tar
0.00	WW.	0.00	to Roanoke

TAR RIVER BASIN

ADD	WARREN CO	MDD	
1.25	IBT	1.63	
1.501	check OK	1.95	
1.500	Sum Below	1.95	
0.220	Con. Loss	0.29	to Roanoke
0.370	Con. Loss	0.48	to Fishing Crk
0.184	W.W.	0.24	to Fishing Crk
0.157	Sale	0.20	to Kerr-Tar
0.182	Sale	0.24	to Norlina
0.387	Sale	0.50	to Warrenton

ADD	Kerr-Tar	MDD	
0.16	check OK	0.20	
0.16	Sum Below	0.21	
0.02	Con. Loss	0.03	to Fishing Crk
0.13	W.W.	0.17	to Fishing Crk

ADD	Norlina	MDD	
0.182	check OK	0.24	
0.182	Sum Below	0.24	
0.027	Con. Loss	0.04	to Roanoke
0.027	Con. Loss	0.04	to Fishing Crk
0.128	WW.	0.17	to Fishing Crk

ADD	Warrenton	MDD	
0.387	check OK	0.50	
0.387	Sum Below	0.50	
0.041	Con. Loss	0.05	to Fishing Crk
0.346	WW	0.45	to Fishing Crk

FISHING CREEK (SUB-BASIN TO TAR)

WARREN COUNTY

FRANKLIN COUNTY

NEUSE RIVER BASIN

0.259

ADD	Franklin Co.	MDD	
9.793	check OK	12.75	
9.793	Sum Below	12.75	
6.253	Con. Loss	8.14	to Tar
1.103	Con. Loss	1.44	to Neuse
1.475	W.W.	1.92	to Tar
0.259	Sale	0.34	to Youngsville
0.168	Sale	0.22	to Bunn
0.267	Sale	0.35	to Lake Royale
0.267	Sale	0.35	to Kerr-Tar

ADD	Youngsville	MDD	
0.259	check OK	0.34	
0.259	Sum Below	0.34	
0.000	Con. Loss	0.00	to Tar
0.153	Con. Loss	0.20	to Neuse
0.106	W.W.	0.14	to Tar

ADD	Bunn	MDD	
0.168	check OK	0.22	
0.168	Sum Below	0.22	
0.030	Con. Loss	0.04	to Tar
0.139	WW.	0.18	to Tar

ADD	Lake Royal	MDD	
0.267	check OK	0.348	
0.267	Sum Below	0.348	
0.264	Con. Loss	0.343	to Tar
0.003	WW.	0.004	to Tar

Franklinton Contract	
0.258	From Tar

Louisburg Contract	
0.229	From Tar

ADD	Kerr-Tar HUB	MDD	
0.267	check OK	0.35	
0.267	Sum Below	0.35	
0.040	Con. Loss	0.05	to Tar
0.227	W.W.	0.30	to Tar

IBT SUMMARY FOR KLRWS

		ADD	MDD
Withdrawal	ROANOKE	24.66	32.12
Consumptive Loss	ROANOKE	0.68	0.88
	TAR	7.82	10.18
	FISHING CREEK (sub-basin to Tar)	0.462	0.60
	NEUSE	1.62	2.10
Waterwater Discharge	ROANOKE	3.86	5.02
	TAR	9.44	12.29
	FISHING CREEK (sub-basin to Tar)	0.791	1.03
	NEUSE	0	0
Total Return to	ROANOKE	4.53	5.90
	IBT TAR	**17.26**	**22.48**
	IBT FISHING CREEK	**1.25**	**1.63**
	TOTAL IBT TO TAR	**18.51**	**24.11**
	IBT NEUSE	1.62	2.10
	check	24.66	32.12

NOTES:

1. MDD values were determined using a 1.305 Peak Day Value, based on 2007 water production data.
2. Water from Franklinton and Louisburg subtracted from Franklin County totals since non KLRWS water.
3. Consumptive use dispersement based on % of system in each basin and # of septic connections within each system.
4. Consumptive use includes wastewater to septic tanks, water used for irrigation and other consumptive uses.
5. Water from Creedmoor and South Granville subtracted from Creedmoor's totals since non KLRWS water.

EXHIBIT 4
TAR RIVER BASIN IBT SUMMARY

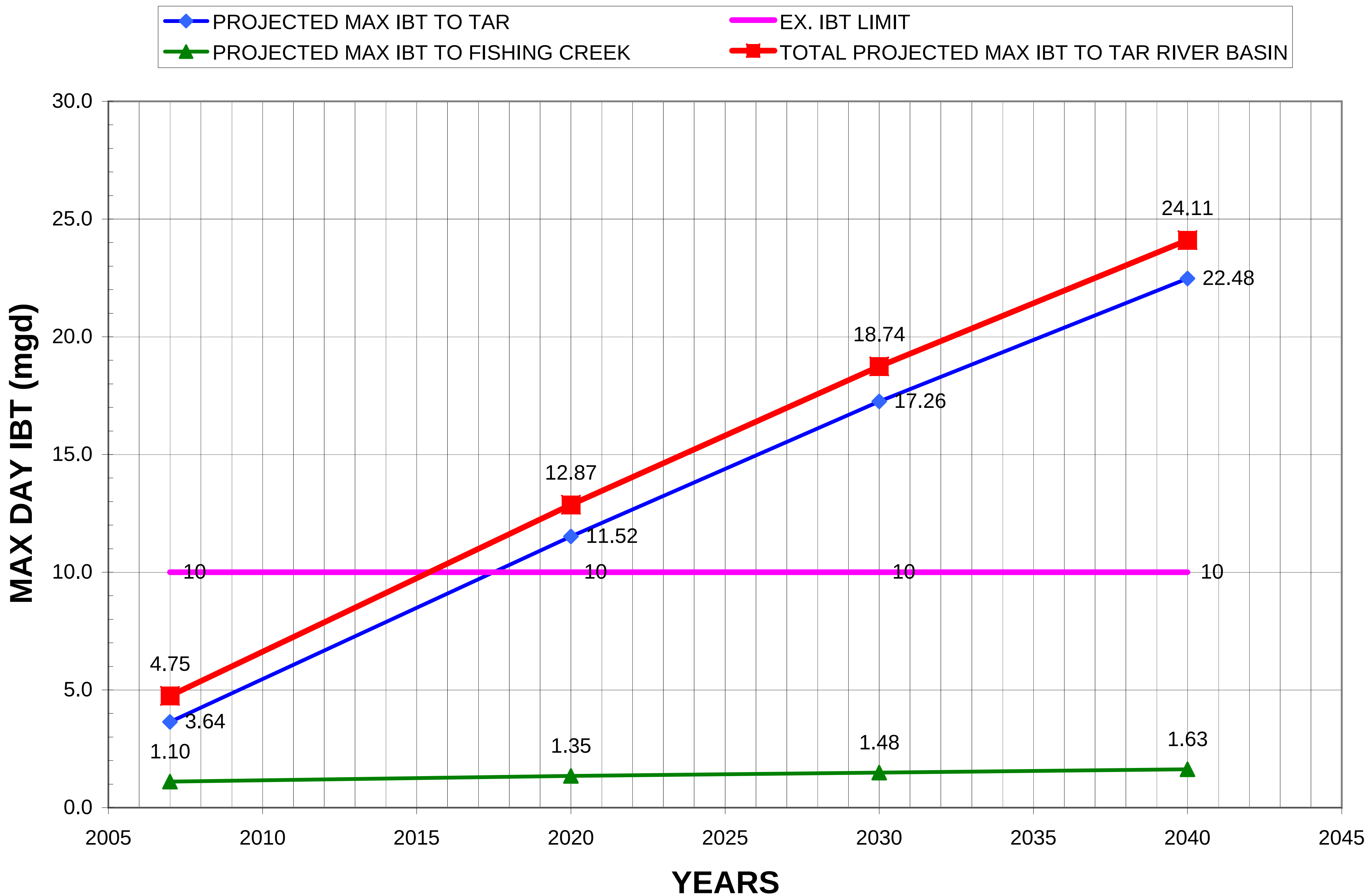
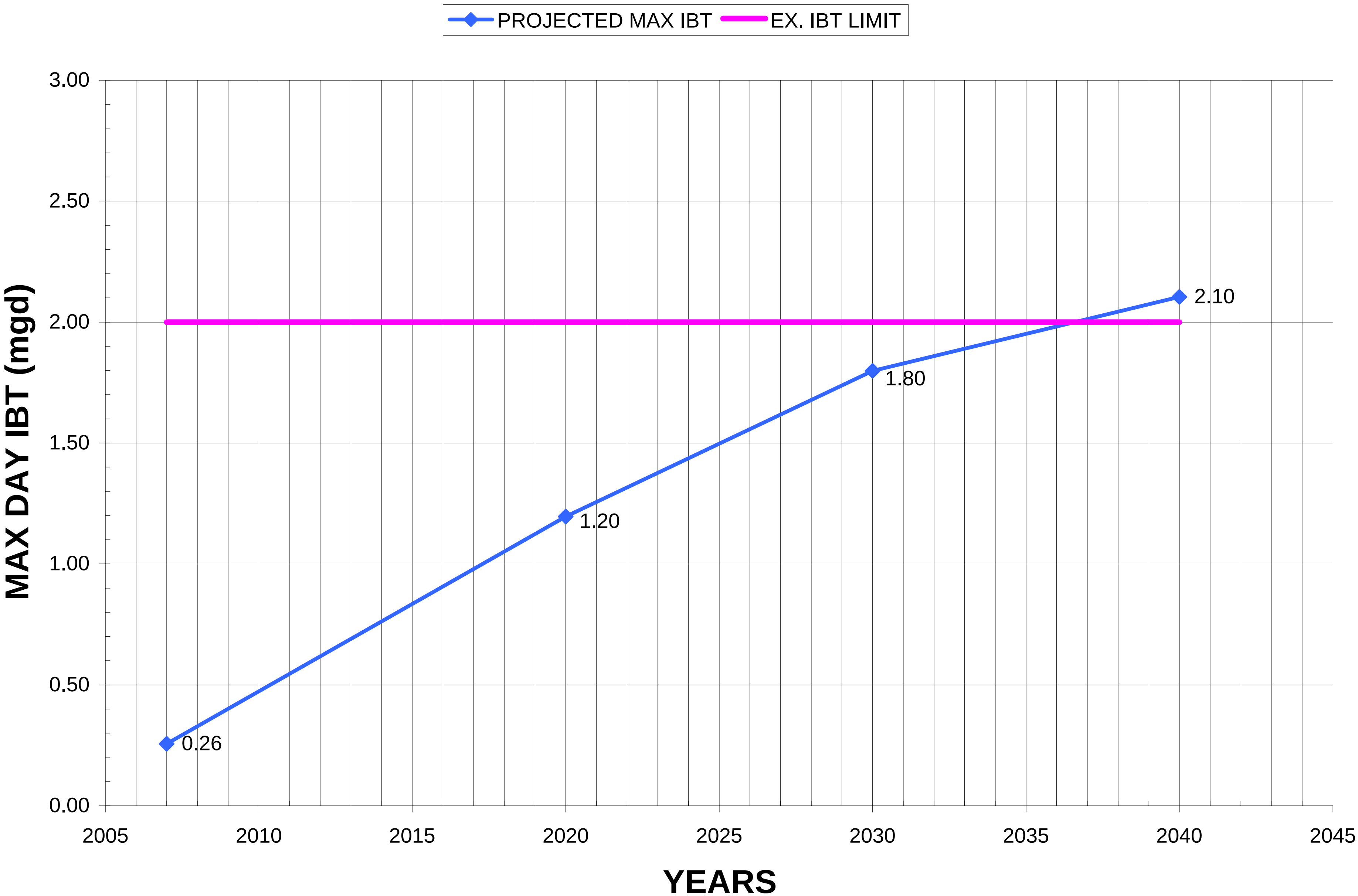


EXHIBIT 5
NEUSE RIVER BASIN IBT SUMMARY



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Appendix A.3 – Scoping Document

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Kerr Lake Regional Water System Interbasin Transfer Request from the Roanoke River Basin

Scoping Document
Interbasin Transfer Certificate and Environmental Impact Statement
February 2009

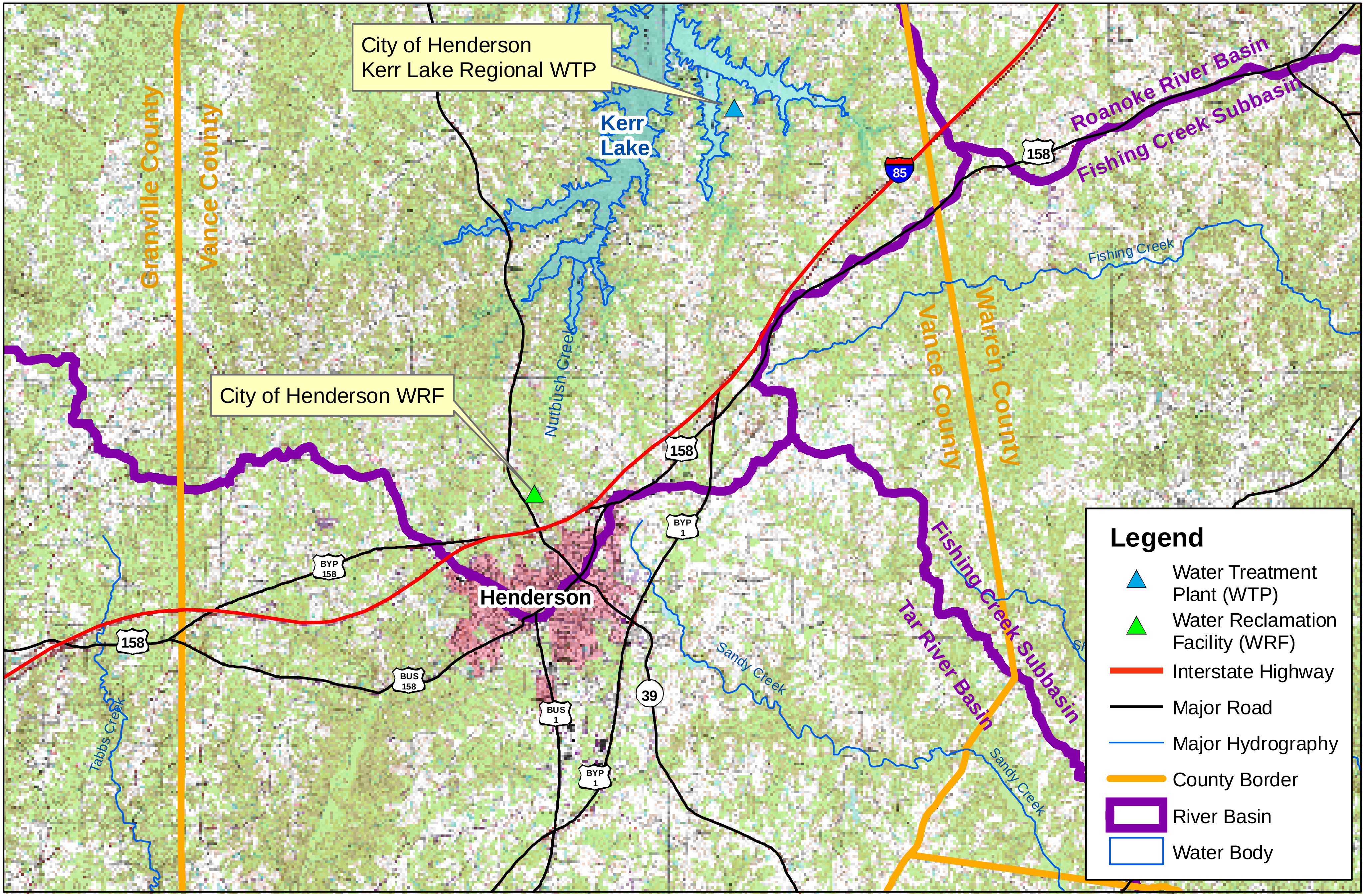
Introduction

The Kerr Lake Regional Water System (KLRWS) currently provides water directly or indirectly to municipal and county systems in four counties and three river basins in northeastern North Carolina. The water supply for the system is John H. Kerr Reservoir (Kerr Lake) (Figure 1). The owners of the KLRWS and primary bulk customers served by the system are City of Henderson, City of Oxford, and Warren County, known as the "Partners." They also currently sell water to secondary bulk customers that include communities in Warren, Vance, Franklin, and Granville Counties which are shown on Figure 2. These include Stovall, Warrenton, Norlina, Vance County, Kittrell, and Franklin County with future sales to Creedmoor, Granville County, and the Triangle North business parks. Franklin County then also sells water to Bunn, Lake Royal, and Youngsville, and obtains additional supply from Franklinton and Louisburg (Figure 2).

The system currently produces on average 6.5 million gallons per day (mgd) of finished water. Maximum day production approaches 8.5 mgd. The KLRWS currently has a maximum day interbasin transfer (IBT) of approximately 5 mgd, a grandfathered IBT of 10 mgd, and a projected IBT of approximately 24 mgd by 2040 to the Tar River Basin. In addition, a small amount of water is also transferred to the Neuse River Basin. While this transfer is currently below 0.3 mgd, it is projected to grow to over 2.0 mgd by 2040. While the KLRWS will not approach the grandfathered IBT during the next 5 to 8 years, it is important to complete this process in a timely manner to ensure continued water service to KLRWS Partners and the local governments with contracts with the partners.

Planning for future demands, KLRWS has undertaken the following steps:

- Completed design and an environment assessment (EA) for water treatment plant (WTP) expansion
- Cooperated with U.S. Army Corps of Engineers (USACE) on a Reallocation Report after requesting a reallocation of water supply storage in order to increase withdrawals (2005)
- Submitted a Notice of Intent to North Carolina Environmental Management Commission (NC EMC) for increased IBT
- Summarized available water demand projects based on 2007 Local Water Supply Plans developed by the primary and secondary bulk customers of the KLRWS
- Prepared this Scoping Document to comply with recent IBT regulations



Source: USGS Topographic Quadrangle Map

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Figure 1
Interbasin Transfer from Roanoke River Basin
Henderson Quadrangle
Kerr Lake Regional Water System

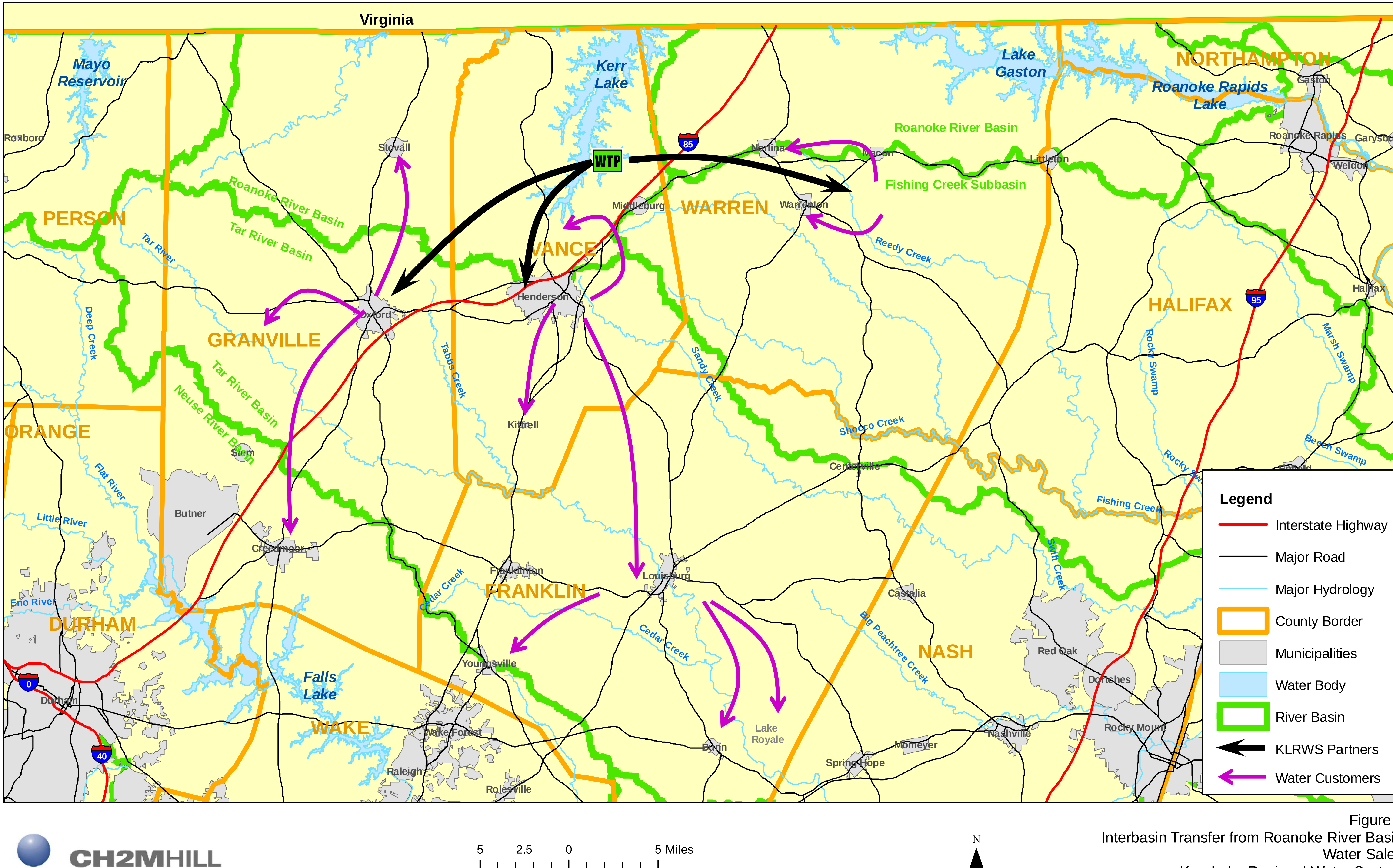

Figure 2
Interbasin Transfer from Roanoke River Basin
Water Sales
Kerr Lake Regional Water System

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The KLRWS Partners completed an EA for an expansion of its water plant in 2003 (EE&T, 2003). This EA received a Finding of No Significant Impact (FONSI) and plan approvals were obtained for a water plant expansion. This EA is a comprehensive document that can become the basis of an environmental impact statement (EIS) to support an IBT certificate. Since an approved EA is typically considered valid by the North Carolina Department of Environment and Natural Resources (NCDENR) for 5 years, this document can be a comprehensive reference for use in an updated EIS to support the IBT certificate process. The 2007 Local Water Supply Updates for the partner communities will also serve as key information to be incorporated into the IBT planning process.

Current Situation and Project Need

Kerr Lake Regional Water System Background

The KLRWS includes the Kerr Lake Regional Water Plant, which is a conventional surface water treatment facility, distribution mains, storage tanks and water meters. The raw water intake is located on the Anderson Creek arm of the lake. Raw water is drawn from the lake intake and sent to the nearby WTP pumping station wet well. From there, it is pumped via a 36-inch raw water transmission line to the WTP's rapid mix basin.

The water source, John H. Kerr Reservoir (Kerr Lake), was formed in 1952 by construction of the John H. Kerr dam, an impoundment of the Roanoke River in Mecklenburg County, Virginia, for hydroelectric power and flood control. The lake encompasses approximately 50,000 acres of surface area and 850 miles of shoreline. The reservoir is owned by USACE. The lake is also of recreational importance for residents of both North Carolina and Virginia.

The 2003 EA concluded that the plant expansion to 20 mgd is necessary, noting that the plant experienced water demands of up to 80 percent of the current maximum daily demand (MDD) (10 mgd) on multiple occasions. The existing ordinances and regulations in place were deemed adequate to counter any secondary and cumulative impacts (SCI) that could occur as the result of the facility expansion. The EA stipulated that specifications will be written to require mitigation practices that meet or exceed the existing state and federal statues. The SCI identified for the water treatment plant expansion would be the similar to those facilitated by an increase in IBT, since the WTP would provide more treatment capacity than could be used within its service area in the Roanoke River Basin. SCI will be a focus of the EIS related to the IBT certificate request.

The EA proposes expanding the existing facility to 20 mgd. In addition to the WTP EA, the KLRWS also requested that the USACE evaluate an increase in allocation of water supply storage in Kerr Lake. The 2005 reallocation report issued by the USACE approves a request by the City of Henderson for a reallocation of 10,292 acre-feet (AF) from the usable conservation pool storage at Kerr Lake for water supply. This brings the total water supply storage allocation to 21,115 AF. This volume corresponds to an average annual withdrawal of 20 mgd. This reallocation would finalize conversion of an original 20 mgd 'water use' agreement to a 'storage agreement' and could meet peak water demands approaching 26 mgd using the current peaking factor of 1.3.

TABLE 1
Kerr Lake Pertinent Reallocation Data

Drainage Area (square miles)		7,800
Storage * (AF)	Total Usable Pool (Elevation 268-320)	2,262,421
	Flood Control Pool (Elevation 300-320)	1,282,367
	Conservation Pool (Elevation 268-300)	980,054
	Hydropower	969,231
	Water Supply	10,823

* Storage remaining after 100 years of sedimentation from July 1953
Source: 2005 USACE Reallocation Report

To reach the conclusion that additional water supply storage should be allocated to KLRWS, several alternatives to increasing storage allocation in Kerr Lake were evaluated by the USACE. These included using other sources for water supply. The alternatives considered and resulting findings are summarized in Table 2. According to the report, new reallocation from conservation storage was the only alternative deemed viable other than "no action." The USACE approved the increased allocation of storage in Kerr Lake for KLRWS. Through the IBT certificate and EIS process, alternatives to the use of Kerr Lake for water supply will also be analyzed. Other considerations will include avoiding an IBT by other means, such as returning wastewater to its source basin.

TABLE 2
Alternative Water Sources Considered by USACE

Alternative	Viability
1. Groundwater/Bulk Finished Water Purchase	Rejected: inadequate supply
2. Alternative Surface Water	Rejected: inadequate supply
3. Conservation	Rejected: not viable for long term
4. No Action	Potentially viable
5. New Reallocation from Conservation Storage (Kerr)	Potentially viable

Source: 2005 USACE Reallocation Report

Study Area

The service area is split between the Roanoke, Tar-Pamlico, and Neuse River basins, as shown in Figure 1. The Roanoke River basin is both a source and receiving basin, while the Tar-Pamlico and Neuse River basins are only receiving basins. The upper northern portion of the service area, including the Kerr Lake, is located in the Roanoke River Basin. The Roanoke River begins in the Blue Ridge Mountains of northwestern Virginia and flows in a generally southeastern direction for 400 miles, entering North Carolina through Kerr Lake. From the lake it flows into Lake Gaston and Roanoke Rapids Lake, and on through the coastal plain before emptying into the Albemarle Sound in eastern North Carolina. Only 36 percent of the basin is within North Carolina, with the remaining 64 percent located in Virginia.

The Neuse and Tar-Pamlico River Basins are the third and fourth largest river basins, respectively, in North Carolina. Both basins are wholly contained within the state. The Neuse River originates in Person and Orange Counties and flows southeasterly until it turns into a tidal estuary near New Bern, which flows into the Pamlico Sound. Similarly, the Tar River originates in Person, Granville, and Vance Counties, and flows southeasterly until it turns into a tidal estuary, near Washington where it changes name to the Pamlico River, and then flows into Pamlico Sound. The Tar-Pamlico River Basin includes the Fishing Creek Subbasin, which includes portions of Vance and Warren Counties, and is considered a separate subbasin under IBT rules.

Municipal wastewater dischargers into the study area are listed in Table 3. Some municipal wastewater is returned to the Roanoke River Basin by the City of Henderson. Nutbush Creek, the receiving stream for the City's discharge, is on the 2006 303(d) list of impaired waters. Other discharges are to the Tar River Basin. Fishing Creek and Sandy Creek are also on the 2006 303(d) list of impaired waters (NCDWQ, 2006).

TABLE 3
Municipal Wastewater Discharges within Service Area

WWTP	Discharge Location	Receiving Basin
City of Henderson	Nutbush Creek (Kerr Lake)	Roanoke River
Town of Oxford	Fishing Creek	Upper Tar River
Town of Warrenton	Fishing Creek	Fishing Creek
Town of Louisburg Tar River	Tar River	Upper Tar River

Water Demand Projections

As the KLRWS first began preparing for a WTP expansion, water demand projections were prepared in 2004. These water demand projections supported the development of a design to expand the WTP and the request for a 20-mgd allocation of storage in Kerr Lake, which was approved by USACE in the 2005 Reallocation Report. KLRWS previous average daily demands for 5-year intervals beginning in 1992 are listed in Table 4.

TABLE 4
KLRWS Past Average Daily Water Demands

Year	1992	1997	2002	2007
Amount (mgd)	4.99	5.07	5.89	6.54

The KLRWS Partners recognize that an IBT certificate is also required if this expansion in water treatment capabilities is constructed because service areas and water sales occur outside the Roanoke River Basin. In 2008, updated population projection data were reviewed when water demand projections were updated (Earth Tech, 2008). Population growth will occur at a slow rate in Vance County and Warren County, while more rapid growth is occurring in Granville County (where Oxford is located) and Franklin County, which is in relatively close proximity to the Research Triangle area. In addition to serving future population growth, the KLRWS Partners are extending water service areas by constructing additional water infrastructure.

Using population data and 2007 Local Water Supply Plans, updated demand projections were developed for each of the Partners and the communities to which they provide water. These demand projections help to more accurately predict IBT. The population projections through 2040 are shown in Table 5 and the demand and IBT projections are summarized in Table 6. Detailed projections are presented in Exhibits 1 and 2.

TABLE 5
Past and Projected Annual County Population Totals

County	2000	2005	2010	2015	2020	2025	2030	2035	2040
Franklin	47,260	53,880	60,120	66,669	73,444	80,262	86,924	93,585	100,247
Granville	48,498	53,090	57,933	62,024	66,143	70,141	74,335	78,529	82,724
Vance	42,954	43,192	43,730	44,223	44,684	45,196	45,679	46,162	46,645
Warren	19,972	20,072	19,830	19,797	19,747	19,662	19,556	19,449	19,343

Source: Earth Tech, 2008

TABLE 6
IBT Summary for KLRWS – 2007, 2020, 2030, and 2040

		2007 (mgd)		2020 (mgd)		2030 (mgd)		2040 (mgd)	
Water Usage	**Subbasin**	**ADD**	**MDD**	**ADD**	**MDD**	**ADD**	**MDD**	**ADD**	**MDD**
Withdrawal	Roanoke	6.54	8.52	14.49	18.87	19.94	25.97	24.66	32.12
Consumptive Loss	Roanoke	0.15	0.19	0.56	0.73	0.71	0.92	0.68	0.88
	Tar	1.16	1.51	4.23	5.51	6.26	8.16	7.82	10.18
	Fishing Creek (subbasin to Tar)	0.333	.043	0.404	0.53	0.432	0.56	0.462	0.60
	Neuse	0.20	0.26	0.92	1.20	1.38	1.80	1.62	2.10
Wastewater Discharge	Roanoke	2.55	3.33	3.14	4.09	3.46	4.51	3.86	5.02
	Tar	1.64	2.14	4.62	6.01	6.99	9.10	9.44	12.29
	Fishing Creek (subbasin to Tar)	0.515	0.67	0.629	0.82	0.708	0.92	0.791	1.03
	Neuse	0	0	0	0	0	0	0	0
Total Return To	Roanoke	2.70	3.52	3.70	4.81	4.17	5.43	4.53	5.90
	IBT Tar	2.80	3.64	8.85	11.52	13.25	17.26	17.26	22.48
	IBT Fishing Creek	0.85	1.10	1.03	1.35	1.14	1.48	1.25	1.63
	Total IBT to Tar	**3.65**	**4.75**	**9.88**	**12.87**	**14.39**	**18.74**	**18.51**	**24.11**
	IBT Neuse	**0.20**	**0.26**	**0.92**	**1.20**	**1.38**	**1.80**	**1.62**	**2.10**

Notes:
1. MDD values were determined using a 1.305 Peak Day Value, based on 2007 water production data.
2. Water from Franklinton and Louisburg was subtracted from Franklin County totals since it is non-KLRWS water.
3. Consumptive use dispersement is based on percent of system in each basin and number of septic connections within each system.
4. Consumptive use includes wastewater to septic tanks, water used for irrigation, and other consumptive uses.
5. Water from Creedmoor and South Granville was subtracted from Creedmoor's totals since it is non-KLRWS water.

EXHIBIT 1
KERR LAKE REGIONAL WATER SYSTEM
SUMMARY OF INTERBASIN TRANSFERS
YEAR 2007

LEGEND

- KERR LAKE REGIONAL WATER SUPPLY
- KERR LAKE PARTNERS
- WATER SALES BY PARTNERS

ABBREVIATIONS

ADD	AVERAGE DAILY DEMAND
Con.	CONSUMPTIVE
IBT	INTERBASIN TRANSFER
KLRWS	KERR LAKE REGIONAL WATER SYSTEM
MDD	MAXIMUM DAILY DEMAND
WW	WASTEWATER

GRANVILLE COUNTY

ROANOKE RIVER BASIN

ADD	Stovall	MDD	
0.035	check OK	0.05	
0.035		0.05	
0.035	Con. Loss	0.05	to Roanoke
0.000	W.W.	0.00	to Roanoke

ADD	Kerr-Tar HUB	MDD	
0.00	check OK	0.00	
0.00	Sum Below	0.00	
0.00	Con. Loss	0.00	to Tar
0.00	W.W.	0.00	to Tar

TAR RIVER BASIN

ADD	Granville Co.	MDD	
0.00	check OK	0.00	
0.00		0.00	
0.00	Con. Loss	0.00	to Roanoke
0.00	Con. Loss	0.00	to Tar
0.00	Con Loss	0.00	to Neuse
0.00	W.W.	0.00	to Tar

ADD	OXFORD	MDD	
1.25	**IBT**	**1.62**	
1.28	check OK	1.67	
1.28	Sum Below	1.67	
0.02	Con. Loss	0.03	to Tar
1.22	W.W.	1.59	to Tar
0.00	Sale	0.00	to Creedmoor
0.04	Sale	0.05	to Stovall
0.00	Sale	0.00	to Granville Co.
0.00	Sale	0.00	to Kerr Tar Hub

NEUSE RIVER BASIN

ADD	Creedmoor	MDD	
0.00	check OK	0.00	
0.00	Sum Below	0.00	
0.00	Con. Loss	0.00	to Tar
0.00	W.W.	0.00	to Tar

TAR RIVER BASIN

ADD	KLRWS	MDD	
3.84	**IBT**	**5.00**	
6.54	Totals	8.52	
	Peaking Factor	1.302	
6.54	Sum Below	8.52	from Roanoke
6.42	SALE	8.36	
0.12	WW PROCESS	0.15	to Roanoke

ADD	HENDERSON	MDD	
1.75	**IBT**	**2.28**	
4.102	check OK	5.34	
4.102	Sum Below	5.34	
-0.083	Con. Loss	-0.11	to Roanoke
-0.036	Con. Loss	-0.05	to Tar
2.436	W.W.	3.17	to Roanoke
0.000	Sale	0.00	to Kerr-Tar
0.074	Sale	0.10	to Kittrell
1.711	Sale	2.23	to Franklin Co.
0.000	Sale	0.00	to Vance Co.

ROANOKE RIVER BASIN

ADD	Kerr-Tar HUB	MDD	
0.00	check OK	0.00	
0.00	Sum Below	0.00	
0.00	Con. Loss	0.00	to Tar
0.00	W.W.	0.00	to Tar

VANCE COUNTY

ADD	Vance Co	MDD	
0.00	check OK	0.00	
0.00	Sum Below	0.00	
0.00	Con. Loss	0.00	to Roanoke
0.00	Con. Loss	0.00	to Tar
0.00	WW.	0.00	to Roanoke

ADD	Kittrell	MDD	
0.074	check OK	0.10	
0.074	Sum Below	0.10	
0.074	Con. Loss	0.10	to Tar
0.000	WW.	0.00	to Tar

TAR RIVER BASIN

ADD	WARREN CO	MDD	
0.85	**IBT**	**1.10**	
1.04	check OK	1.36	
1.04	Sum Below	1.36	
0.17	Con. Loss	0.22	to Roanoke
0.28	Con. Loss	0.36	to Fishing Crk
0.14	W.W.	0.18	to Fishing Crk
0.00	Sale	0.00	to Kerr-Tar
0.15	Sale	0.20	to Norlina
0.30	Sale	0.39	to Warrenton

ADD	Kerr-Tar	MDD	
0.00	check OK	0.00	
0.00	Sum Below	0.00	
0.00	Con. Loss	0.00	to Fishing Crk
0.00	W.W.	0.00	to Fishing Crk

ADD	Norlina	MDD	
0.154	check OK	0.20	
0.154	Sum Below	0.20	
0.023	Con. Loss	0.03	to Roanoke
0.023	Con. Loss	0.03	to Fishing Crk
0.108	WW.	0.14	to Fishing Crk

ADD	Warrenton	MDD	
0.300	check OK	0.39	
0.300	Sum Below	0.39	
0.032	Con. Loss	0.04	to Fishing Crk
0.268	WW	0.35	to Fishing Crk

FISHING CREEK (SUB-BASIN TO TAR)

WARREN COUNTY

FRANKLIN COUNTY

NEUSE RIVER BASIN

ADD	Franklin Co.	MDD	
1.711	check OK	2.23	
1.711	Sum Below	2.23	
0.921	Con. Loss	1.20	to Tar
0.163	Con. Loss	0.21	to Neuse
0.294	W.W.	0.38	to Tar
0.058	Sale	0.08	to Youngsville
0.120	Sale	0.16	to Bunn
0.155	Sale	0.20	to Lake Royale
0.00	Sale	0.00	to Kerr-Tar

ADD	Youngsville	MDD	
0.058	check OK	0.08	
0.058	Sum Below	0.08	
0.000	Con. Loss	0.00	to Tar
0.034	Con. Loss	0.04	to Neuse
0.024	W.W.	0.03	to Tar

ADD	Bunn	MDD	
0.120	check OK	0.16	
0.120	Sum Below	0.16	
0.021	Con. Loss	0.03	to Tar
0.099	WW.	0.13	to Tar

ADD	Lake Royal	MDD	
0.155	check OK	0.202	
0.155	Sum Below	0.202	
0.153	Con. Loss	0.199	to Tar
0.002	WW.	0.002	to Tar

Franklinton Contract	
0.258	From Tar

Louisburg Contract	
0.229	From Tar

ADD	Kerr-Tar HUB	MDD	
0.000	check OK	0.00	
0.000	Sum Below	0.00	
0.000	Con. Loss	0.00	to Tar
0.000	W.W.	0.00	to Tar

IBT SUMMARY FOR KLRWS

		ADD	MDD
Withdrawal	ROANOKE	6.54	8.52
Consumptive Loss	ROANOKE	0.15	0.19
	TAR	1.16	1.51
	FISHING CREEK (sub-basin to Tar)	0.333	0.43
	NEUSE	0.20	0.26
Waterwater Discharge	ROANOKE	2.55	3.33
	TAR	1.64	2.14
	FISHING CREEK (sub-basin to Tar)	0.515	0.67
	NEUSE	0	0
Total Return to	ROANOKE	2.70	3.52
	IBT TAR	**2.80**	**3.64**
	IBT FISHING CREEK	**0.85**	**1.10**
	TOTAL IBT TO TAR	**3.65**	**4.75**
	IBT NEUSE	0.20	0.26
	check	6.54	8.52

NOTES:

1. MDD values were determined using a 1.305 Peak Day Value, based on 2007 water production data.
2. Water from Franklinton and Louisburg subtracted from Franklin County totals since non KLRWS water.
3. Consumptive use dispersement based on % of system in each basin and # of septic connections within each system.
4. Consumptive use includes wastewater to septic tanks, water used for irrigation and other consumptive uses.
5. Water from Creedmoor and South Granville subtracted from Creedmoor's totals since non KLRWS water.

EXHIBIT 2
KERR LAKE REGIONAL WATER SYSTEM
SUMMARY OF INTERBASIN TRANSFERS
YEAR 2040

LEGEND

- KERR LAKE REGIONAL WATER SUPPLY
- KERR LAKE PARTNERS
- WATER SALES BY PARTNERS
- DATA FROM PREVIOUS IBT STUDY 2035

ABBREVIATIONS

ADD	AVERAGE DAILY DEMAND
Con.	CONSUMPTIVE
IBT	INTERBASIN TRANSFER
KLRWS	KERR LAKE REGIONAL WATER SYSTEM
MDD	MAXIMUM DAILY DEMAND
WW	WASTEWATER

GRANVILLE COUNTY

ROANOKE RIVER BASIN

TAR RIVER BASIN

NEUSE RIVER BASIN

ADD	Stovall	MDD	
0.050	check OK	0.07	
0.050		0.07	
0.050	Con. Loss	0.07	to Roanoke
0.000	W.W.	0.00	to Roanoke

ADD	Kerr-Tar HUB	MDD	
0.16	check OK	0.20	
0.16	Sum Below	0.21	
0.02	Con. Loss	0.03	to Tar
0.13	W.W.	0.17	to Tar

ADD	Granville Co.	MDD	
5.03	check OK	6.55	
5.03		6.55	
0.18	Con. Loss	0.23	to Roanoke
0.66	Con. Loss	0.86	to Tar
0.36	Con Loss	0.47	to Neuse
3.83	W.W.	4.99	to Tar

ADD	OXFORD	MDD	
8.51	IBT	11.08	
8.74	check OK	11.38	
8.74	Sum Below	11.38	
0.05	Con. Loss	0.06	to Tar
2.50	W.W.	3.26	to Tar
0.95	Sale	1.24	to Creedmoor
0.05	Sale	0.07	to Stovall
5.03	Sale	6.55	to Granville Co.
0.16	Sale	0.20	to Kerr Tar Hub

ADD	Creedmoor	MDD	
0.95	check OK	1.24	
0.95	Sum Below	1.24	
0.03	Con. Loss	0.04	to Tar
0.92	W.W.	1.20	to Tar

TAR RIVER BASIN

ADD	KLRWS	MDD	
20.13	IBT	26.21	
24.66	Totals	32.12	
	Peaking Factor	1.30	
24.66	Sum Below	32.12	from Roanoke
24.22	SALE	31.53	
0.45	WW PROCESS	0.58	to Roanoke

ADD	HENDERSON	MDD	
10.37	IBT	13.50	
13.976	check OK	18.20	
13.976	Sum Below	18.20	
-0.116	Con. Loss	-0.15	to Roanoke
-0.050	Con. Loss	-0.07	to Tar
3.409	W.W.	4.44	to Roanoke
0.124	Sale	0.16	to Kerr-Tar
0.082	Sale	0.11	to Kittrell
9.793	Sale	12.75	to Franklin Co.
0.734	Sale	0.96	to Vance Co.

ADD	Kittrell	MDD	
0.082	check OK	0.11	
0.082	Sum Below	0.11	
0.082	Con. Loss	0.11	to Tar
0.000	WW.	0.00	to Tar

ROANOKE RIVER BASIN

ADD	Kerr-Tar HUB	MDD	
0.12	check OK	0.16	
0.12	Sum Below	0.16	
0.02	Con. Loss	0.02	to Tar
0.11	W.W.	0.14	to Tar

VANCE COUNTY

ADD	Vance Co	MDD	
0.73	check OK	0.96	
0.73		0.96	
0.32	Con. Loss	0.41	to Roanoke
0.42	Con. Loss	0.54	to Tar
0.00	WW.	0.00	to Roanoke

TAR RIVER BASIN

ADD	WARREN CO	MDD	
1.25	IBT	1.63	
1.501	check OK	1.95	
1.500	Sum Below	1.95	
0.220	Con. Loss	0.29	to Roanoke
0.370	Con. Loss	0.48	to Fishing Crk
0.184	W.W.	0.24	to Fishing Crk
0.157	Sale	0.20	to Kerr-Tar
0.182	Sale	0.24	to Norlina
0.387	Sale	0.50	to Warrenton

ADD	Kerr-Tar	MDD	
0.16	check OK	0.20	
0.16	Sum Below	0.21	
0.02	Con. Loss	0.03	to Fishing Crk
0.13	W.W.	0.17	to Fishing Crk

ADD	Norlina	MDD	
0.182	check OK	0.24	
0.182	Sum Below	0.24	
0.027	Con. Loss	0.04	to Roanoke
0.027	Con. Loss	0.04	to Fishing Crk
0.128	WW.	0.17	to Fishing Crk

ADD	Warrenton	MDD	
0.387	check OK	0.50	
0.387	Sum Below	0.50	
0.041	Con. Loss	0.05	to Fishing Crk
0.346	WW	0.45	to Fishing Crk

FISHING CREEK (SUB-BASIN TO TAR)

WARREN COUNTY

FRANKLIN COUNTY

NEUSE RIVER BASIN

0.259

ADD	Franklin Co.	MDD	
9.793	check OK	12.75	
9.793	Sum Below	12.75	
6.253	Con. Loss	8.14	to Tar
1.103	Con. Loss	1.44	to Neuse
1.475	W.W.	1.92	to Tar
0.259	Sale	0.34	to Youngsville
0.168	Sale	0.22	to Bunn
0.267	Sale	0.35	to Lake Royale
0.267	Sale	0.35	to Kerr-Tar

ADD	Youngsville	MDD	
0.259	check OK	0.34	
0.259	Sum Below	0.34	
0.000	Con. Loss	0.00	to Tar
0.153	Con. Loss	0.20	to Neuse
0.106	W.W.	0.14	to Tar

ADD	Bunn	MDD	
0.168	check OK	0.22	
0.168	Sum Below	0.22	
0.030	Con. Loss	0.04	to Tar
0.139	WW.	0.18	to Tar

ADD	Lake Royal	MDD	
0.267	check OK	0.348	
0.267	Sum Below	0.348	
0.264	Con. Loss	0.343	to Tar
0.003	WW.	0.004	to Tar

Franklinton Contract	
0.258	From Tar

Louisburg Contract	
0.229	From Tar

ADD	Kerr-Tar HUB	MDD	
0.267	check OK	0.35	
0.267	Sum Below	0.35	
0.040	Con. Loss	0.05	to Tar
0.227	W.W.	0.30	to Tar

IBT SUMMARY FOR KLRWS

		ADD	MDD
Withdrawal	ROANOKE	24.66	32.12
Consumptive Loss	ROANOKE	0.68	0.88
	TAR	7.82	10.18
	FISHING CREEK (sub-basin to Tar)	0.462	0.60
	NEUSE	1.62	2.10
Waterwater Discharge	ROANOKE	3.86	5.02
	TAR	9.44	12.29
	FISHING CREEK (sub-basin to Tar)	0.791	1.03
	NEUSE	0	0
Total Return to	ROANOKE	4.53	5.90
	IBT TAR	17.26	22.48
	IBT FISHING CREEK	1.25	1.63
	TOTAL IBT TO TAR	18.51	24.11
	IBT NEUSE	1.62	2.10
	check	24.66	32.12

NOTES:
1 MDD values were determined using a 1.305 Peak Day Value, based on 2007 water production data.
2 Water from Franklinton and Louisburg subtracted from Franklin County totals since non KLRWS water.
3 Consumptive use dispersement based on % of system in each basin and # of septic connections within each system.
4 Consumptive use includes wastewater to septic tanks, water used for irrigation and other consumptive uses.
5 Water from Creedmoor and South Granville subtracted from Creedmoor's totals since non KLRWS water.

The projected Fishing Creek and Tar River maximum daily IBT amounts, which together represent the total IBT to the Tar River Basin, are shown in Figure 3A. The combined Tar River Basin maximum daily IBT amount is projected to exceed the 10 mgd grandfathered IBT limit by 2015. The projected Neuse River maximum daily IBT amount is not expected to exceed 2 mgd until 2036, near the end of the projection period (Figure 3B).

FIGURE 3A
Tar River Basin IBT Summary

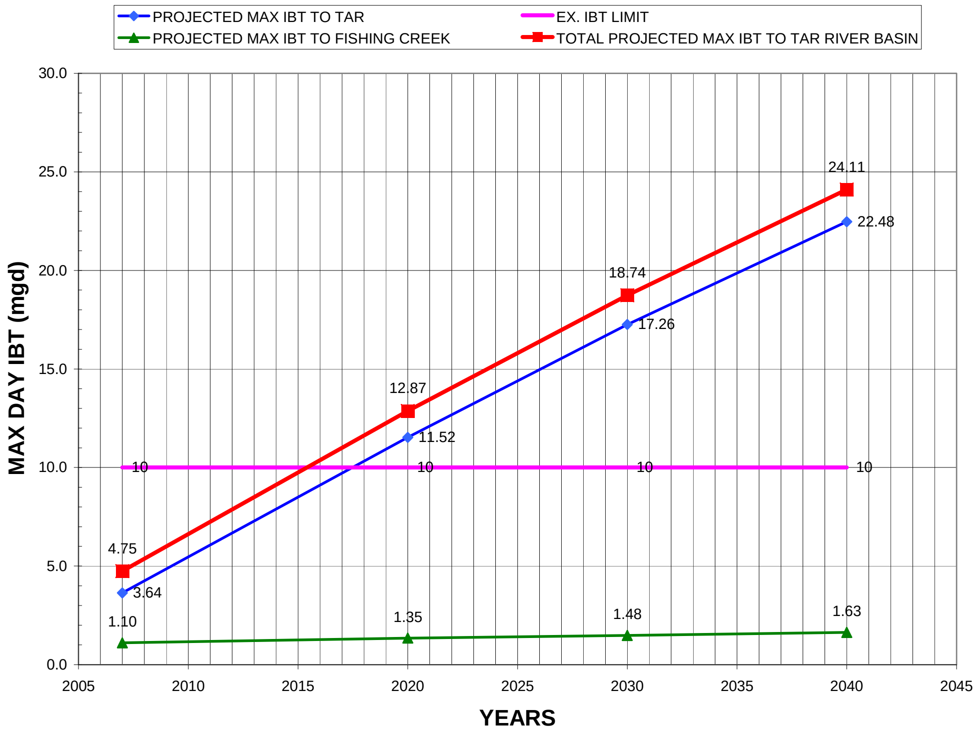
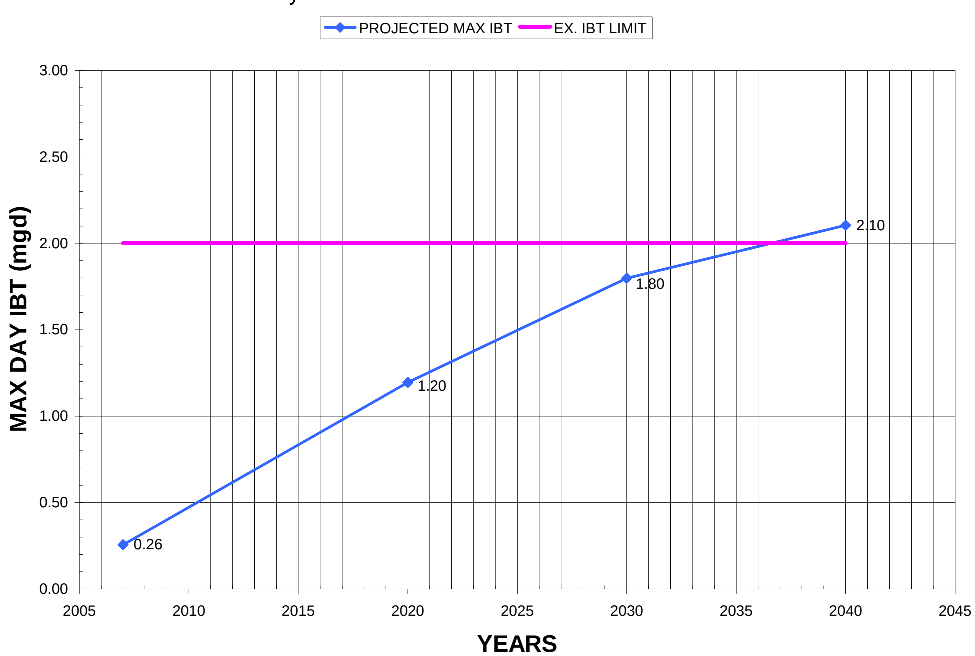


FIGURE 3B
Neuse River Basin IBT Summary



Proposed Project Alternatives

The following proposed project alternatives will be evaluated:

1. **No action.** This alternative would preclude the KLRWS from providing additional reliable water service to its Partners and the local governments with contracts with the Partners. This alternative is deficient because it limits the ability of the KLRWS to meet future peak day demands and provides no operating redundancy or flexibility to the regional KLRWS. KLRWS water production and distribution would be capped by the grandfathered IBT of 10 mgd from the Roanoke River Basin (Kerr Lake) to the Tar and Fishing Creek River Basins.
2. **Increase in IBT facilitated by Expansion of the Kerr Lake Regional Water Plant Service Area and Customer Base** to further serve as a regional provider of water. This would involve expanding the WTP to 20 mgd initially and meeting all contracted and future demands of the system within the planning period. To distribute water to the expanded system, the KLRWS would need an increase in its authorized transfer from the Roanoke River Basin (Kerr Lake) to the Tar-Pamlico and Fishing Creek River Basins from the grandfathered amount of 10 mgd to approximately 24 mgd, of which 1.6 mgd is a requested transfer to the Fishing Creek subbasin. An IBT would also be necessary in the amount of 2.4 mgd from the Roanoke River Basin to the Neuse River Basin.
3. **Avoid IBT by using a water source in the Tar River Basin**, which would eliminate the need for an increased IBT between the Roanoke and Tar River Basins. A new WTP or additional infrastructure and an expansion of the existing WTP would also be necessary. Water service for customers in the Neuse River Basin originating from the Roanoke and Tar River Basins would be considered in more detail in the future since it is not projected to be exceeded until after 2030, or the transfer could be managed not to exceed the 2 mgd threshold.
4. **Avoid IBT by discharging wastewater to the source basin, the Roanoke River Basin.** This alternative would require the construction of new wastewater effluent force mains and pump stations to convey treated wastewater from one or more of the service area's wastewater treatment plants (WWTPs) that discharge to the Tar River or Fishing Creek Basins. City of Henderson currently discharges back to the Roanoke River Basin.

Public Meetings

In addition to the scoping document being submitted to the Division of Water Resources (DWR), a public notice and five meetings are required within 90 days of the start of the process. These meetings are followed by a minimum 30-day public comment period. Upon receipt of scoping comment letters from the agencies and the public comments, a summary of comments will be prepared for consideration during the process. This process was updated with the recent 2007 legislation.

In addition to scoping with NCDENR, federal and other commenting agencies, and the public meetings, discussions will be held with DWR on the required analysis of direct impacts to watershed hydrology, reservoir operations, and water quality from the proposed transfer. It is anticipated that hydrology and operations impacts will be analyzed with the existing OASIS model developed for DWR for the Roanoke system and the Roanoke River Basin Reservoir Operations model. Discussions will be held with DWR, U.S. Geological Survey, and USACE to determine the application of these modeling tools in the IBT evaluation process.

Environmental Impact Statement Tasks

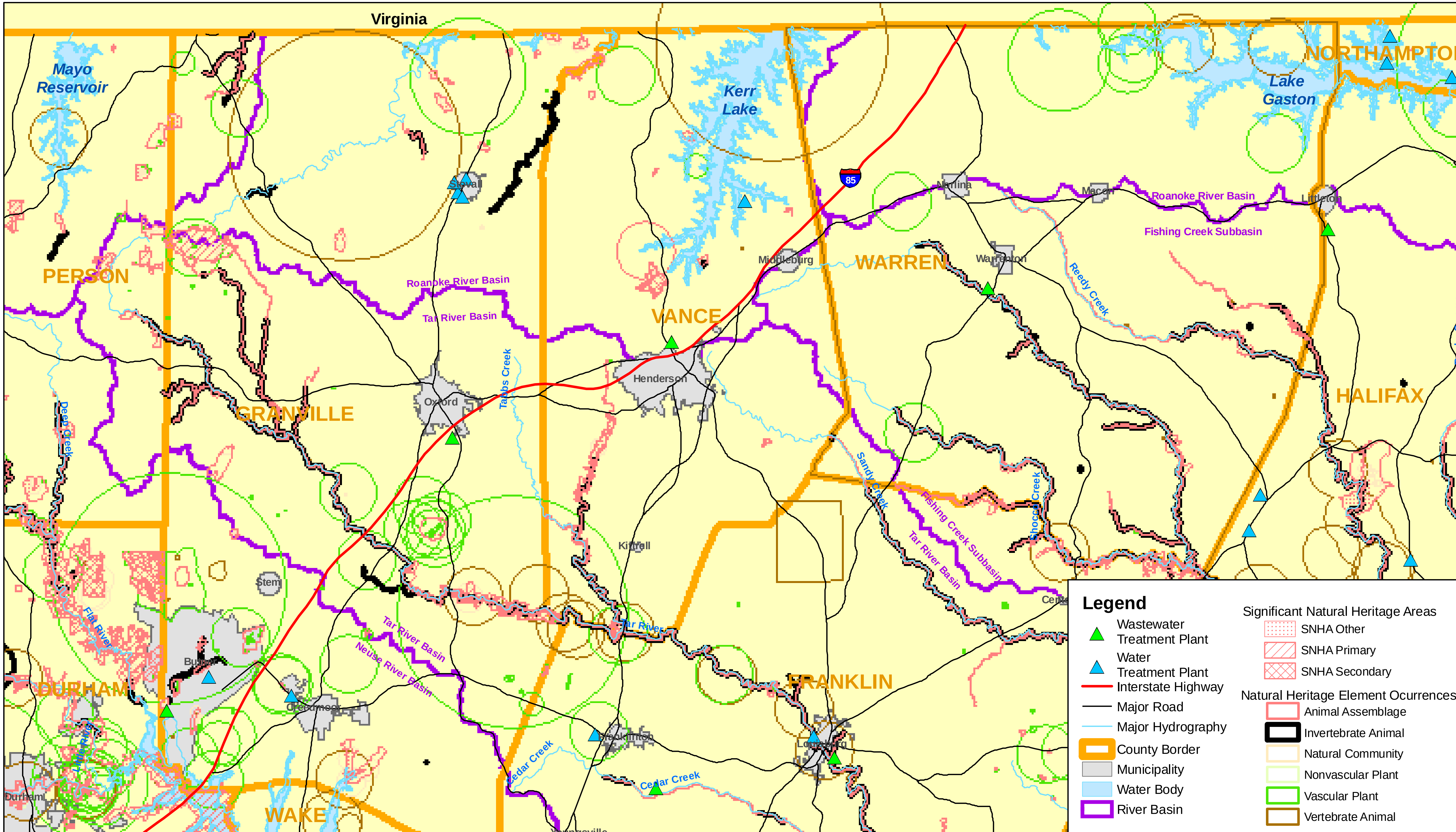
Preparation of a draft EIS will incorporate information from the 2003 EE&T EA, updated demand projections, and analysis of impacts to Kerr Lake, as well as focus on major comments from the agencies and the public. Secondary and cumulative impacts in the receiving basins will be a focus of the draft EIS. References or excerpts from the previously approved EA will be utilized as much as possible. It is anticipated that the following items will require particular focus in preparing the draft EIS. The following tasks will be performed in order to evaluate the preferred alternative:

1. Prepare IBT projections using updated water use and wastewater flows..
2. Perform literature searches to evaluate the existing conditions and possible environmental impacts directly related to the proposed project.
3. Identify source basin impacts using the OASIS model provided by DWR.
4. Review and prepare detailed discussion of receiving basin impacts including impacts due to growth in general, local ordinances, and plans that address growth including stormwater programs, potential impacts on endangered species, as well as impacts of nutrients associated with wastewater discharges and growth in the Neuse, Tar-Pamlico, and Roanoke River Basins.
5. Identify flora, fish. and wildlife resources within the study area, with an emphasis on sensitive species. Identify possible impacts directly related to the proposed project. Federally-listed wildlife species will also be a focus (Table 7 and Figure 4).
6. Conduct a geographical information system (GIS) analysis using existing GIS data layers to provide a visual characterization of the existing land cover, land use, and rare or significant natural areas/habitats within the study area. The GIS information will be used as an aid in determining the extent of possible impacts directly related to the proposed project on wetlands, forests, significant natural areas, and public lands.
7. Conduct a GIS and literature search to identify the presence and significance of historical, cultural, and archaeological resources known to exist within the study area and provide an overview of possible impacts directly related to the proposed project on these resources.
8. Summarize mitigative measures and local ordinances as well as other local or regional efforts that will facilitate mitigation of possible direct and secondary and cumulative impacts of the proposed project.

TABLE 7
Federally Listed Species within the Study Area

Common Name	Scientific Name	Federal Status	County	County Status
Vertebrates				
American eel	*Anguilla rostrata*	FSC	Vance, Franklin, Granville, Warren	Current
Bachman's sparrow	*Aimophila aestivalis*	FSC	Warren	Current
Bald eagle	*Haliaeetus leucocephalus*	BGPA	Vance, Granville, Warren	Current
Carolina darter	*Etheostoma collis lepidinion*	FSC	Granville	Current
Carolina madtom	*Noturus furiosus*	FSC	Vance, Franklin, Granville	Current
Pinewoods shiner	*Lythrurus matutinus*	FSC	Vance, Franklin, Granville, Warren	Obscure
Roanoke bass	*Ambloplites cavifrons*	FSC	Franklin, Warren, Granville	Current
Invertebrates				
Atlantic pigtoe	*Fusconaia masoni*	FSC	Franklin, Granville, Warren	Current
Brook floater	*Alasmidonta varicosa*	FSC	Granville	Current
Chowanoke crayfish	*Orconectes virginiensis*	FSC	Granville	Obscure
Dwarf wedgemussel	*Alasmidonta heterodon*	E	Vance, Franklin, Granville, Warren	Current
Green floater	*Lasmigona subviridis*	FSC	Granville	Current
Tar River spinymussel	*Elliptio steinstansana*	E	Franklin, Warren	Current
Yellow lampmussel	*Lampsilis cariosa*	FSC	Vance, Franklin, Granville	Current
Yellow lance	*Elliptio lanceolata*	FSC	Vance, Franklin, Granville, Warren	Current
Plants				
Butner's barbara's-buttons	*Marshallia sp.*	FSC	Granville	Current
Buttercup phacelia	*Phacelia covillei*	FSC	Vance	Current
Harperella	*Ptilimnium nodosum*	E	Granville	Current
Michaux's sumac	*Rhus michauxii*	E	Franklin	Current
Smooth coneflower	*Echinacea laevigata*	E	Granville	Current
Smooth-seeded hairy nutrush	*Scleria sp. 1*	FSC	Granville	Historic
Tall larkspur	*Delphinium exaltatum*	FSC	Granville	Current
Torrey's Mountain-mint	*Pycnanthemum torrei*	FSC	Granville	Historic
Prairie birdsfoot-trefoil	*Lotus unifoliolatus var. helleri*	FSC	Granville/Warren	Current/Historic

Source: USFWS, 2008
E = Endangered
FSC = Federal Species of Concern
BGPA = Bald and Golden Eagle Protection Act



CH2MHILL

Figure 4
Interbasin Transfer from Roanoke River Basin
Sensitive & Endangered Species
Kerr Lake Regional Water System

Proposed Environmental Impact Statement Outline

1. Project Description
2. Project Purpose and Need
3. Project Alternatives
4. Existing Environmental Characteristics of Project Area
    - 4.1 Topography
    - 4.2 Soils
    - 4.3 Land Use
    - 4.4 Wetlands
    - 4.5 Prime or Unique Agricultural Lands
    - 4.6 Public Lands and Scenic, Recreational, and State Natural Areas
    - 4.7 Areas of Archaeological or Historic Value
    - 4.8 Air Quality
    - 4.9 Noise Level
    - 4.10 Water Resources (Surface Water and Groundwater)
    - 4.11 Forest Resources
    - 4.12 Shellfish or Fish and Their Habitats
    - 4.13 Wildlife and Natural Vegetation
5. Predicted Environmental Effects of Project
   (Direct and Secondary and Cumulative Impacts)
    - 5.1 Topography
    - 5.2 Soils
    - 5.3 Land Use
    - 5.4 Wetlands
    - 5.5 Prime or Unique Agricultural Lands
    - 5.6 Public Lands and Scenic, Recreational, and State Natural Areas
    - 5.7 Areas of Archaeological or Historic Value
    - 5.8 Air Quality
    - 5.9 Noise Level
    - 5.10 Water Resources (Surface Water and Groundwater)
    - 5.11 Forest Resources
    - 5.12 Shellfish or Fish and Their Habitats
    - 5.13 Wildlife and Natural Vegetation
    - 5.14 Introduction of Toxic Substances
6. Programs to Minimize Environmental Impacts
7. References
8. List of necessary permits
9. List of Preparers

Appendices

- Notice of Intent and Scoping Document
- Agency and Public Involvement
- Background Information (2005 USACE Reallocation Report; Others)
- Local Ordinances and Programs

References

Environmental Engineering & Technology, Inc. (EE&T). 2003. City of Henderson, North Carolina Kerr Lake Regional Water System Expansion Environmental Assessment. Prepared for Kerr Lake Regional Water System. June 2003.

North Carolina Center for Geographic Information and Analysis (NCCGIA). 2009. North Carolina One Map Data. Raleigh, North Carolina. http://www.nconemap.com. Accessed January 2009.

North Carolina Division of Water Quality (NCDWQ). 2006. Final North Carolina Water Quality Assessment and Impaired Waters List (2006 Integrated 305(b) and 303(d) Report. Approved May 17, 2007.

United States Army Corps of Engineers (USACE). 2005. Reallocation Report – John H. Kerr Reservoir Water Supply Storage Reallocation Request for the City of Henderson, North Carolina. Wilmington District.

United States Fish and Wildlife Service (USFWS). 2008. Endangered Species, Threatened Species, Federal Species of Concern, and Candidate Species for Franklin, Granville, Vance, and Warren Counties, North Carolina. http://www.fws.gov/nc-es/es/countyfr.html. Updated January 2008 and accessed September 2008.

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Appendix A.4 – Scoping Document Receipt

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North Carolina
Department of Administration

Beverly Eaves Perdue, Governor | Britt Cobb, Secretary

February 20, 2009

Mr. Adam Sharpe
Kerr Lake Regional Water System
c/o CH2MHILL
3201 Beechleaf Court, Suite 300
Raleigh NC 27604

Dear Mr. Sharpe:

Subject: Scoping - Expansion of existing Kerr Lake Regional Water System to 20 mgd and increase water supply storage allocation to 21,115 AF in Warren, Vance, Franklin, and Granville counties.

The N. C. State Clearinghouse has received the above project for intergovernmental review. This project has been assigned State Application Number 09-E-0000-0227. Please use this number with all inquiries or correspondence with this office.

Review of this project should be completed on or before 03/20/2009. Should you have any questions, please call (919)807-2425.

Sincerely,

Valerie McMillan

Valerie W. McMillan, Director
State Environmental Policy Act

Mailing Address:
1301 Mail Service Center
Raleigh, NC 27699-1301

Telephone: (919)807-2425
Fax (919)733-9571
State Courier #51-01-00
e-mail: valerie.w.mcmillan@doa.nc.gov

Location Address:
116 West Jones Street
Raleigh, North Carolina

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Appendix B
Background Documents

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Appendix B.1 – Grandfathered IBT Letter

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NORTH CAROLINA DEPARTMENT OF
ENVIRONMENT AND NATURAL RESOURCES
DIVISION OF WATER RESOURCES

NCDENR

MES B. HUNT JR.
VERNOR

NE MCDEVITT
CRETARY

N N. MORRIS
ECTOR

April 22, 1998

The Honorable Robert G. Young, Mayor
City of Henderson
P.O. Box 1434
Henderson, North Carolina 27536-1434

RE: Interbasin Transfer Capacity Determination Request

Dear Mayor Young:

It was a pleasure to meet with you and your staff last month to discuss the City of Henderson's proposed sale of water to Franklin County. At that meeting, we agreed to make a determination of the Kerr Lake Regional Water System's grandfathered interbasin transfer (IBT) capacity.

We have reviewed the documentation attached to your letter of April 16th and concluded that the Kerr Lake Regional Water System has a grandfathered IBT capacity of 10.0 MGD. We are basing our determination on §143-215.221(2)(b) and that on July 1, 1993 Kerr Lake Regional Water System had the capacity to transfer 10 MGD from the Roanoke River Basin to the Tar and Fishing Creek basins. The limiting facility then was the regional water treatment plant, which had a permitted capacity of 10 MGD.

We appreciate the opportunity to work with the City of Henderson and the Kerr Lake Regional Water System in addressing the region's water needs. If you need additional assistance, please contact either me or Tom Fransen.

Sincerely yours,

John N. Morris

John N. Morris

cc: Eric Williams, City Manager
Mike Hicks, Kerr Lake Regional Water System Director
Tom Fransen, Water Allocation Section Chief
Tony Young, Water Supply Planning Section Chief

P.O. BOX 27687, RALEIGH, NORTH CAROLINA 27611-7687
PHONE 919-733-4064 FAX 919-733-3558

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Appendix B.2 – USACE 2005 Reallocation Report – John H. Kerr Reservoir Water Supply Storage Request for the City of Henderson, North Carolina

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REALLOCATION REPORT

JOHN H. KERR RESERVOIR WATER SUPPLY STORAGE REALLOCATION REQUEST FOR THE CITY OF HENDERSON, NORTH CAROLINA

May 2005

U.S. Army Corps of Engineers
Wilmington District

PREFACE

The Hydro-power Analysis Center prepared Power Benefits Foregone in May 2004. Mr. Terry Brown, P.E. and Mr. Allen Piner, Wilmington District performed the yield analysis and period of record modeling. Ms. Jenny Owens, Wilmington District, submitted the Record of Environmental Evaluation. Mr. Russell Davidson, P.E. and Mr. Kamau Sadiki, Northwestern Division, Corps of Engineers developed power values. Southeastern Power Administration (SEPA) provided their current rates for computing the revenue foregone, as well as criteria for the loss of marketable capacity due to the withdrawal. Mr. Duane Bailey, Savannah District, performed a Quality Assurance Review of the document. Primary contacts at the Wilmington District are Mr. Greg Williams and Mr. Allen Piner.

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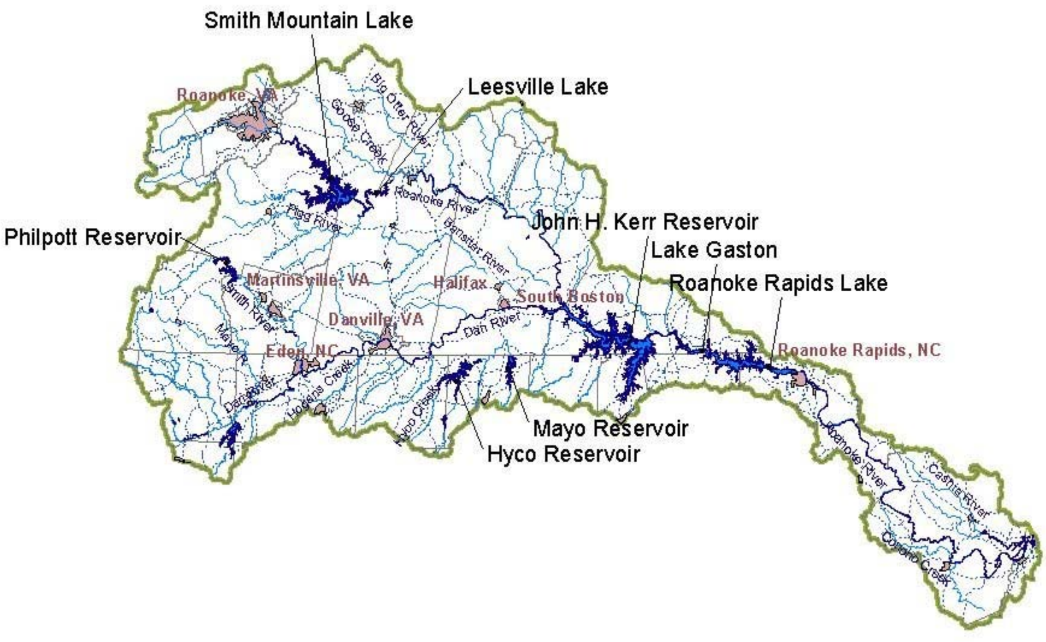
1.0 INTRODUCTION

1.1 Purpose

This reallocation report was prepared to provide information in support of a request by the City of Henderson, North Carolina (sponsor) for a reallocation of 10,292 acre-feet (AF) from the usable conservation pool storage at the John H. Kerr Reservoir (Kerr) for water supply. A map of the area and vicinity is shown in Figure 1. This reallocation will finalize conversion of an original 20 million gallon per day (MGD) ‘water use’ agreement to a ‘storage agreement’. Average annual use for the previous 27 years of operation is approximately 5 MGD with current use at approximately 6 MGD and a projected annual withdrawal of up to 20 MGD for water supply. This water will be used to provide municipal and industrial water supply for the City of Henderson, North Carolina, which operates the Kerr Lake Regional Water System (KLRWS).

Figure 1
Roanoke River Watershed



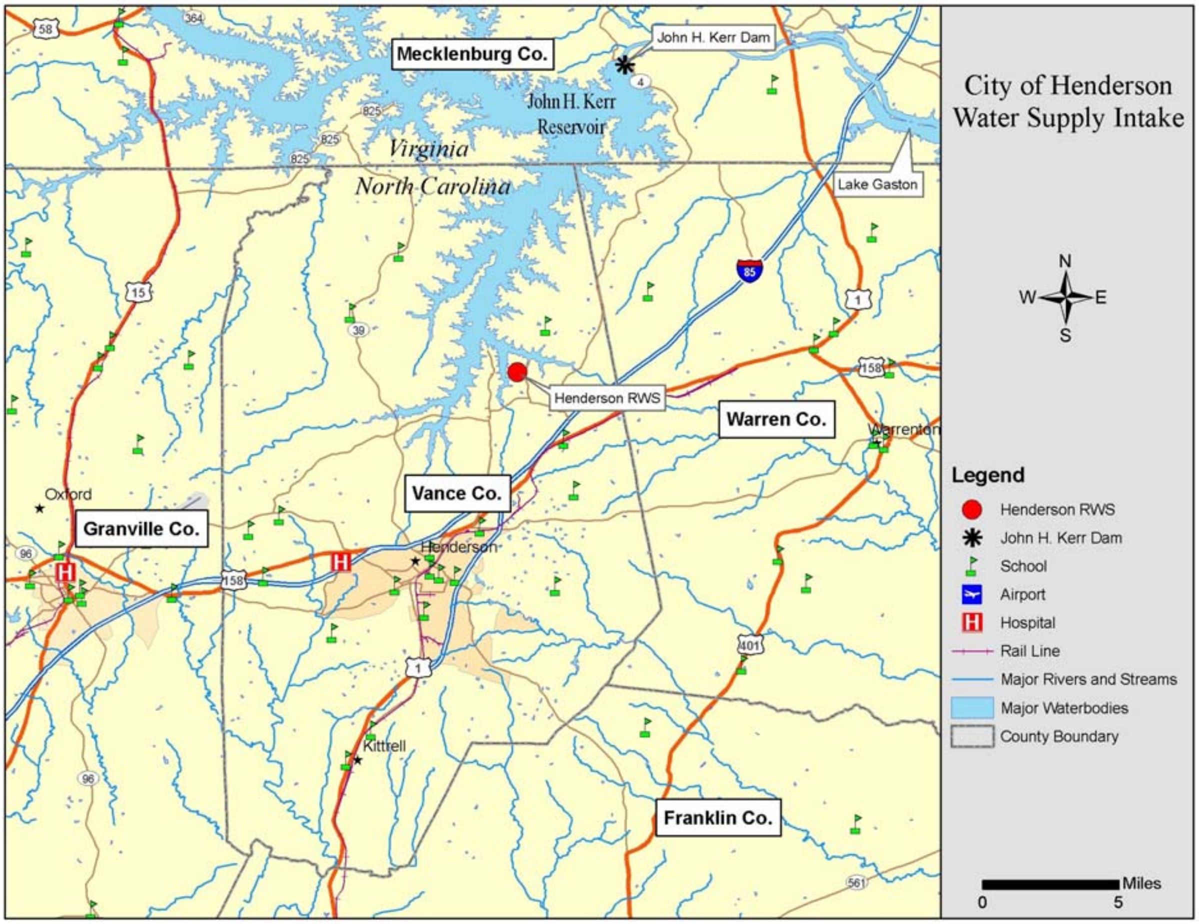
The sponsor began operation and withdrawals from Kerr in 1978. The site is located adjacent to Kerr Reservoir about 7 miles from Henderson, North Carolina, and approximately 20 miles from Kerr Dam (Figure 2).

1.2 Authority for Reallocation

Corps Policy as outlined in paragraph 3-8b(5) of the Planning Guidance Notebook (PGN) is:

"Reallocation or addition of storage that would seriously affect other authorized purposes or that would involve major structural or operational changes requires Congressional approval. Provided these criteria are not violated, 15 percent of the total storage capacity allocated to all authorized project purposes or 50,000 acre feet, whichever, is less, may be allocated from storage authorized for other purposes. Or, this amount may be added to the project to serve as storage for municipal and industrial water supply at the discretion of the Commander, USACE."

Figure 2
City of Henderson Water Supply Intake



All criteria for the Commander's discretionary approval are met as summarized below:

- The 10,292 AF proposed reallocation does not significantly affect other authorized purposes and does not involve major structural or operational changes in the project.

- 15% of the total storage would be 339,363 AF so the 50,000 AF maximum discretionary amount applies. The cumulative amount of reallocation with this reallocation is 21,115 AF, well within the Commander's authority.

Approval levels for the reallocation report and agreement follow:

- **Draft storage agreement—ASA(CW)**
    - Since any agreement with reallocation over 1000 AF requires ASA(CW) approval.
- **Draft reallocation report—HQUSACE—However, report must be submitted to ASA(CW) with draft agreement prior to approval.**
    - Since cumulative amount reallocated of 21,115 AF exceeds the lesser of 4,000 AF or 226,242 AF (10% of available storage of 2,262,421 AF)
    - Since 10,292 AF requested exceeds 1000 AF threshold for HQUSACE approval
- **Final Agreement. –HQUSACE**
    - Since proposed 10,292 AF reallocation amount exceeds the 1000 AF threshold for HQUSACE approval.

Implementation of these criteria for reallocation of storage at Kerr has resulted in three reallocations to municipal and industrial water supply totaling 10,823 AF as shown in Table 1. Therefore, reallocation is a valid potential source for meeting Henderson's need.

Table 1
Kerr ~ Pertinent Data

<u>Drainage Area (square miles)</u>	7800
<u>Elevations (feet, NGVD)</u>	
Top of Dam	332
Base of Dam	188
Spillway crest	288
Top of Conservation Pool	300
Top of Flood Control Pool	320
<u>Storage (AF)</u>*	
Total Usable Pool (Elev 268-320)	2,262,421
Flood Control Pool (Elev 300-320)	1,282,367
Conservation Pool (Elev 268-300)	980,054
Hydropower	969,231
Water Supply	10,823

* Storage remaining after 100 years of sedimentation from July 1953

2.0 BACKGROUND

2.1 Introduction

Kerr storage could normally either be reallocated from the existing conservation storage or it could be reallocated from the flood control storage space. At Kerr the entire flood control storage space is required to satisfy current criteria established for this purpose. In four separate flood events between 1975 and 1996 over ninety per-cent of the controlled flood storage at Kerr was utilized. The April 1987 event pushed the reservoir level to less than six inches away from the point at which releases downstream match eighty-five per-cent of the computed inflow (a volume in excess of 100,000 cfs) while the September 1996 flood event generated the greatest computed inflow on record for this location (second only to the August 1940 event which was used to justify project construction). As a result, all other reallocations of storage at Kerr for water supply have been made from the conservation/power pool. Therefore, this analysis will only concentrate on the volume of conservation/power pool storage that must be reallocated to satisfy water supply requirements. To meet the requirements of Section 4-32d of ER 1105-2-100, the value must be computed in four ways: (1) power benefits forgone, (2) power revenues foregone, (3) replacement cost of power, and (4) updated cost of storage. The highest of the four costs determines the cost to be paid for the storage. The Hydropower Analysis Center (HAC), Portland, Oregon determined the first three methods in a report titled 'Power Benefits Foregone' dated May 2004, attached in its entirety as Appendix A. Results of this effort are summarized in section 4-2 through 4-3 of this report. Water Management, Wilmington District determined the fourth item, 'updated cost of storage' with results summarized in section 4-4.

2.2 Project Description

Kerr Dam is located on the Roanoke River, about 180 river miles above the Albemarle Sound, 20 miles downstream of Clarksville, Virginia 18 miles upstream of the Virginia – North Carolina state line and 80 miles southwest of Richmond, Virginia. The dam is located in Mecklenburg County, Virginia and the reservoir lies within Mecklenburg, Charlotte and Halifax Counties in Virginia and Granville, Vance and Warren Counties in North Carolina. The project was authorized in the Flood Control Act of 1944 (Public Law 534, 78th Congress, 2nd session, December 22, 1944) for reduction of flood damage in the lower Roanoke River, generation of hydroelectric power, mosquito control, pollution abatement and conservation of fish and wildlife, low water control navigation, and for recreation. Initially, all of the conservation storage at Kerr was allocated to hydropower with operational consideration for other purposes as secondary. Operation for navigation never really materialized and was removed from consideration at Kerr once the Roanoke Rapids project was constructed downstream. Reallocation of storage at Kerr for water supply was made possible with passage of Public Law 85-500 also known as the Water Supply Act of 1958. The in-service date for the control of floods is considered to be May 1952. Commercial power generation was initiated in November 1952, and full plant capability was attained in December 1953. The reservoir has 2,262,421 AF of usable storage, which is regulated for power production, flood control, stream flow regulation, recreation, water supply, and fish and wildlife management. The power plant has seven generating units capable of delivering power to customers, with a total installed capacity of 204,000 kilowatts (kw). Kerr Dam is a concrete gravity dam with a gated spillway, flanked by earth dikes, a powerhouse and switchyard. The top elevation of Kerr Dam is 332 feet, msl and it has an overall length of 22,035 feet. The maximum height above the streambed is 144 feet. The spillway has a crest elevation of 288 feet, msl and a total length of 1,092 feet. It is crested with 22 tainter gates, each 42 feet wide by 32 high. The powerhouse has six vertical shaft Francis turbines rated at 32,000 kw each, one unit at 12,000 kw and two station service units (internal use only) rated at 1,000 kw each for a total plant capacity of 206,000 kw (204,000 kw available on-line). Kerr Reservoir at elevation 300 feet, msl covers an area of 48,900 acres, has a shoreline length of 800 miles and extends into Mecklenburg, Charlotte and Halifax counties in Virginia and Granville, Vance and Warren counties in North Carolina.

2.2.1 Impacts of Sedimentation

Available usable storage at Kerr was determined by adjusting the most current computation of storage capacity for sedimentation impacts as directed by Public Law 88-140, attached as Appendix G. These computations were derived by use of the most recent sedimentation survey data found in a report titled *'REPORT OF SEDIMENTATION RESURVEY' November 1997* located in the Wilmington District office. Sedimentation rates computed for each operational zone or pool over the 21-year period of operation from 1976 to 1997 were projected for the remaining 56 years to determine the usable storage. The 21-year period of operation from 1976 to 1997 was used to most closely represent current conditions. This time period very closely reflects current and expected future conditions by use of the same basic operation and guide curve at Kerr and effectively similar impacts from the operation of Smith Mountain-Leesville combination project, which began filling in 1962, and Philpott project. A breakdown of elevation-storage volume data at Kerr as impacted by sedimentation is shown in Table 2.

Table 2
Kerr ~ Usable Storage Volume Determination

Storage Pool	Elevation Range Feet msl	Storage* Change 1976-1997 AF	Rate of Sedimentation 1976-1997 AF/YR	Total* Volume 1997 AF	Projected** Sediment 1997-2053 AF	Projected*** Total Volume 2053 AF
Flood Control	300 to 320	-271	-13	1,281,644	-723	1,282,367
Conservation	268 to 300	12,835	611	1,014,281	34,227	980,054
Total	268 to 320	12,564	598	2,295,925	33,504	2,262,421

* From *'REPORT OF SEDIMENTATION RESURVEY' November 1997*

** Estimated by projection of sedimentation rate observed from1976 to 1997

*** Storage remaining after 100 years of sedimentation from July 1953 the date the project became operational and does not include dead storage and/or storage set aside for hydropower head.

2.3 Current Water Supply Agreements

The City of Clarksville, City of Virginia Beach, Virginia Department of Corrections, Mecklenburg Co-Generation facility, and Burlington Industries, Virginia, and the City of Henderson, North Carolina, are all existing users of water from Kerr for municipal and industrial water supply.

The City of Clarksville and Burlington Industries in Virginia are grandfathered water users at Kerr. Because these entities were users of the affected waters prior to construction of the Kerr project, Clarksville and Burlington are entitled to water at no cost in accordance with pre-project agreements. Currently the City of Clarksville, Virginia, withdraws an average of 0.3 MGD. Burlington Industries at Clarksville, Virginia recently closed and the facilities will be sold, leaving its future impacts questionable. Burlington withdrew an average of 2.2 MGD from Kerr for water supply prior to closing.

The City of Henderson, North Carolina entered into a water use contract on February 12, 1974 and began actual water withdrawals from its current facility in March 1978. This regional water system currently withdraws an annual average of 6 MGD with a monthly range of 5.2 to 6.6 MGD from Kerr. The City currently has a request to purchase storage from Kerr to provide a future projected need of 20 MGD.

The City of Virginia Beach, Virginia, purchased 10,200 AF of storage at Kerr to supplement its withdrawal of up to 60 mgd on January 13, 1984. Withdrawals are made from a pump station on Lake Gaston downstream of Kerr Dam. Required releases from storage at Kerr to supplement this demand are rare.

The Virginia Department of Corrections (VADOC) entered into a contract to utilize an estimated 23 acre-feet of the conservation storage in Kerr for water supply effective April 7, 1989. The specified withdrawal rate is not to exceed 60,000 gallons per day. Water for the Mecklenburg Correctional Center is currently supplied by a regional system, thus delaying construction of a water supply pipeline to Kerr reservoir for an indefinite period of time.

A water supply storage contract with the Mecklenburg Cogeneration Limited Partnership (MCLP) for withdrawals of water from Kerr was signed on June 5, 1991. MCLP constructed a pulverized coal-fired cogeneration plant to supply electric power to Dominion Resources and steam to Burlington Industries, and uses water from Kerr Reservoir for make-up water. MCLP has the right to utilize an estimated 600 acre-feet of conservation storage in John H. Kerr between elevation 268 and 300 feet, m.s.l. During the drought of 2002 MCLP exceeded its 600 acre-feet allocation and will need to increase its storage in the near future. Also, MCLP was recently purchased by Dominion Resources and will need to process a name change.

2.4 Projected Need for Existing Water Users

With the exception of MCLP, no user has expressed any plans to increase its existing allocations. KLRWS is a public water system currently owned by three partners, the sponsor, the City of Oxford, and Warren County, each representing 60%, 20%, and 20% of the overall system ownership respectively. KLRWS provides potable water to the sponsor, Warren County (including all municipalities in Warren County), Franklin County, the City of Oxford, and portions of Vance and Granville Counties. The KLRWS consists of a conventional surface water treatment plant, distribution mains, storage tanks, and water meters. Environmental Engineering & Technology, Inc. (EE&T, Inc.) consulting engineers for the sponsor developed average daily water demand projections over the next thirty years in October 2004. These data are summarized in Table 3 and provided in Appendix B. Counties adjacent to Kerr in North Carolina, which represent the primary service area for KLRWS, are projected to have the greatest cumulative growth rate. Projected water demand based on these data more than justifies the requested 20.0 MGD allocation.

Table 3
KLRWS Average Daily Withdrawals MGD

Year	1992	1997	2002	2010	2020	2030	2035
Withdrawal	4.99	5.07	5.89	10.19	15.88	20.97	24.19

Source: EE&T, Inc. October 6, 2004

3.0 WATER REQUIREMENTS AND ALTERNATIVE SOURCES

3.1 Water Requirements for The City of Henderson

The sponsor will require a gross withdrawal of 20 MGD from Kerr to provide drinking water for its regional water distribution network. The 20 MGD allocation will be sufficient to handle its current and future demands.

While most of the water use will be consumptive, a small portion of the water will be returned to Kerr, with the remaining portion treated and released to the Tar River and Neuse River basins. EE&T, Inc. consulting engineers for the sponsor recorded inter basin transfers of water distributions in 2002 and made projected distributions for 2035. These data were provided in a 2004 Inter Basin Transfer Study prepared by EE&T, Inc. and summarized in Table 4. The storage reallocation and impacts to power generation were based on the 20 MGD gross withdrawal.

Table 4
KLRWS Average Daily IBT

Year	Tar Basin MGD	Roanoke Basin MGD	Neuse Basin MGD
2002	3.35	2.37	0.07
2035	15.35	5.01	0.81

3.2 Alternative Sources

Consulting engineers and internal planners for the sponsor have examined several alternative ground water and surface water sources to identify prospective new sources of water supply.

3.2.1 Southerland Pond Some of this effort simply involved updating similar studies from the mid-sixties. The principle source of water at that time was Southerland Pond on Sandy Creek, six miles east of the city. The A-E firm retained by the city to do this initial analysis performed a thorough study and concluded that the only source capable of meeting the City's forecast water supply demands was Kerr, thus eliminating all other inadequate ground and surface water alternatives. This analysis led to the construction and development of the KLRWS facility adjacent to Kerr Reservoir. An updated review of Southerland Pond as a potential supplemental source of water supply revealed that this pond has since silted in, reducing the safe yield to nearly zero. The original raw water pipeline at Southerland Pond has been abandoned and the original water plant has been demolished. There is no capacity available from this old raw water source.

3.2.2 Groundwater Generally, deep rock wells in the KLRWS service area produce less than 100 gallons per minute (gpm). The Town of Bunn in Franklin County, now receiving water from the KLRWS, had previously relied on wells. The best well in Bunn had a capacity of around 40 gpm. The Town had drilled over 21 wells over a period of 20 years with very little success (Ref: Peirson and Whitman Engineers, consulting Engineers for the Town of Bunn since 1967). The old wells in Warrenton, Norlina, Soul City and other areas of Warren County were similar in capacity to those in Franklin County. The soil and geologic structure in Franklin, Warren, Vance and Granville Counties is such that high yield wells are not possible. Therefore, it would not be cost effective to utilize large well fields as the water supply source.

3.2.3 Lake Gaston Lake Gaston is down gradient from Kerr and would require new construction of at least 14 miles of raw water pipeline, a new raw water intake and pumping facilities. Based on the cost to upgrade the existing KLRWS facility to 20 MGD capacity it is estimated that the raw water intake and pumping facilities would cost approximately $21 million. Additional costs would be expected for real estate, permits and pipeline construction. Also, since Lake Gaston is operated as a privately owned run-of-river hydropower facility with no storage for water supply, the sponsor would need to purchase storage from Kerr to ensure dependable water supply during a repeat of the critical drought.

3.2.4 Town of Oxford The alternative of re-establishing the old Town of Oxford water plant located in Granville County within the KLRWS service area, was investigated in 1995-1996. At that time, the plant had been off-line for over 15 years. The clearwell was used in 1998 for wastewater storage and there remains mercury in the Simplex gases at the plant. Therefore, re-establishment of the old plant is no longer feasible. Oxford also investigated the feasibility of increasing water storage in Oxford and building a package water plant with raw water withdrawal from Lake Devin. The study indicated that it was more cost effective to build a second finished water line from KLRWS plant to Oxford, which has been done. Funding for the new finished water line was provided by Oxford, Granville County and Vance County.

Warren County also built a second finished water line into Warren County in 2002.

The KLRWS facility and corresponding extensive distribution network which began operation in 1978 represents a capital investment for the sponsor and its taxpayers of approximately $21 million. In addition to serving the sponsor it also serves as a public water system for Warren County, portions of Vance, Granville and Franklin Counties. The sponsor has operated as the majority partner in the KLRWS for the past 27 years with considerable capital investment in planning, facilities, and distribution networks with other regional partners, all based on a continued 20 MGD water supply withdrawal capability. This fact, plus the fact that the "no action" alternative would result in a directive to not only cease and desist any and all future water withdrawals but to also remove all equipment and structures, makes this a most undesirable choice for the sponsor. However, the government always reserves the right to exercise the 'no action' alternative for any reallocation of storage at any time. While the "conservation" alternative could potentially provide some minor relief in the short term it is not a viable option for a future long-range solution. This becomes clearly evident considering that the most recent drought of record lasted for a period of 16 months.

3.3 Summary of Alternatives

Table 5 provides a summary of the various alternatives that were considered. While rejecting the first three alternatives for various reasons, this leaves us with two potentially viable ones, a new reallocation of conservation storage from Kerr and the "no action".

Table 5
Summary of Alternative Sources of Water

ALTERNATIVE	VIABILITY
1. Groundwater/Bulk Finished Water Purchase	Rejected: inadequate supply
2. Alternative Surface Water	Rejected: inadequate supply
3. Conservation	Rejected: not viable for long term
4. No Action	Potentially viable
5.New Reallocation from Conservation Storage (Kerr)	Potentially viable

3.4 Storage Requirements for Kerr Withdrawal

The volume of storage required for the sponsor was based on a withdrawal rate of 20 MGD. Inflow during the historical critical low flow period at the project was used as the basis to determine the required storage. The critical low flow period at the project was June 2001 through October 2002. This critical low flow period exceeded the previous critical low flow period of June through October 1968 by a whole year. The storage-yield analysis was determined by adjusting the computed inflows during the critical low flow period to a base case condition by adding the actual Henderson water supply withdrawals back in. The volume of storage to be reallocated was determined as the volume of withdrawal minus the volume of inflow during the critical period. The percentage of storage reallocated was adjusted by trial until the storage allocated and the volume of water used during the critical period balanced. The storage reallocation determined to yield a flow of 20 MGD is 10,292 AF as shown in Table 6. The sponsor has requested and demonstrated a future need for a total withdrawal of 20 MGD from Kerr to match the volume currently allowed in its water use agreement. Storage volumes provided to the Hydropower Analysis Center to determine impacts on hydropower were made without consideration of sedimentation impacts and were rounded up to the next whole 100 AF. While this procedure gave a slightly greater impact to hydropower by use of a larger volume of storage (10,700 AF verses 10,292 AF) than what was actually required, it did not adversely impact the cost to the sponsor as the cost of storage is greater than the cost of hydropower by a factor of 2.2 (refer to Table 15). Because of this magnitude, it is not deemed necessary to recompute impacts to hydropower and the values determined in Appendix A are accepted as computed.

Table 6
Reservoir Yield

Conservation Pool Storage (AF)	980,054	
Storage Reallocated (AF)	10,292	
Storage Reallocated (per cent)	1.05	
Withdrawal Rate (MGD)	20	
Withdrawal Rate (cfs)	31	
Critical Period (days)	478	
Withdrawal Volume Critical Period (AF)		29,339
Inflow Volume Critical Period (AF)	1,814,030	
Per cent of Inflow allocated to water supply	1.05	
Volume of Inflow used for water supply (AF)		19,047
Volume of storage utilized during critical period (AF)		10,292

3.5 Impact on Reservoir Operation

The overall impact on operation at Kerr will not change with conversion from a 'water use' agreement to a 'water storage' agreement for 20 MGD. Operation of the reservoir with a 20 MGD water withdrawal during the critical low flow period would result in an elevation at Kerr of 0.26 feet lower than what would be expected without any withdrawal.

3.6 Impact of New Storage Reallocation on Other Project Purposes

3.6.1 Hydropower. The main impact of the proposed withdrawal for water supply will be a reduction in power output from Kerr. These impacts are addressed in detail in Appendix A.

3.6.2 Flood Control. Reallocation from the conservation pool will have no impact on flood control.

3.6.3 Recreation. With conversion of an existing 20 MGD 'water use' to a 20 MGD 'water storage' agreement there will be no change in the water control plan to meet water supply requirements and/or downstream minimum flow requirements. The increase in elevation draw down due to 20 MGD water supply will be 0.26 feet lower than if there were no water supply withdrawals during the recent drought of record. Normal reservoir operations and recreation activities (fishing, boating, swimming, etc.) will not be adversely impacted by this change.

3.6.4 Water Supply. The proposed reallocation would have no impact on other water supply users since the reallocation would come from the conservation storage allocated to hydropower. Reallocation of 10,292 AF of storage to satisfy this request would leave 28,885 AF of storage remaining for reallocation at Kerr under the discretionary authority of the Chief of Engineers.

3.6.5 Streamflow Regulation and Water Quality. The proposed action to convert an existing 20 MGD 'water use' to a 20 MGD 'water storage' agreement will not change the impacts on the total volume of water released from Kerr Dam. The maximum water supply withdrawal of 31 cfs (at the 20 MGD rate) is quite small compared to average annual releases of almost 8,000 cfs from Kerr Dam. No adjustment in reservoir operation will be required to accommodate the withdrawal and the supporting storage reallocation. The volume of Kerr Reservoir is too large compared to the volume withdrawn on any given day for the proposed withdrawal to have a noticeable effect. Because the proposed reallocation as made from the conservation pool would merely be a reallocation of the storage presently in the reservoir, no adverse impacts are expected to the surface or ground water quality and quantity.

3.6.6 Fish & Wildlife. As this action only involves conversion from water use to water storage with no change in the total withdrawal the impact on fish and wildlife and other environment-related impacts will not change. Refer to Appendix D for a further statement on environmental impacts associated with this reallocation.

4.0 DERIVATION OF USER COSTS

4.1 Introduction

This chapter describes the derivation of user costs for a storage reallocation from the conservation storage at Kerr.

According to Section 4-32d of ER 1105-2-100, the cost to be paid by the water supply storage user is established as the highest of

Benefits foregone as a result of the storage reallocation, or
Revenues foregone as a result of the storage reallocation, or
Cost of replacing the outputs that were provided by that increment of storage before reallocation, or
Updated cost of storage

In the case of Kerr, the output that must be replaced would be the updated cost of storage. Since the power benefits foregone are specified by economic evaluation criteria to be the cost of replacement power, the benefits foregone and cost of replacement are identical. Thus, a separate calculation of cost of replacement power is not required.

Reallocation from both conservation storage and flood control storage must be considered. The choice as to which reallocation will be permitted must be based on the alternative having the least impact on existing project purposes (i.e., the least benefits foregone). At Kerr the entire flood control storage space is required to satisfy current criteria established for this purpose. In four separate flood events between 1975 and 1996 over ninety per-cent of the controlled flood storage was utilized. The April 1987 event pushed the reservoir level to less than six inches away from the point at which releases downstream match eighty-five per-cent of the computed inflow (a volume in excess of 100,000 cfs) while the September 1996 flood event generated the greatest computed inflow on record for this location (second only to the August 1940 event which was used to justify project construction). Therefore, this analysis will only concentrate on the volume of conservation/power pool storage that must be reallocated to satisfy water supply requirements. The actual cost to the sponsor will be based on the value of reallocated conservation pool storage. This equates to determining the greatest impact to hydropower since the entire conservation pool storage at Kerr was authorized for hydropower production.

4.2 Power Benefits Foregone

Power benefits foregone represent the impact the withdrawal will have on the National Economic Development (NED) power benefits of the Roanoke River reservoir system. Power benefits are divided into energy and capacity benefits. The following sections summarize these benefits. Detailed information on how they were developed can be found in Chapters 2, 3, and 4 of Appendix A.

4.2.1 Energy Benefits Foregone. A hydro project's National Economic Development (NED) energy benefit is computed as the product of the project's average annual energy production and a unit energy value. That energy value is intended to measure the cost of producing the same energy by the regional power system if the hydro project were replaced by the most likely thermal alternative.

Energy values are currently developed by the Corps' Northwestern Division office using PROSYM, an hourly power system production cost model. The applicable regional power system is modeled with and without an increment of hydro generation. The difference in system cost between the two simulations represents the value of hydro energy lost. Dividing that cost by the energy output of that increment of hydro will give the average unit value of the hydro energy, and this is commonly called the “energy value.” The average value of hydroelectric energy in the VACAR power system over the life of the water supply contract is estimated to be about \$33.51/MW-hour (see Section 3.6.8 and Table 3-3 of Appendix A).

Using the \$33.51/MWh energy value and the losses in average annual energy production for each case, as described in Chapter 5 of Appendix A, average annual energy benefits foregone were computed for each case.

Table 7
Annual Energy Benefits Foregone

LOST ENERGY	ENERGY VALUE	BENEFITS FOREGONE
1981 MWh	\$33.51/MWh	\$66,383

4.2.2 Capacity Benefits Foregone. A hydro project’s NED capacity benefit is computed as the product of the project’s dependable capacity and a unit capacity value. The capacity value is intended to measure the cost of constructing the increment of equivalent thermal generating capacity that would replace the hydro capacity in the power system.

Using the \$84.26/kW-year capacity value and the losses in dependable capacity for each case (see Appendix A, Section 5 and Table 5-1), average annual capacity benefits foregone were computed for each case, as follows:

Table 8
Annual Capacity Benefits Foregone

LOST DEPEND. CAPACITY	CAPACITY VALUE	BENEFITS FOREGONE
327 kW	\$84.26/kW-year	\$27,553

4.3 Revenues Foregone. Revenues foregone represent the income reduction suffered by the regional Federal Power Marketing Agency (Southeastern Power Administration) as a result of lost power sales. These lost sales are due to the reduced power output caused by the water supply withdrawal and storage reallocation. The revenues foregone are to be based on the current rates of the Federal power-marketing agency, which in the case of the Roanoke River projects is the Southeastern Power Administration (SEPA). The rates that were in effect for 2004 are as follows:

Energy value: 8.25 mills/kWh
Capacity value: \$23.52/kW-year

The energy value would be applied to the average annual energy loss calculated as described in Section 3.4 of Appendix A. The capacity value, however, would be applied to the loss in marketable capacity rather than the loss in dependable capacity (see Section 4.5 of Appendix A). Further details concerning marketable capacity and revenues foregone may be found in Section 6 of Appendix A.

4.3.1 Energy Revenues Foregone. The average annual energy revenues foregone for each of the alternatives would be as follows:

Table 9
Energy Revenue Foregone

LOST ENERGY	SEPA ENERGY RATE	REVENUES FOREGONE
1981 MWh	$8.25/MWh	$ 16,343

4.3.2 Capacity Revenues Foregone The average annual capacity revenues foregone for each of the alternatives would be as follows:

Table 10
Capacity Revenue Foregone

LOST MARKETABLE CAPACITY	SEPA CAPACITY CHARGE	REVENUES FOREGONE
325 kW	$23.52/kW-year	$ 7,644

4.4 Updated Cost of Storage

Water supply storage reallocation at Corps of Engineers' reservoir projects is outlined in chapter 4 of IWR Report 96-PS-4 (Revised). This reference discusses in detail the authority, guidance, opportunities and procedures required to accomplish this process. The cost of authorized municipal and industrial (M&I) water supply storage in a new or existing project is to include two components: (a) the direct costs (costs attributed specifically to that purpose, such as the cost of a water supply intake), and (b) the allocated joint costs (an allocated portion of the costs of facilities that are shared by all project purposes). In the case of Kerr, there are no direct costs assigned to water supply. Therefore, the sponsor's share of the project cost will be the product of the project's total joint use cost and the ratio of the sponsor's storage space to the total storage space. Section 4-32d(2d) of ER 1105-2-100 stipulates that these joint costs must be updated to current FY 2005 price levels.

The updated cost of reallocated storage in this study was estimated by updating the cost of the joint use features from the midpoint of construction to the fiscal year in which the reallocation of storage is approved. This method eliminates consideration of interest during construction and costs associated with specific project purposes such as hydropower. The updated cost of storage is then multiplied by the reallocated storage as a percent of the total available storage to determine the current value of the reallocated storage.

From paragraph 5 of the 'Cost Allocation Study' dated February 1956, construction was initiated in February 1946 and by definition on page D-12 of IWR Report 96-PS_4 (Revised), June 1952 is the date construction was complete. Therefore, 1949 was used as the midpoint of construction for baseline cost projections. The Engineering News Record (ENR) and Civil Works Construction Cost Index System (CWCCIS) were used to determine the FY2005 estimated construction cost values as directed in Table 4-4 on page 4-10 of IWR Report 96-PS-4 (Revised).

TABLE 11
ENR and CWCCIS Cost Update Indices

ENR Construction Cost Index

Year	ENR Index	Ratio
1949	477	
1967	1074	2.2516

CWCCIS Update Index

Feature	1967	FY2005	Index Ratio
Relocations	100	600.64	6.0064
Reservoirs	100	633.16	6.3316
Dams	100	578.92	5.7892
Roads, Railroads & Bridges	100	600.64	6.0064
Bldgs, Grounds, and Utilities	100	582.41	5.8241
Permanent Operating Equip	100	582.41	5.8241

Storage Requirements

Total Flood Control Storage	1,282,367	Ac-Ft
Total Conservation Storage	980,054	Ac-Ft
Total Usable Storage	2,262,421	Ac-Ft
Reallocated Storage Required	10,292	Ac-Ft
Total Usable Storage	2,262,421	Ac-Ft
Ratio of Reallocated to Total	0.00454911	

TABLE 12
Updated Cost of Storage

Description	As-Built Joint-Use Costs ($)	ENR Index Ratio	CWCCIS Index Ratio	Land Update Factor	FY 2005 Jo Use Cost ($)
Lands and Damages	10,401,000			13.338 1/	138,728
Relocations	14,810,000	2.2516	6.0064		200,290
Reservoirs	5,140,000	2.2516	6.3316		73,277
Dams	24,601,000	2.2516	5.7892		320,673
Roads, Railroads & Bridges	1,043,000	2.2516	6.0064		14,105
Buildings, Grounds, and Utilities	570,000	2.2516	5.8241		7,474
Permanent Operating Equipment	380,000	2.2516	5.8241		4,983
Total Cost	56,945,000				759,532

Footnote: 1/ Derivation of Factor:

As-built Joint-Use Cost (-) Lands and Damages = $ 46,544,0

FY '05 Cost (-) Lands and Damages = $620,804,1

Ratio 620,804,145/46,544,000 = 13.338

The calculation for the updated cost of storage from John H. Kerr Reservoir for 10,292 acre-feet of sto (out of a total usable storage of 2,262,421 acre-feet) is as follows:

<u>$759,532,683 x 10,292 acre-feet</u> = $3,455,197

2,262,421 acre-feet

Table 12 shows computations used to determine the current cost of storage required for a 20 MGD water supply withdrawal. A reallocation of 10,292 AF from the conservation pool would cost $3,455,197.

4.5 Summary of Storage Values

Table 13 summarizes the annual benefits foregone. Also shown are net present values based on a 5-1/8 percent discount rate and the 50-year remaining life of the Kerr project (2004-2053). The net present value is $1,559,000 for 20 MGD.

Table 13
Benefits Foregone

Capacity Benefits Foregone	$27,385
Energy Benefits Foregone	$66,383
Average Annual Benefits Foregone	$93,768
Present Value of Benefits Foregone	$1,559,000

Table 14 indicates annual and net present value of revenues foregone for both storage options. Revenues foregone are substantially lower than benefits foregone.

Table 14
Revenues Foregone

Capacity Revenues Foregone	$7,644
Energy Revenues Foregone	16,343
Average Annual Revenues Foregone	$23,987
Present Value of Revenues Foregone	$398,800

To summarize, the net present values of the four costs for each alternative are as follows:

Table 15
Summary of Costs

Updated Cost of Storage	$3,455,197
Revenues Foregone	$398,800
Benefits Foregone	$1,559,000
Replacement Cost	$1,559,000

As noted earlier, the price to be charged to the sponsor for the reallocated storage would be the highest of the four values cited above. Therefore, updated cost of storage would control. The cost payable for reallocation of the conservation pool storage is $3,455,197 for 20 MGD.

4.6 O&M and RRR Expense These expenses are described here and utilized in Exhibit B of the draft water supply agreement provided as Appendix H.

4.6.1 Operation and Maintenance Expense Annual operation and maintenance expenses charged to the sponsor are estimated by multiplying the proportion of reallocated storage to total useable storage by the total joint-use operation and maintenance (O&M) expense. The following equation summarizes the calculation:

(Required Storage AF/Total Storage AF)*$Annual Joint-Use O&M = $Cost

The $2,722,255 total joint use O&M expense is an average from fiscal year 1994-2004 as indicated in Table 16. Table 17 indicates the estimated annual cost for 20 MGD as $12,384. Future years should increase slightly with inflation.

TABLE 16

John H Kerr Joint-Use Operation and Maintenance Cost

Year	($)
1994	2,491,478
1995	2,537,131
1996	2,831,041
1997	3,014,254
1998	2,914,601
1999	2,359,534
2000	2,465,247
2001	2,208,906
2002	2,843,171
2003	3,389,934
2004	2,889,508
Total	29,944,805
Average	2,722,255

TABLE 17

Apportioned Joint-Use O&M Cost

Reallocated Storage Required (AF)	10,292
Total Usable Storage (AF)	2,262,421
Ratio of Reallocated Storage to Total	0.00454911
Estimated Annual O&M Cost ($)	2,722,255
Estimated O&M cost ($/yr)	12,384

4.6.2 Major Repair, Replacement and Rehabilitation Major repair, replacement and rehabilitation (RRR) costs charged to the sponsor are determined by multiplying the proportion of reallocated storage to total useable storage by the total joint-use RRR expense. This is similar to the method used to compute annual O&M costs. The $950,906 total joint use RR&R expense is an average from fiscal year 1995-2004 as indicated in Table 18. Table 19 indicates the estimated annual cost for 20 MGD as $4,326.

TABLE 18
Joint-Use Repair, Replacement and Rehabilitation Cost

Year	($)
1995	- 320,112
1996	31,365
1997	31,810
1998	3,517,824
1999	- 400,924
2000	402,461
2001	- 27,050
2002	629,125
2003	5,648,107
2004	- 3,545
Total	9,509,061
Average	950,906

TABLE 19
Apportioned Joint-Use Repair, Replacement and Rehabilitation Cost

Reallocated Storage Required (AF)	10,292
Total Usable Storage (AF)	2,262,421
Ratio of Reallocated to Total	0.00454911
Estimated Annual RR&R Cost ($)	950,906
Estimated RR&R cost ($/yr)	4,326

Given the uncertain nature of major RR&R costs plus the fact that they are payable only when incurred, it is suggested that the sponsor place the resultant amount in an annual reserve or sinking fund for future contingency.

5.0 OTHER CONSIDERATIONS

5.1 Financial Feasibility

As a test of financial feasibility, the annual cost of storage should be compared to the cost of the most likely, least costly alternative that the applicant would undertake in the absence of utilizing the Federal project. This should be an alternative that would provide water of equivalent quality and quantity. The following decision process was analyzed.

As wells and local surface water options are inadequate, the most likely alternative to the Federal project is the purchase of water from another entity. No other industrial or municipal system within a reasonable distance is known to possess a surplus supply of water adequate to meet the sponsor's needs. A possible alternative would be to obtain water from another lake or reservoir source. This would require the construction of a pipeline at a minimum and possible relocation of the water treatment facility adjacent to the water source. The closest water source other than Kerr is Lake Gaston, which is a private hydropower lake owned by Dominion Resources. This option would require construction of at least a 14-mile pipeline depending on the location and construction of a new intake structure and pump facility. Based on the sponsor's cost to upgrade its existing facility to 20 MGD the cost of a new facility would be approximately $21 million, not counting the cost for a pipeline, pumping plant, real estate, and necessary access and environmental permits. Since Lake Gaston has no storage to supply a dependable yield for water supply and since this lake is downstream of Kerr, the sponsor would need to purchase storage at Kerr, the same result we are addressing here. This exercise has taken on a circuitous nature without an adequate alternative.

The reallocation of storage has a significant advantage over the alternative purchase of water from private sources. The annual water purchase with an initial five-year interest rate at 5-1/8 percent (the lowest rate offered to date by guidelines for reallocated storage) represents a major cost savings over potential alternatives. Construction of a pipeline to allow purchase of water from private sources would be very expensive, and likely to result in much greater environmental impact that the proposed reallocation of storage. The existing raw water facility is already in place and operational.

5.2 Cost Account Adjustments

According to Section 4-33d(3) of ER 1105-2-100,

> *When there is a loss of revenue of existing purposes, or additional operation and/or maintenance expense to existing purposes are incurred because of the new water supply addition, such charges shall be shown as a direct charge against the water supply function. This will effect the appropriate cost reductions in the existing project purposes and all revenues from the new addition will be credited to the new purpose. If hydropower revenues are being reduced as a result of the reallocation, the power-marketing agency will be credited for the amount of revenues to the Treasury foregone as a result of the reallocation. In instances where existing contracts between the power marketing agency and their customer would result in a cost to the Federal Government to acquire replacement power to fulfill the obligations of contracts, an additional credit to*

the power marketing agency can be made for such costs incurred during the remaining period of the contracts.

In the case of the proposed sponsor reallocation, there would be a loss of revenue due to the reduction in the power-generating capabilities of Kerr. During the early years of the reallocation (2005-2018), there would also be the possibility of the marketing agency (SEPA) having to purchase replacement power.

The estimated credit to the power-marketing agency for each of the four cases is as follows. The back-up calculations and further details on credit to the power marketing agency can be found in Chapter 7 of Appendix A.

Table 20
Credit to Marketing Agency

Withdrawal Alternative	5 MGD	20 MGD
Energy credit	$11,896	$47,511
Capacity credit	$5,066	$20,088
Annual credit to PMA	**$16,962**	**$67,599**

5.3 Environmental Considerations

The environmental impact of the withdrawal and discharge will not be significant. As all facilities are already constructed and in operation there is no additional risk to the environment. No archeological/cultural or threatened and endangered species will be impacted.

Operation of the water intake facility will not change as a result of converting from a water use agreement to a water storage agreement. The discharge from the wastewater pipeline is designed to meet all applicable water quality criteria for a NPDES permit.

These factors minimize and limit environmental impact and are addressed in a Record of Environmental Evaluation provided in Appendix D.

5.4 Structural Changes

No structural modifications will need to be made to Corps of Engineers facilities to accommodate either the storage reallocation or the water supply withdrawal.

5.5 Test for Low Income Community Discount

Public Law (PL) 101-640 specifically defines a "low income community" as a community with a population less than 20,000 that is located in a county with a per capita income less than the per capita income of two-thirds of the counties in the United States. The maximum amount of water supply storage space, that may be provided to a community under this authority, may not exceed an amount of water supply storage space sufficient to yield 2,000,000 gallons of water per day. The sponsor currently exceeds the requirement for maximum daily water supply use of 2 MGD thus rendering it ineligible for this discount.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary of Findings

There are no viable alternatives available to the sponsor as a source of water verses their proposed conversion of the water use agreement to a water storage agreement at Kerr.

Reallocation of storage at Kerr from the conservation pool will satisfy the sponsor's need.

In order to support the sponsor's firm withdrawal of 20 MGD, a reallocation of 10,292 AF of storage will be required from the conservation pool.

There would be a reduction in the power capability of Kerr as a result of the withdrawal.

The net present values of the four cost parameters specified by Section 4-32d of ER 1105-2-100 are as follows:

Updated Cost of Storage	$3,455,197
Revenues Foregone	$398,800
Benefits Foregone	$1,559,000
Replacement Cost	$1,559,000

Updated cost of storage is the highest cost, and this would establish the cost to be paid by the sponsor for the storage allocation.

There would be slightly greater pool fluctuations at Kerr during periods of low flow. However, these small changes in pool elevation would not have a perceptible impact on reservoir recreation. Likewise, it is not anticipated that the reallocation would have any significant impact water quality, or fish and wildlife.

6.2 Recommendations

The reallocation of storage discussed in this report is economically justified and will not significantly impact the authorized purposes of Kerr. The reallocation will not require any structural or operational change.

Therefore, pursuant to the authority provided in the Water Supply Act of 1958, as amended, it is recommended that the reallocation of 10,292 acre-feet of conservation storage be approved. Approval is subject to the execution of a water storage contract between the U.S. Army Corps of Engineers and The City of Henderson, North Carolina and is subject to the successful fulfillment of all requirements of said contract.

Appendix B.3 – Extension of Authorization to Construct Letter

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NCDENR

North Carolina Department of Environment and Natural Resources

Division of Water Resources

Pat McCrory
Governor

Thomas A. Reeder
Director

John E. Skvarla III
Secretary

March 14, 2013

RECEIVED
CMO
MAR 18 2013
BY: PSS

Mr. Eric Williams
180 Beckford Drive
Henderson, North Carolina 27536

Re: **Extension of Authorization to Construct**
Kerr Lake WTP Additions
PWS ID# NC0291010, Vance County

Dear Mr. Williams:

This letter is in response to a request for an Extension of the Authorization to Construct for **Kerr Lake WTP Additions, Serial No. 05-01344.** The Authorization to Construct is extended and will expire on March 14, 2015.

The Extension of the Authorization to Construct is valid only if the site conditions and the previously approved engineering parameters have not changed, as required by 15A NCAC 18C .0305 (a). The Extension of the Authorization to Construct and the engineering plans and specifications approval letter shall be posted at the primary entrance of the job site before and during construction.

Approval must be secured from the Department before any construction or installation if:

- Deviation from the approved engineering plans and specifications is necessary; or
- There are changes in site conditions affecting capacity, hydraulic conditions, operating units, the function of water treatment processes, the quality of water to be delivered, or conditions imposed by the Department in any approval letters.

Upon completion of the construction or modification and in accordance with Rule .0303, the applicant shall submit a certification statement signed and sealed by a registered professional engineer stating that construction was completed in accordance with approved engineering plans and specifications, including any provisions stipulated in the Department's engineering plan and specification approval letter. Prior to Final Approval, the applicant shall submit a signed certification stating that the requirements in 15A NCAC 18C .0307 (d) and (e) have been satisfied and if applicable, a completed application for an Operating permit and fee. Once the certification statements and operating permit application and fee, if applicable, are received and determined adequate, the Department will grant Final Approval in accordance with Rule .0309 (a). Therefore, no construction, alteration, or expansion of a water system shall be placed into service until Final Approval has been issued by the Department.

If we can be of further assistance, please call (919) 707-9100.

Sincerelv.

Siraj Chohan, P.E., Team Leader
Technical Services Branch

SMC/tk
cc: Michael Douglas, P.E., Regional Engineer
Terra Tech Engineering Inc

Public Water Supply Section – Jessica C. Godreau, Chief
1634 Mail Service Center, Raleigh, North Carolina 27699-1634
Phone: 919-707-9100 \ FAX: 919-715-4374 \ Lab Form FAX: 919-715-6637 \ Internet: www.ncwater.org/pws/

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Appendix B.4 – Agency Comment Matrix

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Agency Comment Response Matrix
Environmental Assessment - Kerr Lake Regional Water System Interbasin Transfer Request from the Roanoke River Basin
DENR Internal # 1614

Completed January 12, 2015

Division	Point of Contact	Role/Office	Comment	Response to comment
NC Wildlife Resources Commission	Vann Stancil	Research Coordinator, Habitat Conservation	Maintaining appropriate flows in the Roanoke River is important for anadromous fish such as Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus* , striped bass, *Morone saxatilis* , American shad, *Alosa sapidissima* , and hickory shad, *A. mediocris* , as well as resident aquatic species. Anadromous fish depend on high flows during the spring to ascend rivers to spawn and eggs and larval are affected by flow regimes as they travel downstream during early development.	Comment noted.
NC Wildlife Resources Commission	Vann Stancil	Research Coordinator, Habitat Conservation	While we do not anticipate significant impacts to aquatic and terrestrial wildlife resources as a result of the preferred alternative for this project, the NCWRC recommends that as much water as practically possible be returned to the Roanoke River basin. Directing future infrastructure expansion to support the transport of wastewater to the Roanoke River basin will help decrease the proportion of water transferred to other basins. This will remain important as future water demands are forecasted beyond the current 30 and 45 year planning periods and plans derived to further expand water supplies. The NCWRC encourages the KLRWS to continue to pursue water conservation measures such as leak detection and water reuse.	Comment noted.
NC Natural Heritage Program	Allison Weakley	Conservation Planner	Sections 4.7 and 4.12 refer to NCNHP data from 2014 for natural areas, but Section 4.12 references NCNHP data from 2009 for Federally listed aquatic species. The NCNHP database is dynamic, and data are distributed quarterly. To ensure the most current data for rare species that occur within the study area are considered, including the Federal and State protection statuses for these species, the most recent version of the data (2014) should be used. For example, the rare aquatic species list in Section 4.12 does not include Neuse River Waterdog; this species is a Federal Species of Concern (At Risk Species) and a State Special Concern species. The most current NCNHP may be accessed via the NCNHP Data Services webpage at www.ncnhp.org.	The most recent 2014 data was used during compilation of the EA. This has been reviewed and addressed in Section 4.12.
NC Natural Heritage Program	Allison Weakley	Conservation Planner	Section 4.7 (page 4-30) states that "Figure 4-4 shows the locations of NHPNAs within the service area, "however this figure does not appear to be included in the EA; there are also several other references to Figure 4-4 in the EA. Likewise, Section 4.12.1.1 (page 4-34) states that occurrences of Federally listed aquatic species are shown in Figure 4-5, and Section 5.7.2 (page 5-33) states that natural areas along the Tar River and Fishing Creek are shown in Figure 4-2, but these figures do not appear to be included in the EA either.	Comment has been addressed regarding figure references through the EA.
NC Natural Heritage Program	Allison Weakley	Conservation Planner	Natural areas identified by the NCNHP are referred to as "NHPNAs" in Section 4.7 and as "SNHAs" in Sections 5.7 and 5.12; these natural areas should be referred to Natural Heritage Program Natural Areas, or NHPNAs, consistently throughout the document.	Comment has been addressed in Sections 5.7 and 5.12.
NC Natural Heritage Program	Allison Weakley	Conservation Planner	Section 4.12 (page 4-34) refers to specific regulations that exist at the state and federal levels to protect endangered and threatened species and their habitats, but the EA appears to only address Federally listed species, and does not address State listed species.	Comment has been addressed in Section 4.12.
NC Natural Heritage Program	Allison Weakley	Conservation Planner	In Table 4-41, *Marshallia* sp. should be listed as *Marshallia legrandii* .	Comment has been addressed in Section 5.13.1.
NC Natural Heritage Program	Allison Weakley	Conservation Planner	Section 5.13.1 states that "several federally listed threatened and endangered terrestrial species are known to occur… in the source and receiving basins, " and that many terrestrial natural areas are present, but this section does not specifically address secondary and cumulative impacts to these species or to terrestrial natural areas.	Comment has been addressed in Section 5.13.1.
NC Natural Heritage Program	Allison Weakley	Conservation Planner	Section 4.12.2 and Appendix C list Natural Heritage Program natural areas within the study area, but the EA does not provide information on the site rating or significance of the natural areas. A reference to the source, including the date the list was generated, is also not included in Tables C-2 and C-3 in Appendix C.	Comment has been addressed in Section 4.12.2 and in Appendix C.
NC Division of Parks and Recreation	Justin Williamson	Environmental Review Coordinator	DPR would like it to be made aware that we currently manage several recreational features throughout Kerr Lake State Park that are dependent upon optimal water levels. These include 28 boat docks, 18 boat ramps, 2 fishing piers, several campsites and swim beaches. The Division of Parks and Recreation request that all efforts be taken to protect the natural resource and recreational opportunities that Kerr Lake State Park currently offers.	Comment noted.

Agency Comment Response Matrix

Environmental Assessment - Kerr Lake Regional Water System Interbasin Transfer Request from the Roanoke River Basin

DENR Internal # 1614

Completed January 12, 2015

Division	Point of Contact	Role/Office	Comment	Response to comment
NC Department of Public Safety-Risk Management Section	Dan Brubaker	NFIP Engineer	No comments.	N/A
NCDENR Raleigh Regional Office	DDM	Division of Air Quality	No comments.	N/A
NCDENR Raleigh Regional Office	DS & RB	Division of Water Resources - WQROS (Aquifer & Surface)	No comments.	N/A
NCDENR Raleigh Regional Office	WAH	Division of Water Resources - Public Water Supply	Plans and specifications for the construction, expansion, or alternation of a public water system must be approved by the Division of Water Resources/Public Water Supply Section prior to the award of a contract or the initiation of construction, expansion, or alternation of a public water system must be approved by the Division or Water Resources/Public Water Supply Section prior to the award of a contract or the initiation of construction as per 15A NCAC 18C .0300 et. seq. Plans and specifications should be submitted to 1634 Mail Service Center, Raleigh, North Carolina 27699-1634. For more information, contact the Public Water Supply Section, (191) 707-9100.	Comment noted. This process will be followed for the planned Water Treatment Plant expansion.
NCDENR Raleigh Regional Office	WAH	Division of Water Resources - Public Water Supply	If existing water lines will be relocated during the construction, plans for the water line relocation must be submitted to the Division of Water Resources/Public Water Supply Section at 1634 Mail Service Center, Raleigh, North Carolina 27699-1634. For more information, contact the Public Water Supply Section, (191) 707-9100	Comment noted.
NCDENR Raleigh Regional Office	JLH	Division of Energy, Mineral and Land Resources (Land Quality & Stormwater Programs)	No comments.	N/A
NCDENR Raleigh Regional Office	MRP	Division of Waste Management - Underground Storage Tanks	Notification of the proper regional office is requested if "orphan" underground storage tanks (USTS) are discovered during any excavation operation.	Comment noted.

Appendix B.5 – Agency Comments

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NCDENR
North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

Donald R. van der Vaart
Secretary

MEMORANDUM

TO: Harold Brady
Division of Water Resources

FROM: Lyn Hardison
Division of Environmental Assistance and Customer Service
Permit Assistance & Project Review Coordinator

RE: Draft Environmental Assessment
Water System Interbasin Transfer from Kerr Lake
Vance, Granville, Warren and Franklin Counties
DENR Internal # 1613

Date: January 9, 2015

The NC Department of Public Safety Emergency Management requested to participate in NC Department Environment and Natural Resources internal review process and it was granted essentially to help expedite the environmental document for the applicant.

Both departments have reviewed the proposal for the referenced project. Based on the information provided, the agencies have identified permits that may be required and offered some valuable information that will assist the applicant in preparing the necessary environmental document. The comments are attached for the applicant's consideration.

The Department agencies will continue to be available to assist the applicant through the environmental review and permitting processes.

Thank you for the opportunity to respond.

Attachments

North Carolina Wildlife Resources Commission

Gordon Myers, Executive Director

MEMORANDUM

TO: Lyn Hardison
NCDENR Division of Environmental Assistance & Outreach

FROM: Vann F. Stancil
Research Coordinator
Habitat Conservation

DATE: January 6, 2015

SUBJECT: Comments on Draft EA for IBT increase from Kerr Lake to Tar River, Neuse River & Fishing Creek basins, Vance, Granville, Warren & Franklin Counties. Project No. 1614.

Biologists from the North Carolina Wildlife Resources Commission (NCWRC) have reviewed the proposed project description. Our comments are provided in accordance with certain provisions of the NC Environmental Policy Act (G.S. 113A-1 through 113A-10; 1 NCAC 25) and the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

The Kerr Lake Regional Water System (KLRWS) seeks to increase the existing interbasin transfer (IBT) from John H. Kerr Reservoir (Kerr Lake) in the Roanoke River basin to the Tar River basin, Neuse River basin, and Fishing Creek subbasin to provide sufficient water for future demand. The KLRWS currently provides water for parts of Vance, Granville, Warren and Franklin counties. The KLRWS expects water demand to increase beyond the 10 MGD allowed with the current IBT certificate during the next 30 to 45 years. The US Army Corps of Engineers (USACE) has already allocated the storage equivalent of 20 MGD average day demand within Kerr Lake to the KLRWS.

The KLRWS has assessed several alternatives to meet their water needs for the next 30 years. These alternatives include using surface water from within the Tar and Neuse river basins, using groundwater from within the Tar and Neuse river basins, discharging treated wastewater back into the Roanoke River basin, and using coastal surface or groundwater. The applicant's

Mailing Address: Division of Inland Fisheries • 1721 Mail Service Center • Raleigh, NC 27699-1721
Telephone: (919) 707-0220 • **Fax:** (919) 707-0028

preferred alternative is to increase the IBT from the Roanoke River basin from 10 to 20 MGD and continue to treat and discharge wastewater into the Tar River, Neuse River, and Fishing Creek basins.

The applicant compared Kerr Lake levels and flows in the Roanoke River downstream between the current IBT and the proposed increase to 20 MGD. Given the volume of water in Kerr Lake and typical flows in the Roanoke River, the increased withdrawal had minimal effects on lake levels or river discharge.

Maintaining appropriate flows in the Roanoke River is important for anadromous fish such as Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus*, striped bass, *Morone saxatilis*, American shad, *Alosa sapidissima*, and hickory shad, *A. mediocris*, as well as resident aquatic species. Anadromous fish depend on high flows during the spring to ascend rivers to spawn and eggs and larval are affected by flow regimes as they travel downstream during early development.

While we do not anticipate significant impacts to aquatic and terrestrial wildlife resources as a result of the preferred alternative for this project, the NCWRC recommends that as much water as practically possible be returned to the Roanoke River basin. Directing future infrastructure expansion to support the transport of wastewater to the Roanoke River basin will help decrease the proportion of water transferred to other basins. This will remain important as future water demands are forecasted beyond the current 30 and 45 year planning periods and plans derived to further expand water supplies. The NCWRC encourages the KLRWS to continue to pursue water conservation measures such as leak detection and water reuse.

Thank you for the opportunity to review and comment on this project. Please do not hesitate to contact me at vann.stancil@ncwildlife.org or 919-284-5218 if you have any questions or concerns about these project comments.

ec: Gabriela Garrison, NCWRC

NCDENR
North Carolina Department of Environment and Natural Resources
Office of Land and Water Stewardship

Pat McCrory
Governor

Bryan Gossage
Director

Donald R. van der Vaart
Secretary

January 7, 2015

TO: Lyn Hardison, NCDENR State Clearinghouse Coordinator

FROM: Allison (Schwarz) Weakley, North Carolina Natural Heritage Program *Allison Weakley*

SUBJECT: Draft Environmental Assessment (EA) – Water System Interbasin Transfer (IBT) from Kerr Lake (Roanoke River Basin) to Tar River Basin, Fishing Creek Subbasin, and Neuse River Basin in Vance, Granville, Warren, and Franklin Counties, North Carolina

REFERENCE: Project No. 1614

Thank you for the opportunity to provide information from the North Carolina Natural Heritage Program (NCNHP) database for the proposed project referenced above. Within the four counties identified in the study area, the NCNHP has records for 98 rare species and 30 important natural communities tracked by the NCNHP, 85 natural areas (of which 19 are aquatic and 66 are terrestrial), and 45 records for conservation/managed areas.

We have reviewed the draft Environmental Assessment and have the following general comments.

- Sections 4.7 and 4.12 refer to NCNHP data from 2014 for natural areas, but Section 4.12 references NCNHP data from 2009 for Federally listed aquatic species. The NCNHP database is dynamic, and data are distributed quarterly. To ensure the most current data for rare species that occur within the study area are considered, including the Federal and State protection statuses for these species, the most recent version of the data (2014) should be used. For example, the rare aquatic species list in Section 4.12 does not include Neuse River Waterdog; this species is a Federal Species of Concern (At Risk Species) and a State Special Concern species. The most current NCNHP may be accessed via the NCNHP Data Services webpage at www.ncnhp.org.
- Section 4.7 (page 4-30) states that "Figure 4-4 shows the locations of NHPNAs within the service area," however this figure does not appear to be included in the EA; there are also several other references to Figure 4-4 in the EA. Likewise, Section 4.12.1.1 (page 4-34) states that occurrences of Federally listed aquatic species are shown in Figure 4-5, and Section 5.7.2 (page 5-33) states that natural areas along the Tar River and Fishing Creek are shown in Figure 4-2, but these figures do not appear to be included in the EA either.
- Natural areas identified by the NCNHP are referred to as "NHPNAs" in Section 4.7, and as "SNHAs" in Sections 5.7 and 5.12; these natural areas should be referred to Natural Heritage Program Natural Areas, or NHPNAs, consistently throughout the document.
- Section 4.12 (page 4-34) refers to specific regulations that exist at the state and federal levels to protect endangered and threatened species and their habitats, but the EA appears to only address Federally listed species, and does not address State listed species.
- In Table 4-41, *Marshallia* sp. should be listed as *Marshallia legrandii*.

- Section 5.13.1 states that "several federally listed threatened and endangered terrestrial species are known to occur… in the source and receiving basins," and that many terrestrial natural areas are present, but this section does not specifically address secondary and cumulative impacts to these species or to terrestrial natural areas.
- Section 4.12.2 and Appendix C list Natural Heritage Program natural areas within the study area, but the EA does not provide information on the site rating or significance of the natural areas. A reference to the source, including the date the list was generated, is also not included in Tables C-2 and C-3 in Appendix C.

We would be glad to provide additional information regarding rare species, natural communities, natural areas and conservation/managed areas within the study area upon request. Please feel free to contact me at 919-707-8629 or Allison.Weakley@ncdenr.gov if you have questions or additional information is needed.

NCDENR

North Carolina Department of Environment and Natural Resources

Pat McCrory
Governor

John E. Skvarla, III
Secretary

December 16, 2014

MEMORANDUM

TO: Lyn Hardison, SEPA Program Coordinator

FROM: Justin Williamson, Environmental Review Coordinator, North Carolina Division of Parks and Recreation

SUBJECT: Project #1614 Draft EA for a Water System Interbasin Transfer from Kerr Lake

The North Carolina Department of Parks and Recreation (DPR) have conducted a review of Project #1614 in Vance County, North Carolina. DPR would like it to be made aware that we currently manage several recreational features throughout Kerr Lake State Park that are dependent upon optimal water levels. These include 28 boat docks, 18 boat ramps, 2 fishing piers, several campsites and swim beaches.

The Division of Parks and Recreation request that all efforts be taken to protect the natural resource and recreational opportunities that Kerr Lake State Park currently offers.

Thank You for the opportunity to provide comments on this project. For any questions please contact Justin Williamson at (919) 707-9329 or justin.williamson@ncparks.gov.

Department of Environment and Natural Resources
Project Review Form

Project Number	County	Date Received	Date Response Due
1614	Vance, Granville, Warren, and Franklin Counties	12/11/2014	1/6/2015
Draft Environmental Assessment for an Water System Interbasin Transfer from Kerr Lake (Roanoke River Basin) - Proposal to transfer 14.2 mgd water from the existing intake on Kerr Lake (Roanoke Basin); 10.7 mgd to the Tar River basin, 1.7 mgd to the Fishing Creek subbasin, and 1.8 mgd to the Neuse River basin).			

This project is being reviewed as indicated below:

Regional Office	Sections	In-House Review
☐ Asheville ☐ Fayetteville ☐ Mooresville ☒ Raleigh ☐ Washington ☐ Wilmington ☐ Winston-Salem	☒ Air ☒ DWR – All Water Programs ☒ Land Quality & Stormwater Programs ☒ UST ☒ Public Water	☐ Marine Fisheries ☐ Coastal Management ☐ Waste Mgmt (Haz, solid, Inactive, Superfund & UST) ☒ Air Quality ☒ CC & PS Div. of Emergency Mgmt. ☐ Water Resources Management (Public Water, Planning & Water Quality Program) ☐ Shellfish Sanitation ☒ Parks & Recreation ☐ DWR – Transportation Unit _____ ☒ Wildlife Vann/Gabriela ☐ Wildlife (DOT) _____

Regional Coordinator Sign-off:	Date:	In-House Reviewer/Agency:
_____	_____	_____

Response (check all applicable)

☐ No objection to project as proposed ☐ No comment

☐ Insufficient information to complete review ☒ Other (specify or attach comments)

Thank you for the opportunity to review the Environmental Assessment for the Interbasin Transfer from the Roanoke River Basin for the Kerr Lake Regional Water System. Because the project involves allocation and not construction or development, there do not appear to be any impacts in the Special Flood Hazard Areas. The EA appears to adequately address floodplain impacts. We do not have any comments on the draft EA. Please let me know if you have any questions. - Dan Brubaker, NFIP Engineer, NC Department of Public Safety-Risk Management Section-(919) 825-2300-dan.brubaker@ncdps.gov

RETURN TO:

Lyn Hardison – Lyn.Hardison@ncdenr.gov, 252-948-3842

943 Washington Square Mall

Washington N C 27889

State of North Carolina
Department of Environment and Natural Resources
INTERGOVERNMENTAL REVIEW - PROJECT COMMENTS

Reviewing Office: Raleigh Regional Office

Project Number __-1614 Due Date: 1/6/2015
County Vance

After review of this project it has been determined that the ENR permit(s) and/or approvals indicated may need to be obtained in order for this project to comply with North Carolina Law. Questions regarding these permits should be addressed to the Regional Office indicated on the reverse of the form. All applications, information and guidelines relative to these plans and permits are available from the same Regional Office.

	PERMITS	SPECIAL APPLICATION PROCEDURES or REQUIREMENTS	Normal Process Time (statutory time limit)
☐	Permit to construct & operate wastewater treatment facilities, sewer system extensions & sewer systems not discharging into state surface waters.	Application 90 days before begin construction or award of construction contracts. On-site inspection. Post-application technical conference usual.	30 days (90 days)
☐	NPDES - permit to discharge into surface water and/or permit to operate and construct wastewater facilities discharging into state surface waters.	Application 180 days before begin activity. On-site inspection. Pre-application conference usual. Additionally, obtain permit to construct wastewater treatment facility-granted after NPDES. Reply time, 30 days after receipt of plans or issue of NPDES permit-whichever is later.	90-120 days (N/A)
☐	Water Use Permit	Pre-application technical conference usually necessary	30 days (N/A)
☐	Well Construction Permit	Complete application must be received and permit issued prior to the installation of a well.	7 days (15 days)
☐	Dredge and Fill Permit	Application copy must be served on each adjacent riparian property owner. On-site inspection. Pre-application conference usual. Filling may require Easement to Fill from N.C. Department of Administration and Federal Dredge and Fill Permit.	55 days (90 days)
☐	Permit to construct & operate Air Pollution Abatement facilities and/or Emission Sources as per 15 A NCAC (2Q.O100 thru 2Q.0300)	Application must be submitted and permit received prior to construction and operation of the source. If a permit is required in an area without local zoning, then there are additional requirements and timelines (2Q.0113).	90 days
☐	Permit to construct & operate Transportation Facility as per 15 A NCAC (2D.0800, 2Q.0601)	Application must be submitted at least 90 days prior to construction or modification of the source.	90 days
☐	Any open burning associated with subject proposal must be in compliance with 15 A NCAC 2D.1900	N/A	60 days (90 days)
☐	Demolition or renovations of structures containing asbestos material must be in compliance with 15 A NCAC 20.1110 (a) (1) which requires notification and removal prior to demolition. Contact Asbestos Control Group 919-707-5950.		
☐	Complex Source Permit required under 15 A NCAC 2D.0800		
☐	The Sedimentation Pollution Control Act of 1973 must be properly addressed for any land disturbing activity. An erosion & sedimentation control plan will be required if one or more acres to be disturbed. Plan filed with proper Regional Office (Land Quality Section) At least 30 days before beginning activity. A fee of **$65** for the first acre or any part of an acre. An express review option is available with additional fees.		20 days (30 days)
☐	Sedimentation and erosion control must be addressed in accordance with NCDOT's approved program. Particular attention should be given to design and installation of appropriate perimeter sediment trapping devices as well as stable stormwater conveyances and outlets.		(30 days)
☐	Mining Permit	On-site inspection usual. Surety bond filed with ENR Bond amount varies with type mine and number of acres of affected land. Any arc mined greater than one acre must be permitted. The appropriate bond must be received before the permit can be issued.	30 days (60 days)
☐	North Carolina Burning permit	On-site inspection by N.C. Division Forest Resources if permit exceeds 4 days	1 day (N/A)
☐	Special Ground Clearance Burning Permit - 22 counties in coastal N.C. with organic soils	On-site inspection by N.C. Division Forest Resources required "if more than five acres of ground clearing activities are involved. Inspections should be requested at least ten days before actual bum is planned."	1 day (N/A)
☐	Oil Refining Facilities	N/A	90-120 days (N/A)
☐	Dam Safety Permit	If permit required, application 60 days before begin construction. Applicant must hire N.C. qualified engineer to: prepare plans, inspect construction, certify construction is according to ENR approved plans. May also require permit under mosquito control program. And a 404 permit from Corps of Engineers. An inspection of site is necessary to verify Hazard Classification. A minimum fee of $200.00 must accompany the application. An additional processing fee based on a percentage or the total project cost will be required upon completion.	30 days (60 days)

Project Number: __-1614 Due Date: 1/6/2015			Normal Process Time (statutory time limit)
PERMITS		SPECIAL APPLICATION PROCEDURES or REQUIREMENTS	
☐	Permit to drill exploratory oil or gas well	File surety bond of $5,000 with ENR running to State of NC conditional that any well opened by drill operator shall, upon abandonment, be plugged according to ENR rules and regulations.	10 days N/A
☐	Geophysical Exploration Permit	Application filed with ENR at least 10 days prior to issue of permit. Application by letter. No standard application form.	10 days N/A
☐	State Lakes Construction Permit	Application fee based on structure size is charged. Must include descriptions & drawings of structure & proof of ownership of riparian property.	15-20 days N/A
☐	401 Water Quality Certification	N/A	60 days (130 days)
☐	CAMA Permit for MAJOR development	$250.00 fee must accompany application	55 days (150 days)
☐	CAMA Permit for MINOR development	$50.00 fee must accompany application	22 days (25 days)
☐	Several geodetic monuments are located in or near the project area. If any monument needs to be moved or destroyed, please notify: N.C. Geodetic Survey, Box 27687 Raleigh, NC 27611		
☐	Abandonment of any wells, if required must be in accordance with Title 15A. Subchapter 2C.0100.		
☒	Notification of the proper regional office is requested if "orphan" underground storage tanks (USTS) are discovered during any excavation operation.		
☐	Compliance with 15A NCAC 2H 1000 (Coastal Stormwater Rules) is required.		45 days (N/A)
☐	Tar Pamlico or Neuse Riparian Buffer Rules required.		
☒	Plans and specifications for the construction, expansion, or alteration of a public water system must be approved by the Division of Water Resources/Public Water Supply Section prior to the award of a contract or the initiation of construction as per 15A NCAC 18C .0300 et. seq. Plans and specifications should be submitted to 1634 Mail Service Center, Raleigh, North Carolina 27699-1634. All public water supply systems must comply with state and federal drinking water monitoring requirements. For more information, contact the Public Water Supply Section, (919) 707-9100.		30 days
☒	If existing water lines will be relocated during the construction, plans for the water line relocation must be submitted to the Division of Water Resources/Public Water Supply Section at 1634 Mail Service Center, Raleigh, North Carolina 27699-1634. For more information, contact the Public Water Supply Section, (919) 707-9100.		30 days

Other comments (attach additional pages as necessary, being certain to cite comment authority)

Division	Initials	No comment	Comments	Date Review
DAQ	ddm	☒		12/16/14
DWR-WQROS	ds	☐		12/30/14
(Aquifer & Surface)	rb	☒		1/5/14
DWR-PWS	WAH	☐	See last two checked boxes above.	12/19/14
DEMLR (LQ & SW)	JLH	☒		1/6/15
DWM - UST	MRP	☐	See above.	12/16/14

REGIONAL OFFICES

Questions regarding these permits should be addressed to the Regional Office marked below.

☐ **Asheville Regional Office**
2090 US Highway 70
Swannanoa, NC 28778
(828) 296-4500

☐ **Mooresville Regional Office**
610 East Center Avenue, Suite 301
Mooresville, NC 28115
(704) 663-1699

☐ **Wilmington Regional Office**
127 Cardinal Drive Extension
Wilmington, NC 28405
(910) 796-7215

☐ **Fayetteville Regional Office**
225 North Green Street, Suite 714
Fayetteville, NC 28301-5043
(910) 433-3300

☒ **Raleigh Regional Office**
3800 Barrett Drive, Suite 101
Raleigh, NC 27609
(919) 791-4200

☐ **Winston-Salem Regional Office**
585 Waughtown Street
Winston-Salem, NC 27107
(336) 771-5000

☐ **Washington Regional Office**
943 Washington Square Mall
Washington, NC 27889
(252) 946-6481

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Appendix C
Existing Conditions

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Appendix C.1 – Environmental Justice Assessment

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APPENDIX C

Environmental Justice Assessment

Executive Order 12898 "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations" (1994) requires the Kerr Lake Regional Water System (KLRWS) to determine the impact of the proposed interbasin transfer on minority and low-income populations. According to the US Environmental Protection Agency (EPA), environmental justice is defined as the

> "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. Environmental justice efforts focus on improving the environment in communities, specifically minority and low-income communities, and addressing disproportionate adverse environmental impacts that may exist in those communities."

In accordance with NCDENR guidance for preparing Engineering reports, the Environmental Justice Assessment requires the following:

- Minority populations – Document and identify the existence of all minority populations in the service area. According to the Council on Environmental Quality's (CEQ) Environmental Justice Guidance Section under the National Environmental Policy Act (NEPA), "minority populations should be identified where either: (a) the minority population of the affected area exceeds 50 percent or (b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis" (CEQ, 1977).
- Low-income populations – Document and identify the existence of all low-income populations in the service area. "Low-income populations in an affected area should be identified with the annual statistical poverty thresholds from the Bureau of the Census' Current Population Reports…" (CEQ, 1977).
- If minority and/or low-income populations exist, an explanation must be provided if there are disparities in the provision and location of infrastructure between the general population and the minority and/or low-income populations.
- Existing public facilities and infrastructure – Document if the minority and/or low-income populations have suffered historically from environmental management/public facilities such as sites for wastewater treatment, sludge disposal, land treatment, landfills, recycling centers, incinerators, hazardous/nuclear disposal, and prisons.
- If the minority and/or low-income populations are impacted disproportionately and adversely, the applicant may need to reevaluate alternatives and develop mitigative measures to minimize adverse impacts.

Project Definition

The proposed project includes the provision of additional water supply via an increase in interbasin transfer (IBT) to the three partners of the KLRWS and its wholesale customers. Additional infrastructure is not included in this project; instead, existing connections will be used to convey water. Each partner (City of Henderson, City of Oxford and Warren County) and its wholesale customers are independently responsible for their service areas and wastewater treatment. Those receiving water are shown in Figure E-1. Customers are contained within Vance, Granville, Warren, and Franklin Counties within North Carolina. John H. Kerr reservoir, the water source, straddles the state line, with waters in both Virginia and North Carolina.

Methodology

Data from the US Census Bureau (year 2010) and North Carolina Center for Geographic Information and Analysis were used to characterize the population in the vicinity of the proposed project. Geographic Information System (GIS) software was used to identify census data for Vance, Granville, Warren, and Franklin Counties. As the exact future service area boundaries are not known, given that each entity is responsible for their service areas, data were analyzed at the county level. Growth projections included in the EIS (Section 2) show that the majority of growth is expected within Vance, Granville, and Franklin Counties and little change in population is expected in Warren County.

Minority Populations

Using NEPA guidance, populations considered minority include Hispanic, Black, Asian, American Indian and Alaska Native, Native Hawaiian and Other Pacific Islander, Other, and people of two or more races. Minority population data is available on the census block level. For each of the 31 census blocks within or intersecting the four counties involved with the project, the sum of the population considered minority was tabulated and is shown in Table E-1.

All counties have higher percentages of minority populations than the North Carolina average of 34 percent, considered the baseline for the purposes of this analysis. Warren County minority residents comprise almost double the state average, at 62 percent. Franklin County was close to the state average of minority population while the other two counties were moderately higher than the state average.

TABLE E-1
Minority Percentages at the County Level

County	Percentage of Population Considered Minority, 2009
Baseline: North Carolina	34.0%
Franklin County	35.8%
Granville County	42.6%
Vance County	58.0%

TABLE E-1
Minority Percentages at the County Level

County	Percentage of Population Considered Minority, 2009
Warren County	62.4%

Source: US Census Bureau QuickFacts, 2010

Low-Income Populations

The US Census Bureau's income information is most recently available for the year 2008, and as with the minority population summary data were compiled at the county level and compared to the North Carolina median household income. The percentage of population below the poverty level, also know as low-income population, is shown in Table E-2. Both Granville and Franklin Counties have similar low income populations to the state median of $46,574 (2008 dollars). Vance and Warren Counties have significantly higher percentages of low income households than the state median. Data available from the North Carolina Department of Commerce are comparable (2011a). Vance and Warren Counties are also designated as Tier 1 counties by the North Carolina Department of Commerce, meaning they are among the most economically distressed counties in the state; Granville and Franklin Counties are designated as Tier 2 out of three tiers (2011b).

TABLE E-2
Low-Income Percentages at the County Level

County	Median Household Income, 2008	Persons Below Poverty Level, Percent, 2008
Baseline: North Carolina	$46,574	14.6%
Franklin County	$46,189	14.1%
Granville County	$48,468	13.7%
Vance County	$34,093	25.7%
Warren County	$33,632	24.4%

Source: US Census Bureau QuickFacts, 2010

Existing Public Facilities and Infrastructure

The Environmental Justice Assessment requires that any historical suffering by minority and/or low-income populations due to nearby environmental management/public facilities be documented. The guidance specifically requests information about wastewater treatment, sludge disposal, land treatment, landfills, recycling centers, incinerators, hazardous/nuclear disposal, and prisons being sited near minority and/or low-income populations.

Warren County is the site of a hazardous waste landfill that generated much discussion of environmental justice issues in the late 1970s and early 1980s. The community of Warren County organized to voice their opposition to the landfill via protests and legal battles. The landfill began operation in 1982, receiving PCB-contaminated soil. Ultimately, the landfill continued operation and the local mainly minority population's fight against the landfill is an example of the environmental justice movement. North Carolina and federal agencies funded clean-up of contamination at the site in the early 2000s (NCDENR, 2011).

Impacts of Proposed Interbasin Transfer on Minority and Low Income Populations

The purpose of this Environmental Justice Assessment is to determine the impact of the proposed IBT on minority and low-income populations within Vance, Granville, Warren, and Franklin Counties in North Carolina. As described above, Warren County has almost twice the percentage of minority population than the state as a whole, and Vance County and Granville County were moderately higher than the state average. Vance and Warren Counties' population below the poverty line was higher than the state average. Thus, Granville, Vance, and Warren County must be evaluated to determine if minority or low income populations would be impacted disproportionately by the proposed IBT.

Overall, communities within Vance, Granville, Warren, and Franklin Counties will not bear adverse or disproportionate impacts due to the availability of future water supply. No construction of infrastructure is associated with the proposed IBT. Instead, this proposed project would ensure any future economic opportunities would not likely be limited by the availability of adequate water supply. For example, while the availability of adequate future water supply is not a primary driver of growth in Warren County, water supply assurances are important for this county's ability to attract future employment opportunities via industry and development.

While the Warren County community has undergone what can be considered a disproportionate burden on a low income and minority community with the construction and operation of the hazardous waste landfill, this public water supply project does not impose a burden on the community or specifically exclude a minority population and instead ensures that a reliable public water supply is available to Warren County and others. Water supply would not be a limiting factor in the area's economy and ability to attract new industries or residents.

Each of these counties benefits from the availability of water supply resulting from the proposed project, with one not receiving more proportional benefit than another (based on demand projections and KLRWS partnership agreements). Therefore, it is unlikely that one of these counties, and in turn their minority and low income populations, would bear adverse or disproportionate impacts as a result of the proposed IBT.

Summary

In summary, the proposed project does not disproportionately negatively affect minorities or low income populations within Vance, Granville, Warren, and Franklin Counties. Instead, the proposed project provides a reliable water source to meet future needs. Also, as there are no discernable projected impacts to water levels in Kerr Lake as discussed in the

EIS, the proposed project does not adversely impact other communities around Kerr Lake or downstream.

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Appendix C.2 – Existing Conditions Data

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TABLE C-1

John H. Kerr Reservoir Boat Ramp Information

RAMP	OPERATED BY	TOP ELEVATION	BOTTOM ELEVATION
Bluestone	USACE	305.52'	289.0'
Buffalo	USACE	303.72'	L-290.0'; R-285.0'
Eagle Point	USACE	306.72	L-292.0'; R-291.7'
Eastland Creek	USACE	309.15'	L-290.2'; R-286.2'
Grassy Creek	USACE	306.56'	L-291.6'; R-289.3'
Island Creek	USACE	315.74'	288.4'
Ivy Hill	USACE	307.69'	284.8'
Longwood	USACE	308.6'	L-290.1'; R-286.2'
North Bend C	USACE	309.51'	L-291.7'; R-285.8'
North Bend A	USACE	314.69'	290.9'
North Bend Main	USACE	311.73'	285.0'
Palmer Point	USACE	304.94'	293.3'
Rudds Creek Campground	USACE	307.13'	293.0' (single)
Rudds Creek Day Use	USACE	306.34'	285.0' (double)
Staunton View	USACE	306.7'	291.2'
Henderson Point	KLSRA	304.79'	289.5' (double)
Henderson Point-Shelter 1	NCWRC	306.47'	290.0'
Henderson Point-Shelter 2	KLSRA	306.8'	291.79'
Henderson Point-Shelter 3	KLSRA	306.67'	292.87'
Kimball Point	KLSRA	304.28'	285.77'
Nutbush #1 (at picnic shelter)	KLSRA	302.83'	292.41'
Nutbush #2 (4 lanes)	KLSRA	310.0'	L-291.0'; R-288.0'
Nutbush #3 (South side of bridge)	KLSRA	302.7'	290.0'
Satterwhite Point (J.C. Cooper)	KLSRA	303.38'	292.35'
Clarksville Marina	Town of Clarksville	305.38'	289.9'
Satterwhite Point Marina	NCDNR	307.03'	294.0'
Steele Creek-Townsville (new)	NCDNR	310.0'	
Steele Creek-Townsville (old)	NCDNR	305.31'	290.5'
Bullocksville	KLSRA	305.92'	291.75'
County Line	NCWRC	306.71'	L-294.5'; R-285.0'
Flemingtown Road	NCWRC	305.21'	292.9'
Hibernia	KLSRA	305.82'	L-290.48'; R-293.2'
Hibernia	NCWRC	305.43'	290.6'
Occoneechee (Old #1)	VADCR	304.88'	291.6'
Occoneechee #1 (HWY 58)	VADCR	308.25'	289.0'
Occoneechee #2 Park Office)	VADCR	308.3'	289.0'
Staunton River State Park	VADCR	310.0'	291.0'
Clover	VDGIF	313.0'	292.0'
Hyco River	VDGIF	313.0'	291.0'

Source: USACE, 2014b

TABLE C-2

Natural Heritage Program Natural Areas within the Project Area

ID	Natural Heritage Program Natural Area	Acres	County
75	CATTAIL CREEK WOODS	43.3	Vance
960	CROOKED RUN WILDLIFE MANAGEMENT AREA	461.1	Vance
184	INDIAN CREEK HARDWOOD FOREST	50.2	Vance
1858	MIDDLE TAR RIVER AQUATIC HABITAT	33.6	Vance
1813	RUIN CREEK SLOPES	727.8	Vance
1563	RUIN CREEK/TABBS CREEK AQUATIC HABITAT	76.4	Vance
129	SWIFT CREEK (VANCE/WARREN/FRANKLIN/NASH/ EDGECOMBE) AQUATIC HABITAT	0.3	Vance
376	TABBS CREEK RICH SLOPES	273.0	Vance
1763	TAR RIVER CAMASSIA SLOPES	150.2	Vance
968	TAR RIVER/WILTON SLOPES	41.3	Vance
460	TUNGSTEN HARDWOOD FORESTS	166.0	Vance
777	FISHING CREEK AQUATIC HABITAT	142.0	Warren
2287	FISHING CREEK/ARCOLA HARDWOOD FOREST	406.1	Warren
1000	LITTLE FISHING CREEK AQUATIC HABITAT	34.7	Warren
611	LITTLE FISHING CREEK/ODELL HARDWOOD FOREST	446.6	Warren
2124	LITTLE SHOCCO CREEK AQUATIC HABITAT	18.4	Warren
2579	LITTLE SHOCCO CREEK HARDWOOD FOREST	100.9	Warren
733	LOWER SHOCCO CREEK BLUFFS AND FLOODPLAIN	275.9	Warren
2895	MAPLE BRANCH FLOODPLAIN FOREST	243.5	Warren
2290	REEDY CREEK AQUATIC HABITAT	72.3	Warren
1019	REEDY CREEK HARDWOOD FORESTS	329.3	Warren
474	SHOCCO CREEK AQUATIC HABITAT	84.4	Warren
2289	SHOCCO CREEK/CENTERVILLE FLOODPLAIN FOREST	431.1	Warren
2372	SHOCCO CREEK/LICKSKILLET HARDWOOD FOREST	740.9	Warren
129	SWIFT CREEK (VANCE/WARREN/FRANKLIN/NASH/ EDGECOMBE) AQUATIC HABITAT	9.8	Warren
1428	AARONS CREEK AQUATIC HABITAT	31.1	Granville
2032	BEAVER POND CREEK UPLAND FORESTS	94.2	Granville
312	BEAVERDAM LAKE SWAMPS AND ARKOSE OUTCROPS	899.2	Granville
949	CAMP BUTNER NATURAL AREA	334.5	Granville
1535	COUNTY LINE FLATROCKS	2.5	Granville
64	CUB CREEK AQUATIC HABITAT	21.0	Granville
848	DIABASE SILL NEAR CLAY	540.0	Granville
2363	FALLS LAKE SHORELINE AND TRIBUTARIES	33.0	Granville
2156	FOX CREEK AQUATIC HABITAT	27.1	Granville
2013	GOSHEN GABBRO FOREST	1893.2	Granville
1771	HESTER DIABASE AREA	19.8	Granville
344	KNAP OF REEDS CREEK BEAVER PONDS AND SWAMP	48.9	Granville
1658	KNAP OF REEDS CREEK DIABASE FOREST AND GLADES	162.6	Granville
1170	KNAP OF REEDS CREEK DIABASE LEVEE AND SLOPES	136.1	Granville
1657	KNAP OF REEDS CREEK RAVINE	44.4	Granville
786	LAKE ROGERS DIABASE AREA	13.1	Granville
3180	LEDGE CREEK/HOLMAN CREEK SLOPES	114.4	Granville
2466	LICK BRANCH SLOPES	34.1	Granville
2650	LITTLE GRASSY CREEK AQUATIC HABITAT	10.1	Granville
899	LONG MOUNTAIN/CROOKED FORK FOREST	95.3	Granville
1858	MIDDLE TAR RIVER AQUATIC HABITAT	6.4	Granville
1231	MURDOCH CENTER DIABASE SILL	19.9	Granville
2148	NORTH FORK (TAR RIVER) AQUATIC HABITAT	17.9	Granville
814	NORTHSIDE DIABASE AREA	1.9	Granville
83	PICTURE CREEK DIABASE BARRENS	407.4	Granville
911	PYROPHYLLITE RIDGE MONADNOCKS	105.5	Granville
1563	RUIN CREEK/TABBS CREEK AQUATIC HABITAT	0.9	Granville
702	SATTERWHITE MONADNOCK	171.8	Granville
2578	SHELTON CREEK ALLUVIAL FOREST	27.6	Granville

TABLE C-2

Natural Heritage Program Natural Areas within the Project Area

ID	Natural Heritage Program Natural Area	Acres	County
2062	SHELTON CREEK AQUATIC HABITAT	47.7	Granville
3014	SMITH CREEK ALLUVIAL FOREST AND SLOPES	480.8	Granville
792	SOUTH BUTNER CEDAR GLADES	6.9	Granville
215	SOUTH BUTNER DIABASE SWAMP AND FOREST	141.5	Granville
1426	SPEWMARROW CREEK FORESTS (ALONG SR 1445)	172.0	Granville
1544	SPEWMARROW CREEK HARDPAN FOREST AT SR 1443	54.6	Granville
222	STOVALL HARDPAN FOREST	68.9	Granville
188	TALLYHO MONADNOCK	58.1	Granville
2239	TAR RIVER FERN SLOPES	81.0	Granville
3179	TAR RIVER/BELLTOWN ROAD SLOPES	27.9	Granville
2140	TAR RIVER/TRIASSIC BASIN FLOODPLAIN	489.0	Granville
968	TAR RIVER/WILTON SLOPES	1476.9	Granville
797	TOWNSVILLE ROAD XERIC FOREST	104.5	Granville
460	TUNGSTEN HARDWOOD FORESTS	124.3	Granville
1929	UPPER TAR RIVER AQUATIC HABITAT	248.1	Granville
462	US 15 HARDPAN FOREST	32.7	Granville
378	BIG PEACHTREE CREEK FLATROCK	6.5	Franklin
1626	BOG FLATROCK	19.7	Franklin
1909	BUNN FLATROCK	13.5	Franklin
895	CEDAR CREEK AQUATIC HABITAT	81.2	Franklin
42	CEDAR ROCK CHURCH FLATROCK	6.0	Franklin
1535	COUNTY LINE FLATROCKS	25.0	Franklin
1990	CROOKED CREEK (FRANKLIN) AQUATIC HABITAT	131.0	Franklin
2577	CYPRESS CREEK NATURAL AREA	59.8	Franklin
777	FISHING CREEK AQUATIC HABITAT	2.8	Franklin
298	LAUREL MILL NATURAL AREA	30.2	Franklin
1807	LITTLE RIVER (FRANKLIN/WAKE/JOHNSTON/ WAYNE) AQUATIC HABITAT	14.0	Franklin
2124	LITTLE SHOCCO CREEK AQUATIC HABITAT	10.5	Franklin
2579	LITTLE SHOCCO CREEK HARDWOOD FOREST	205.8	Franklin
733	LOWER SHOCCO CREEK BLUFFS AND FLOODPLAIN	885.0	Franklin
1858	MIDDLE TAR RIVER AQUATIC HABITAT	430.4	Franklin
234	MOCCASIN CREEK AQUATIC HABITAT	5.9	Franklin
2086	NORRIS CREEK RARE PLANT SITE	23.0	Franklin
57	NORTH BIG PEACHTREE CREEK FLATROCK	0.6	Franklin
2049	OVERTON ROCK	3.8	Franklin
1991	RED BUD CREEK SLOPES	149.0	Franklin
474	SHOCCO CREEK AQUATIC HABITAT	32.3	Franklin
2289	SHOCCO CREEK/CENTERVILLE FLOODPLAIN FOREST	449.3	Franklin
538	SIMS BRIDGE ROAD LEVEE FOREST	5.3	Franklin
129	SWIFT CREEK (VANCE/WARREN/FRANKLIN/NASH/ EDGECOMBE) AQUATIC HABITAT	200.5	Franklin
1763	TAR RIVER CAMASSIA SLOPES	1.0	Franklin
2216	TAR RIVER/LYNCH CREEK FLOODPLAIN	114.2	Franklin
666	WEST BIG PEACHTREE CREEK FLATROCK	10.4	Franklin

Source: NCNHP, 2014

Note: Further details regarding each natural area including its NCNHP site rating and geospatial databases are available at www.ncnhp.org/web/nhp/natural-areas

TABLE C-3

Natural Heritage Program Natural Areas within the Roanoke, Tar, and Neuse River Basins

ID	Natural Heritage Program Natural Area	Acres	Basin
7	Swift Creek Swamp Forest	949.1	Tar-Pamlico
10	Ocracoke Inlet Bird Nesting Islands	101.5	Tar-Pamlico
22	Hill Forest Chestnut Oak/Shortleaf Pine Forest	206.5	Neuse
27	Shepard Hill Road Forests and Beaver Ponds	188.2	Roanoke
38	Flat River Slopes below Lake Michie	642.1	Neuse
42	Cedar Rock Church Flatrock	6.0	Tar-Pamlico
47	Mush Island	1677.1	Roanoke
51	Upper Alligator River Pocosin	2109.9	Tar-Pamlico
57	North Big Peachtree Creek Flatrock	0.6	Tar-Pamlico
59	Tillery Longleaf Pine Forest	31.5	Tar-Pamlico
60	William B. Umstead State Park	5578.8	Neuse
61	Mill Creek Cypress Forest	143.9	Neuse
62	Camp Atkinson Hardwood Forest (does not qualify)	39.0	Neuse
63	Eldridge Road Sandhill and Pocosins	42.6	Neuse
64	Cub Creek Aquatic Habitat	21.9	Tar-Pamlico
68	Larkspur Ridge/Roanoke Big Oak Woods	163.8	Roanoke
75	Cattail Creek Woods	43.3	Tar-Pamlico
76	Tar River/Spring Hope Slopes	67.0	Tar-Pamlico
78	Cape Hatteras Point	360.3	Tar-Pamlico
83	Picture Creek Diabase Barrens	407.4	Neuse
86	Reedy Branch Floodplain	14.7	Neuse
92	Fort Barnwell Bluffs	24.5	Neuse
109	Deep Gully	72.0	Neuse
120	Jessups Mill/Georges Mill Corridor (Dan River)	1079.2	Roanoke
122	Hodges Mill Creek Granitic Flatrocks	11.7	Neuse
124	Cliffs of the Neuse State Park	912.7	Neuse
129	Swift Creek (Vance/Warren/Franklin/Nash/Edgecombe) Aquatic Habitat	545.4	Tar-Pamlico
148	Alligator River Swamp Forest	251.8	Tar-Pamlico
184	Indian Creek Hardwood Forest	71.7	Roanoke, Tar-Pamlico
188	Tallyho Monadnock	36.6	Neuse
191	Hills Ferry/Palmyra Slopes	819.6	Roanoke
197	Alligator River/Swan Creek Lake Swamp Forest	6363.7	Tar-Pamlico
215	South Butner Diabase Swamp and Forest	141.5	Neuse
222	Stovall Hardpan Forest	68.9	Roanoke
223	Cub Creek Tributary Rare Plant Site	5.3	Tar-Pamlico
229	Dan River Hemlock Bluffs	173.7	Roanoke
230	Dan River Cliffs	140.1	Roanoke
234	Moccasin Creek Aquatic Habitat	70.0	Neuse
254	Middle Creek Amphibolite Slope (does not qualify)	36.8	Neuse
255	Country Line Creek Aquatic Habitat	148.6	Roanoke
279	Upper Barton Creek Bluffs and Ravine	73.0	Neuse
287	Voice of America Site A	2801.1	Tar-Pamlico
288	Phlox Woods	20.7	Roanoke
293	Union Point Pocosin	1747.2	Neuse
298	Laurel Mill Natural Area	30.2	Tar-Pamlico
299	Sevenmile Creek Sugar Maple Bottom	88.0	Neuse
304	Paupers Island/Goodwin Creek Natural Area	136.9	Neuse
309	Little River Galax Bluffs	16.1	Neuse
311	Richardson Bridge Bottomlands	1347.9	Neuse
312	Beaverdam Lake Swamps and Arkose Outcrops	899.2	Neuse
320	Southwest Rolesville Granitic Outcrops	18.8	Neuse
323	Aarons Corner Rare Plant Site	23.8	Roanoke
344	Knap of Reeds Creek Beaver Ponds and Swamp	66.7	Neuse
348	Benson Goldenrod Site	2.1	Neuse
349	Bentonville Battlefield Natural Area	127.1	Neuse
357	Cabin Branch Creek Bottomland-Swamp	241.7	Neuse

TABLE C-3

Natural Heritage Program Natural Areas within the Roanoke, Tar, and Neuse River Basins

ID	Natural Heritage Program Natural Area	Acres	Basin
367	Middle Creek (Wake/Johnston) Aquatic Habitat	217.0	Neuse
369	Mill Creek Aquatic Habitat	127.3	Neuse
370	Lake Mirl Granitic Flatrocks	4.5	Neuse
376	Tabbs Creek Rich Slopes	280.0	Tar-Pamlico
378	Big Peachtree Creek Flatrock	6.5	Tar-Pamlico
384	Flower Hill/Moccasin Creek Bluffs	73.4	Neuse
388	Little Creek Bittercress Site	88.9	Roanoke
394	Ocracoke Island Central Section	1583.5	Tar-Pamlico
397	Walnut Creek Sandhills	302.0	Neuse
403	Hofmann Forest Cypress Natural Area	27.5	Neuse
407	Dan River Aquatic Habitat	1240.3	Roanoke
410	Bay City Low Pocosin	1323.1	Tar-Pamlico, Neuse
413	Little Road Longleaf Pine Savannas	403.6	Neuse
415	Mayo River Aquatic Habitat	207.1	Roanoke
428	Roanoke River Delta Islands	11140.9	Roanoke
432	Nobles Millpond	190.0	Neuse
434	Dover Bay Pocosin	2442.3	Neuse
441	Pamlico Point Marshes and Impoundments	6621.0	Tar-Pamlico, Neuse
455	Middle Eno River Bluffs and Slopes	2123.8	Neuse
459	Cedar Mountain	141.3	Roanoke
460	Tungsten Hardwood Forests	290.3	Roanoke
462	US 15 Hardpan Forest	32.7	Roanoke
470	Goose Creek State Park and Vicinity	2053.2	Tar-Pamlico
472	New Dump Island Bird Nesting Colony	10.7	Tar-Pamlico
474	Shocco Creek Aquatic Habitat	116.6	Tar-Pamlico
477	Hofmann Forest White Oak Pocosin	4357.7	Neuse
479	Tar River/Blue Banks Farm Slopes	139.8	Tar-Pamlico
481	Indian Island	40.9	Tar-Pamlico
482	Crabtree Creek/Ebenezer Church Road Slopes	79.1	Neuse
483	Harvester Road Tall Pocosin	8021.2	Tar-Pamlico
485	Caswell Upland Hardwood Forest	3132.3	Roanoke
494	Jacobs Creek Slopes	14.5	Roanoke
504	Cane Creek Slopes	16.7	Roanoke
505	Sweetwater Creek/Trent River Natural Area	496.7	Neuse
523	Broadneck Swamp/Company Swamp	7746.6	Roanoke
531	Devil's Gut	2113.7	Roanoke
533	East Belews Creek Watershed	277.7	Roanoke
538	Sims Bridge Road Levee Forest	5.3	Tar-Pamlico
541	Sauratown Mountain	1004.6	Roanoke
544	Southwest Prong Flatwoods	303.5	Neuse
548	Dare County Pocosin	5649.1	Tar-Pamlico
551	Conoho Neck Swamp	8918.5	Roanoke
552	Couch Mountain	39.1	Neuse
558	Tar River Floodplain	8752.2	Tar-Pamlico
566	Mine Road Upland Hardwood Forest (does not qualify)	4.6	Roanoke
568	Cedar Island/North Bay Barrier Strand	1635.4	Tar-Pamlico, Neuse
584	Pungo River Preserve	374.4	Tar-Pamlico
609	Conaby Swamp Natural Area	95.2	Roanoke
610	Burdens Millpond (does not qualify)	171.5	Roanoke
611	Little Fishing Creek/Odell Hardwood Forest	447.1	Tar-Pamlico
616	Robertsons Pond and Buffalo Creek Floodplain	837.6	Neuse
626	Buckhorn Reservoir	2623.6	Neuse
631	Henrico Granite Flatrock	2.1	Roanoke
636	South Minnesott Sand Ridge	155.2	Neuse
638	Mill Creek Hardwood Forests (does not qualify)	23.6	Roanoke
640	Old Still Creek Natural Area	56.3	Neuse

TABLE C-3

Natural Heritage Program Natural Areas within the Roanoke, Tar, and Neuse River Basins

ID	Natural Heritage Program Natural Area	Acres	Basin
652	Long Branch Sandhills	86.5	Neuse
660	Black Creek Sandhill and Bluff	43.7	Neuse
662	Lake Ellis Simon	1814.4	Neuse
666	West Big Peachtree Creek Flatrock	10.4	Tar-Pamlico
671	Pocosin Wilderness	145.6	Neuse
675	Chocowinity Creek Natural Area	631.9	Tar-Pamlico
692	Ray Road Rich Forests	114.1	Roanoke
702	Satterwhite Monadnock	171.8	Roanoke
703	Lower Roanoke River Aquatic Habitat	2005.1	Roanoke
714	Hebron Road Remnant Glade	90.1	Neuse
722	Abington Wetland Area	46.8	Roanoke
732	Conoconnara Swamp Forest	82.4	Roanoke
733	Lower Shocco Creek Bluffs and Floodplain	1227.0	Tar-Pamlico
740	Conine Island	5276.7	Roanoke
743	Mayodan Bluffs	48.0	Roanoke
747	Indian Woods/Broadneck Swamp	302.1	Roanoke
754	Grubbs Road Lake	68.6	Roanoke
764	Conaby Creek/Swan Bay Swamp	3594.0	Roanoke
777	Fishing Creek Aquatic Habitat	822.4	Tar-Pamlico
781	Swift Creek (Wake/Johnston) Aquatic Habitat	242.5	Neuse
782	Fowlers Mill Creek Granitic Flatrocks	12.9	Neuse
784	Old US 64 Granitic Flatrock	1.9	Neuse
786	Lake Rogers Diabase Area	13.1	Neuse
787	Jackson Swamp Remnants	20.7	Tar-Pamlico
792	South Butner Cedar Glades	6.9	Neuse
794	Stancils Chapel Pine Flatwoods	140.6	Neuse
797	Townsville Road Xeric Forest	104.5	Roanoke
807	Eno River Blue Wild Indigo Slope	7.2	Neuse
814	Northside Diabase Area	1.9	Neuse
835	Turtle Pond and (Cape Hatteras) Lighthouse Pond	35.5	Tar-Pamlico
844	Buxton Woods	4036.3	Tar-Pamlico
848	Diabase Sill Near Clay	540.0	Tar-Pamlico
850	Light Ground Pocosin Central Section	2662.9	Neuse
852	Scranton Hardwood Forest	5712.2	Tar-Pamlico
863	Stony Creek Spring	27.1	Neuse
865	Swanquarter Bay Wetlands	19502.2	Tar-Pamlico
866	Pennys Bend/Eno River Bluffs	323.7	Neuse
869	Rock House Creek Slopes	200.6	Roanoke
890	Van Swamp	3667.4	Tar-Pamlico
891	Buzzard Point Floodplain Forests	6157.0	Roanoke
893	Big Swash	1812.8	Roanoke
894	Flat River Bend Forest	17.4	Neuse
895	Cedar Creek Aquatic Habitat	81.2	Tar-Pamlico
899	Long Mountain/Crooked Fork Forest	490.6	Roanoke
907	Live Oak Bay	1795.4	Neuse
910	Temple Rock	5.9	Neuse
911	Pyrophyllite Ridge Monadnocks	105.5	Tar-Pamlico
917	Duck Creek/Upper Broad Creek Natural Area	5363.1	Neuse
926	Roanoke River/NC 11 Floodplain Forests	1324.6	Roanoke
931	Fitzgerald Woodland	88.4	Roanoke
934	Denny Store Gabbro Forest	254.3	Tar-Pamlico
949	Camp Butner Natural Area	334.5	Neuse
959	Bull Neck Swamp and Bluffs	353.2	Roanoke
960	Crooked Run Wildlife Management Area	461.1	Roanoke
961	Mill Creek Outcrops	47.4	Neuse
966	Pollocks Ferry Natural Area	2302.3	Roanoke

TABLE C-3

Natural Heritage Program Natural Areas within the Roanoke, Tar, and Neuse River Basins

ID	Natural Heritage Program Natural Area	Acres	Basin
968	Tar River/Wilton Slopes	1518.2	Tar-Pamlico
974	Hills Creek/Camp Hardee Woods	206.6	Tar-Pamlico
975	St. Clair Creek Natural Area	449.1	Tar-Pamlico
977	Cool Springs Sand Ridge and Swamp	1491.9	Neuse
980	Eno River Aquatic Habitat	266.3	Neuse
988	Fishing Creek/Enfield Bottomland	3141.9	Tar-Pamlico
1000	Little Fishing Creek Aquatic Habitat	182.7	Tar-Pamlico
1001	Cherry Point Piney Island	12160.5	Neuse
1002	Camp Butner Game Land	2043.3	Neuse
1004	Upper Neuse River Floodplain	1676.5	Neuse
1014	Rose Bay Marshes	3067.4	Tar-Pamlico
1019	Reedy Creek Hardwood Forests	329.3	Tar-Pamlico
1023	Hemlock Bluffs State Natural Area	122.0	Neuse
1027	Catfish Lake/Catfish Lake South Wilderness	3526.4	Neuse
1043	Hill Forest Dial Creek Hardwood Forest	1247.5	Neuse
1046	Griers Church Road Ultramafic Forest	988.3	Roanoke
1049	Voice of America Site B	2710.8	Tar-Pamlico, Neuse
1060	Moccasin Swamp	1175.0	Neuse
1078	South Fork Little River Marsh	17.9	Neuse
1111	Ocracoke Island Eastern End	1513.1	Tar-Pamlico
1118	Coniott Ridge	141.5	Roanoke
1127	The Rocks	19.9	Neuse
1130	Roanoke River Fall Zone Aquatic Habitat	484.6	Roanoke
1137	Stantonsburg Oxbow	46.5	Neuse
1144	Middle Roanoke River Aquatic Habitat	332.1	Roanoke
1150	Flat River Aquatic Habitat	265.0	Neuse
1155	Broad Creek Marshes and Forests	882.4	Tar-Pamlico
1160	Core Banks and Portsmouth Island	14067.9	Tar-Pamlico, Neuse
1162	Masontown Pocosin	1105.8	Neuse
1164	Bonds Branch Rare Plant Site	113.3	Roanoke
1170	Knap of Reeds Creek Diabase Levee and Slopes	136.1	Neuse
1173	Jamesville Island/Warren Neck	12290.5	Roanoke
1190	Mount Tirzah Slopes	483.9	Neuse
1191	Turkey Creek Aquatic Habitat	56.9	Neuse
1192	Lum Hall Forests	65.7	Roanoke
1203	Lackey Store/Snow Creek Forests	198.0	Roanoke
1210	Contentnea Creek Aquatic Habitat	104.5	Neuse
1214	Camp Tuscarora Sandhills	221.1	Neuse
1218	Wading Place Creek and Swamps	356.3	Roanoke
1221	Fishing Creek Floodplain Forest	2819.7	Tar-Pamlico
1231	Murdoch Center Diabase Sill	19.9	Neuse
1236	Hatteras Island Middle Section	1648.0	Tar-Pamlico
1242	Lick Creek Bottomland Forest	1684.7	Neuse
1244	Benefit Church Forests	172.6	Roanoke
1255	Blue Pond Salamander Site	2.6	Neuse
1266	Harris Mill Run Slopes	229.2	Tar-Pamlico
1284	Camassia Slopes/Gumberry Swamp	1156.7	Roanoke
1305	Richland Creek Hardwood Forest	73.6	Neuse
1310	Poplar Point Slopes	79.3	Roanoke
1319	Cascade Creek/Indian Creek (Hanging Rock) Aquatic Habitat	20.4	Roanoke
1323	Suffolk Scarp Bogs	1034.4	Tar-Pamlico
1324	Stony Creek Aquatic Habitat	105.9	Tar-Pamlico
1325	Sweetwater Creek Swamp	1002.9	Roanoke
1348	Gull Rock Game Land	22908.3	Tar-Pamlico
1354	Marks Creek Floodplain	740.2	Neuse
1373	Little River (Orange/Durham) Aquatic Habitat	148.9	Neuse

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Natural Heritage Program Natural Areas within the Roanoke, Tar, and Neuse River Basins

ID	Natural Heritage Program Natural Area	Acres	Basin
1376	Selma Pine Flatwoods	112.9	Neuse
1388	Sea Gate Woods	73.7	Neuse
1393	Green Branch Sandhills	209.0	Neuse
1395	Neuse River (Clayton) Forests	1671.6	Neuse
1401	Beech Branch/Tar River Meander Loop	193.9	Tar-Pamlico
1404	Reedy Branch	17.8	Neuse
1415	Pettigrew State Park	338.6	Tar-Pamlico
1417	Cypress Swamp/Sandy Run Floodplain Forest	7565.2	Roanoke
1420	Turkey Creek Natural Area	39.1	Neuse
1426	Spewmarrow Creek Forests (Along SR 1445)	172.0	Roanoke
1428	Aarons Creek Aquatic Habitat	31.2	Roanoke
1438	Dan River Shores Rich Slope	117.5	Roanoke
1452	Springers Point	136.2	Tar-Pamlico
1456	Island Creek Natural Area	284.0	Neuse
1457	Cokey Swamp	1489.2	Tar-Pamlico
1460	Chicod Creek Swamp and Slopes	260.7	Tar-Pamlico
1465	Roundhouse Road Forest	74.6	Roanoke
1475	Hobucken Marshes	2298.7	Neuse
1476	Little River Gorge	1398.1	Neuse
1478	Nevil Creek Natural Area	786.4	Tar-Pamlico
1485	Sheep Rock Slopes	277.9	Roanoke
1487	West Belews Creek Swamps and Forests	164.6	Roanoke
1490	Northwest Pocosin	10767.3	Tar-Pamlico, Neuse
1492	Cherry Point Tucker Creek Natural Area	1233.5	Neuse
1493	Catfish Lake Impoundment Bay Rims	624.7	Neuse
1500	Mitchells Mill State Natural Area	213.8	Neuse
1501	North Minnesott Sand Ridge	1028.7	Tar-Pamlico, Neuse
1503	Camp Lasater Forest (does not qualify)	243.9	Roanoke
1507	Pleasantville Basic Forest	137.0	Roanoke
1510	Lilleys Swamp	70.6	Roanoke
1511	Rascoe Millpond	430.2	Roanoke
1518	Roquist Creek Swamp	105.7	Roanoke
1524	Catsburg Natural Area	124.9	Neuse
1527	Frogsboro Flats	463.5	Roanoke
1531	Walnut Creek Sumac Site	5.1	Neuse
1534	Conoho Creek Slopes and Floodplain	1604.4	Roanoke
1535	County Line Flatrocks	27.5	Tar-Pamlico
1536	Western Gum Swamp Remnants	1264.3	Tar-Pamlico
1544	Spewmarrow Creek Hardpan Forest at SR 1443	54.6	Roanoke
1554	Holts Lake/Black Creek Swamp	588.0	Neuse
1562	East Dismal Swamp	17.0	Roanoke
1563	Ruin Creek/Tabbs Creek Aquatic Habitat	77.3	Tar-Pamlico
1568	Flat Shoals Monadnock	809.6	Roanoke
1572	Cashie River Swamp	4680.6	Roanoke
1578	Trent River/Brice Creek Marshes	244.7	Neuse
1583	Gibbs Point Marsh	1461.4	Tar-Pamlico
1584	Cedar Grove Rare Plant Site	25.2	Roanoke
1596	Flint Mill Hole Natural Area	590.3	Roanoke
1605	Roanoke Earthworks and Fall Line Islands	1202.2	Roanoke
1608	Lake Johnson Nature Park	131.7	Neuse
1609	Pantego Wetlands	1832.4	Tar-Pamlico
1613	Core Sound (Wainwright) Bird Nesting Islands	17.7	Tar-Pamlico, Neuse
1618	Hannah Creek Swamp	1223.9	Neuse
1626	Bog Flatrock	19.7	Tar-Pamlico
1633	Mattamuskeet National Wildlife Refuge	49414.0	Tar-Pamlico
1645	Wendell Lake	152.7	Neuse

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Natural Heritage Program Natural Areas within the Roanoke, Tar, and Neuse River Basins

ID	Natural Heritage Program Natural Area	Acres	Basin
1657	Knap of Reeds Creek Ravine	44.4	Neuse
1658	Knap of Reeds Creek Diabase Forest and Glades	162.6	Neuse
1666	Big Beaver Island Creek Slopes	26.1	Roanoke
1672	Middle Creek Floodplain Knolls	149.1	Neuse
1673	Hannah Creek Sandhill	56.8	Neuse
1685	Middle Creek Bluffs and Floodplain	358.0	Neuse
1687	Haw Creek Meanders	1316.3	Tar-Pamlico
1688	Hatteras Inlet Bird Nesting Islands	55.8	Tar-Pamlico
1689	Hatteras Sand Flats	481.3	Tar-Pamlico
1694	Steele Creek Hardwood Forest (does not qualify)	71.4	Roanoke
1701	Eno River/Cates Ford Slopes and Uplands	1549.8	Neuse
1705	Mudham Road Beaver Ponds	106.7	Neuse
1706	Oyster Creek Pine Hammocks	2035.8	Tar-Pamlico
1709	Little Peters Creek Bluffs	96.3	Roanoke
1712	Georges Mill Bittercress Site	86.4	Roanoke
1720	Leaksville Loam Forests	138.3	Roanoke
1732	Sally Simmons Limestone Ledge	22.5	Neuse
1737	Yates Millpond	162.0	Neuse
1738	Occoneechee Neck Floodplain Forest	1707.9	Roanoke
1740	Rocky Branch Conglomerate Exposure	60.1	Roanoke
1743	Providence Church Road Forest (does not qualify)	85.3	Roanoke
1757	Sophie Island Natural Area	962.5	Tar-Pamlico
1759	Conine Terrace Forest	170.7	Roanoke
1763	Tar River Camassia Slopes	151.1	Tar-Pamlico
1771	Hester Diabase Area	19.8	Tar-Pamlico, Neuse
1776	Riverdale Goldenrod Roadsides	12.3	Neuse
1778	Pantego Swamp and Pocosins	5259.5	Tar-Pamlico
1779	Long Shoal River Marshes and Pocosins	10750.9	Tar-Pamlico
1784	New Light Creek Slopes (does not qualify)	50.4	Neuse
1785	Little Beaverdam Creek Slopes	95.8	Neuse
1787	Upper Pungo River Wetlands	2910.1	Tar-Pamlico
1789	Flanner Beach Natural Area	269.1	Neuse
1802	Bethel/Grindle Hardwood Flats	253.4	Tar-Pamlico
1805	Adam Mountain	41.3	Neuse
1807	Little River (Franklin/Wake/Johnston/ Wayne) Aquatic Habitat	526.8	Neuse
1812	Cedar Island Flatwoods and Bays	3094.1	Tar-Pamlico, Neuse
1813	Ruin Creek Slopes	727.8	Tar-Pamlico
1816	Neuse River Floodplain and Bluffs	11937.7	Neuse
1818	Light Ground Pocosin Southeast Section	56.3	Neuse
1826	Pungo Lake Natural Areas	5041.6	Tar-Pamlico
1831	Cates Creek Hardwood Forest	80.3	Neuse
1832	Gum Swamp Bottomland Hardwood Forest	34.6	Neuse
1837	Back Landing Bay	912.5	Tar-Pamlico
1841	Swift Creek Magnolia Slopes (does not qualify)	19.0	Neuse
1858	Middle Tar River Aquatic Habitat	763.4	Tar-Pamlico
1860	Hyco Lake Ultramafic Ravines	100.5	Roanoke
1867	South Prong Natural Area	542.9	Neuse
1870	Cedar Island Marshes	10464.6	Tar-Pamlico, Neuse
1871	Eastern Gum Swamp	2126.6	Tar-Pamlico, Neuse
1874	Bear Slide Bluff	12.0	Roanoke
1878	Old Weaver Trail Slopes	317.9	Neuse
1886	Atlantic Natural Area	8263.3	Tar-Pamlico, Neuse
1888	Trent River Aquatic Habitat	503.9	Neuse
1903	Roper Island	1941.9	Tar-Pamlico
1906	Alligator River Refuge/Southeast Marshes	6959.5	Tar-Pamlico
1909	Bunn Flatrock	13.5	Tar-Pamlico

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Natural Heritage Program Natural Areas within the Roanoke, Tar, and Neuse River Basins

ID	Natural Heritage Program Natural Area	Acres	Basin
1910	Voice of America Site C	650.4	Tar-Pamlico, Neuse
1914	Eno River Diabase Sill	44.5	Neuse
1926	Wild Cat Hollow	26.1	Neuse
1928	Lower Tar River Aquatic Habitat	2082.4	Tar-Pamlico
1929	Upper Tar River Aquatic Habitat	257.9	Tar-Pamlico
1930	Moccasin Creek Wetlands	59.6	Neuse
1931	Howell Woods	3027.7	Neuse
1936	Cherry Point Oak Grove Swamps	143.3	Neuse
1949	Swift Creek Bluffs	48.5	Neuse
1953	Great Bend of the Neuse Natural Area	81.1	Neuse
1958	Shell Landing	2.0	Neuse
1960	Rocky Swamp Aquatic Habitat	63.1	Tar-Pamlico
1964	Belews Creek Bog and Marshes	54.7	Roanoke
1966	Great Lake/Pond Pine Wilderness Natural Area	33.8	Neuse
1973	Occoneechee Mountain	166.4	Neuse
1979	Fort Branch Bluffs	133.0	Roanoke
1981	Hancock Creek Forest	116.4	Neuse
1986	Lake Raleigh Hardwood Forest	89.0	Neuse
1990	Crooked Creek (Franklin) Aquatic Habitat	131.0	Tar-Pamlico
1991	Red Bud Creek Slopes	149.2	Tar-Pamlico
1995	Camp Betty Hastings Forests	524.0	Roanoke
1996	Medoc Mountain State Park	1741.8	Tar-Pamlico
1997	Flat River Slopes above Lake Michie	2504.3	Neuse
1998	Selma Heath Bluffs	18.3	Neuse
2001	Mayo River Anglin Mill Bluffs	123.6	Roanoke
2008	Looking Glass Run Swamp and Bluffs	244.9	Roanoke
2013	Goshen Gabbro Forest	1927.2	Roanoke, Tar-Pamlico
2032	Beaver Pond Creek Upland Forests	94.3	Roanoke
2036	Gull Island	53.8	Tar-Pamlico
2040	Cowbone Oxbows/Sage Pond Natural Area	2041.8	Neuse
2049	Overton Rock	3.8	Tar-Pamlico
2050	Hanging Rock State Park and Vicinity	2402.2	Roanoke
2056	Ocracoke Island Western End (Sand Flats)	1246.4	Tar-Pamlico
2062	Shelton Creek Aquatic Habitat	47.7	Tar-Pamlico
2065	Otter Creek Natural Area	123.3	Tar-Pamlico
2069	Bennett Place Forest	41.8	Neuse
2071	Billfinger Road Flatwoods	73.6	Neuse
2078	Jones Island	4523.5	Neuse
2079	Wide Mouth Creek Conglomerate Exposure	24.1	Roanoke
2083	New Lake Fork Pocosin and New Lake	15364.5	Tar-Pamlico
2086	Norris Creek Rare Plant Site	23.0	Tar-Pamlico
2097	Brogden Bottomlands	1186.4	Neuse
2100	Lower Tar River Marshes and Swamp	5455.0	Tar-Pamlico
2109	Goose Creek Marshes and Forests	2455.0	Tar-Pamlico
2110	Gate 9 Pond	41.4	Neuse
2115	Roquist Pocosin	5846.2	Roanoke
2121	Upper Alligator River Marshes and Forests	14831.8	Tar-Pamlico
2122	Little Lake/Long Lake/Sheep Ridge Wilderness	9597.2	Neuse
2124	Little Shocco Creek Aquatic Habitat	28.9	Tar-Pamlico
2127	Long Point and Wysocking Bay Marshes	4043.5	Tar-Pamlico
2130	Moores Springs North Bluff	652.9	Roanoke
2140	Tar River/Triassic Basin Floodplain	489.0	Tar-Pamlico
2146	Havelock Station Flatwoods and Powerline Corridor	1284.8	Neuse
2148	North Fork (Tar River) Aquatic Habitat	17.9	Tar-Pamlico
2156	Fox Creek Aquatic Habitat	27.1	Tar-Pamlico
2178	New Hope Chestnut Oak Forest	5.4	Neuse

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Natural Heritage Program Natural Areas within the Roanoke, Tar, and Neuse River Basins

ID	Natural Heritage Program Natural Area	Acres	Basin
2179	Crabtree Creek Monadnock Ridge	640.9	Neuse
2180	Camp Chestnut Ridge	281.1	Neuse
2190	Poplar Ridge Slopes and Bottom	131.9	Neuse
2191	Cates Creek Hardpan Forest	7.5	Neuse
2193	Little River Uplands	1213.9	Neuse
2195	Jimmy Ed Road Hardpan Forest	19.8	Neuse
2197	Eno River Mesic Slopes and Floodplain	207.5	Neuse
2216	Tar River/Lynch Creek Floodplain	114.2	Tar-Pamlico
2239	Tar River Fern Slopes	81.0	Tar-Pamlico
2265	Six Forks Longleaf Pine Forest	41.7	Neuse
2286	Swift Creek/Gold Rock Swamp Forest	780.2	Tar-Pamlico
2287	Fishing Creek/Arcola Hardwood Forest	406.1	Tar-Pamlico
2289	Shocco Creek/Centerville Floodplain Forest	880.4	Tar-Pamlico
2290	Reedy Creek Aquatic Habitat	79.3	Tar-Pamlico
2295	Hyco/Ghent Hardwood Forest	147.2	Roanoke
2311	Betsy-Jeff Penn 4-H Camp Forest	81.7	Roanoke
2318	Brown Mountain	818.0	Roanoke
2341	Smith River Slopes	40.5	Roanoke
2345	Collins Bridge Bluffs	48.6	Roanoke
2353	Dan River Bends	530.9	Roanoke
2359	Eno River Mountain Spleenwort and Rhododendron Bluff	21.7	Neuse
2363	Falls Lake Shoreline and Tributaries	8080.8	Neuse
2365	Red Mountain/Flat River Slopes	226.5	Neuse
2372	Shocco Creek/Lickskillet Hardwood Forest	740.9	Tar-Pamlico
2376	Epps-Martin Road Upland Forest (does not qualify)	16.5	Roanoke
2394	McGhees Mill Basic Forest	89.2	Roanoke
2395	McGhees Mill Powerline Clearing	3.5	Roanoke
2463	Drinkwater Creek Wet Hardwood Forest	116.9	Tar-Pamlico
2464	Bonnerton Road Wet Hardwood Forest and Seeps	260.8	Tar-Pamlico
2465	Sparrow Road Wet Hardwood Forest	125.5	Tar-Pamlico
2466	Lick Branch Slopes	34.1	Roanoke
2467	Lake Michie Corridor	1883.0	Neuse
2469	Quail Roost Oak Uplands (does not qualify)	16.9	Neuse
2474	Archies Knob	154.5	Roanoke
2477	Snow Creek Wetland (does not qualify)	5.3	Roanoke
2479	Mountain View Forest (does not qualify)	282.1	Roanoke
2480	Town Fork Forest (does not qualify)	216.5	Roanoke
2481	Ash Camp Creek Wetland	50.9	Roanoke
2482	Mills Creek Equisetum Wetland (does not qualify)	14.2	Roanoke
2483	Pine Hall Slopes	130.4	Roanoke
2500	Hyco/Castle Floodplain Forest	99.8	Roanoke
2521	Clam Shoal	72.7	Tar-Pamlico
2542	Odom Floodplain and Bluffs	236.6	Roanoke
2577	Cypress Creek Natural Area	59.8	Tar-Pamlico
2578	Shelton Creek Alluvial Forest	27.6	Tar-Pamlico
2579	Little Shocco Creek Hardwood Forest	306.7	Tar-Pamlico
2594	McGhees Mill Road Rare Plant Site	14.5	Roanoke
2595	Dunnaway Road Rare Plant Site	42.8	Roanoke
2596	South Hyco Creek Slopes	137.4	Roanoke
2597	Storys Creek/Marlowe Creek Swamp	374.9	Roanoke
2599	Marlowe Creek Slopes	226.7	Roanoke
2600	Hagers Mountain	84.1	Roanoke
2601	Piedmont Community College Hardwood Forest	414.9	Roanoke
2602	Carver Drive Outcrops and Seeps	101.5	Roanoke
2603	Mill Creek/NC 49 Hardwood Forest	339.0	Roanoke
2604	Mayo Creek Slopes (does not qualify)	87.8	Roanoke

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Natural Heritage Program Natural Areas within the Roanoke, Tar, and Neuse River Basins

ID	Natural Heritage Program Natural Area	Acres	Basin
2605	Poole Road Ridge	193.2	Roanoke
2606	Dirgie Mine Road Rare Plant Site	15.2	Roanoke, Tar-Pamlico
2607	Adcock Road Hardwood Forest	341.7	Roanoke, Tar-Pamlico
2608	Tar River (Person) Slopes	125.9	Tar-Pamlico
2609	Wheelers Church Basic Forest	71.6	Roanoke, Neuse
2610	Alderidge Creek Flats	259.5	Neuse
2611	Hurdle Mills Flats	220.4	Neuse
2612	Satterfield Road Rare Plant Site	4.0	Neuse
2613	Timberlake Hardpan Forest	10.0	Neuse
2614	South Flat River Outcrops	90.5	Neuse
2615	Chappels Creek Flats (does not qualify)	119.9	Neuse
2616	Deep Creek Salamander Site	5.8	Neuse
2618	Deep Creek Mountain and Slopes	257.5	Neuse
2650	Little Grassy Creek Aquatic Habitat	10.1	Roanoke
2651	Cashie River Aquatic Habitat	543.2	Roanoke
2657	Crabtree Creek Aquatic Habitat	110.4	Neuse
2675	Hogans Creek Floodplain and Slopes	941.0	Roanoke
2689	Mebane Bridge Slope	18.6	Roanoke
2709	Smith River Bluffs	21.0	Roanoke
2711	Stokesdale Slopes	53.7	Roanoke
2714	Tate Road Forest	238.6	Roanoke
2718	Walnut Creek Bottomland Forests	283.8	Neuse
2724	Lower Eno River/Little River Bottomlands	2364.9	Neuse
2725	Middle Lick Creek Bottomlands	1034.2	Neuse
2728	Stirrup Iron Creek Marsh and Sloughs	217.9	Neuse
2729	Leatherwood Cove	159.0	Neuse
2740	Brumley Impoundment Mafic Slopes	37.1	Roanoke
2780	Brice Creek Swamps	723.7	Neuse
2824	Redwood Road Remnant Glade	22.5	Neuse
2856	Middle Conoconnara Swamp	446.1	Roanoke
2887	Hell Swamp Wet Hardwood Forest	70.4	Tar-Pamlico
2894	Fishing Creek Fern Slopes	91.1	Tar-Pamlico
2895	Maple Branch Floodplain Forest	243.5	Tar-Pamlico
2938	Country Line Creek Bluffs	61.3	Roanoke
2939	Country Line Creek Natural Area	2305.8	Roanoke
2940	Bigelow Road Slopes	316.3	Roanoke
2943	Long Road Mafic Uplands	63.8	Roanoke
2946	Polk Huff Road Dry Forest	10.4	Tar-Pamlico
2980	Russell Loop Road Dry Forest	63.6	Roanoke
2989	Dan River/Caswell Swamp and Levee	73.4	Roanoke
2990	Wolf Island Creek/Dan River Slopes	45.2	Roanoke
2991	Hogans Creek/NC 86 Hardwood Forest	110.0	Roanoke
2992	Dan River/Blanch Levee and Slopes	48.8	Roanoke
2993	St. James Church Flats	160.4	Roanoke
2994	River Bend Road Mafic Slopes	64.1	Roanoke
2995	Hyco Lake Slopes	199.1	Roanoke
2996	Dan River/Milton Floodplain and Slopes	74.6	Roanoke
2997	Country Line Creek/Milton Slopes	49.8	Roanoke
3001	Hyco Creek Slopes	248.8	Roanoke
3013	Lynch Creek Hardwood Forest	60.0	Roanoke
3014	Smith Creek Alluvial Forest and Slopes	479.8	Neuse
3065	Garris Chapel Cypress Pond	38.4	Neuse
3097	Mud Castle Slopes	232.5	Roanoke
3099	Halifax Bluffs	263.9	Roanoke
3171	Tar River/Wolfpen Branch Floodplain	149.5	Tar-Pamlico
3172	River Park North Floodplain Forest	349.8	Tar-Pamlico

TABLE C-3

Natural Heritage Program Natural Areas within the Roanoke, Tar, and Neuse River Basins

ID	Natural Heritage Program Natural Area	Acres	Basin
3179	Tar River/Belltown Road Slopes	27.9	Tar-Pamlico
3180	Ledge Creek/Holman Creek Slopes	114.4	Neuse
3191	Kernersville Lake Park Hardwood Forest	110.9	Roanoke

Source: NCNHP, 2014

Note: Further details regarding each natural area including its NCNHP site rating and geospatial databases are available at www.nchnhp.org/web/nhp/natural-areas

Table C-4

Vance County Historic Landmarks

Historic Landmark	Location	Building/District #
Ashburn Hall (Capehart House)	W of Kittrell on SR 1101, Kittrell	77001009
Ashland	N of Henderson on Satterwhite Point Rd., Henderson	73001371
Belvidere (Boyd House)	NC 1329, NE end, Williamsboro	92001603
Burnside Plantation House	On SR 1335, Williamsboro	71000621
Capehart, Thomas, House	W of Kittrell on SR 1105, Kittrell	77001010
Crudup, Josiah, House	S of Kittrell on US 1, Kittrell	79003342
Henderson Central Business Historic District (Henderson Fire Station and Municipal Building)	Garnett St. from Church to Young Sts., Henderson	87001249
Henderson Fire Station and Municipal Building	Garnett and Young Sts., Henderson	78001973
LaGrange (Robards-Royster House)	S of Townsville off SR 1308, Harris Crossroads	82003519
Library and Laboratory Building--Henderson Institute (Henderson Institute Historical Museum)	Rock Spring St., Henderson	95001399
Machpelah	12079 NC 39, Townsville	7000215
Mistletoe Villa	Young Ave., Henderson	78001974
Parham, Maria, Hospital (Maria Parham Apartments)	406 S. Chestnut St., Henderson	94001066
Pleasant Hill/Hawkins House (Rivenoak)	W of Middleburg on SR 1371, Middleburg	79001758
Pool Rock Plantation	NE of Williamsboro on SR 1380, Williamsboro	78001977
St. James Episcopal Church and Rectory	Jct. of SR 1551 and SR 1555, Kittrell	78001976
St. John's Episcopal Church	SR 1329, Williamsboro	71000622
Stone, Daniel, Plank House	Address Restricted, Henderson	84002531
Vance County Courthouse	Young St., Henderson	79001975
West End School	1000 S. Chestnut St., Henderson	4001585
Zollicoffer's Law Office	215 N. Garnett St., Henderson	78001975

Table C-4

Warren County Historic Landmarks

Historic Landmark	Location	Building/District #
Browne, Mary Ann, House (Oakley;Oakley Grove;Faulcon--Browne House:Browne.Dr. LaFavet)	NC 1530, Vaughan	86001912
Buck Spring Plantation (Nathaniel, Macon, House)	N of Vaughan on SR 1348, Vaughan	70000480
Buxton Place	NC 58 W side, 0.2 mi. N of jct. with NC 1628, Inez	93000323
Chapel of the Good Shepherd (added 1977 - Building - #77001013)	E of Ridgeway, Ridgeway	77001013
Cherry Hill ** (added 1974 - Building - #74001384)	SE of Warrenton on NC 58, Inez	74001384
Coleman-White House (Whitesome)	Halifax and Hall Sts., Warrenton	73001380
Dalkeith	SW of Arcola off NC 43, Arcola	74001382
Duke, Green, House	SE of Manson off SR 1100, Manson	74001383
Elgin	SE of Warrenton on SR 1509, Warrenton	73001381
Hawkins, William J., House	W of Norlina on SR 1103, Ridgeway	78001982
Hebron Methodist Church	SR 1306, Oakville	84002547
Lake O'Woods	S of Inez of SR 1512, Inez	79001760
Liberia School	4.5 mi. S of Warrenton, Sw side of NC 58, Wareenton	05000438
Little Manor	Address Restricted, Littleton	73001378
Reedy Rill	S of Warrenton off SR 1600, Warrenton	74001385
Shady Oaks (Cheek-Twitty House)	SE of Warrenton on SR 1600, Warrenton	76001346
Skinner, Dr. Charles and Susan, House and Outbuildings	NC 1528, 0.25 mi. SW of NC 158, Littleton	00001186
Sledge-Hayley House	Frankin and Hayley Sts., Warrenton	80002904
Thornton, Mansfield, House (added 1977 - Building - #77001014)	SE of Warrenton, Warrenton	77001014
Tusculum	SE of Warrenton off SR 1635, Arcola	74001386
Warren County Fire Tower	4.5 mi. S of Warrenton on NC 58 S, Liberia	0000064
Warren County Training School	East side of NC 1300, Wise	06000294
Warrenton Historic District	U.S. 401, Warrenton	76001347
Watson, John, House (Burwell House)	Petway Burwell Rd., 1/4 mi. W of NC 401, Warrenton	90001954
Williams Jr., Solomon and Kate, House (The Anchorage)	Jct. of NC 58 and NC 1626, Inez	3000968

Table C-4

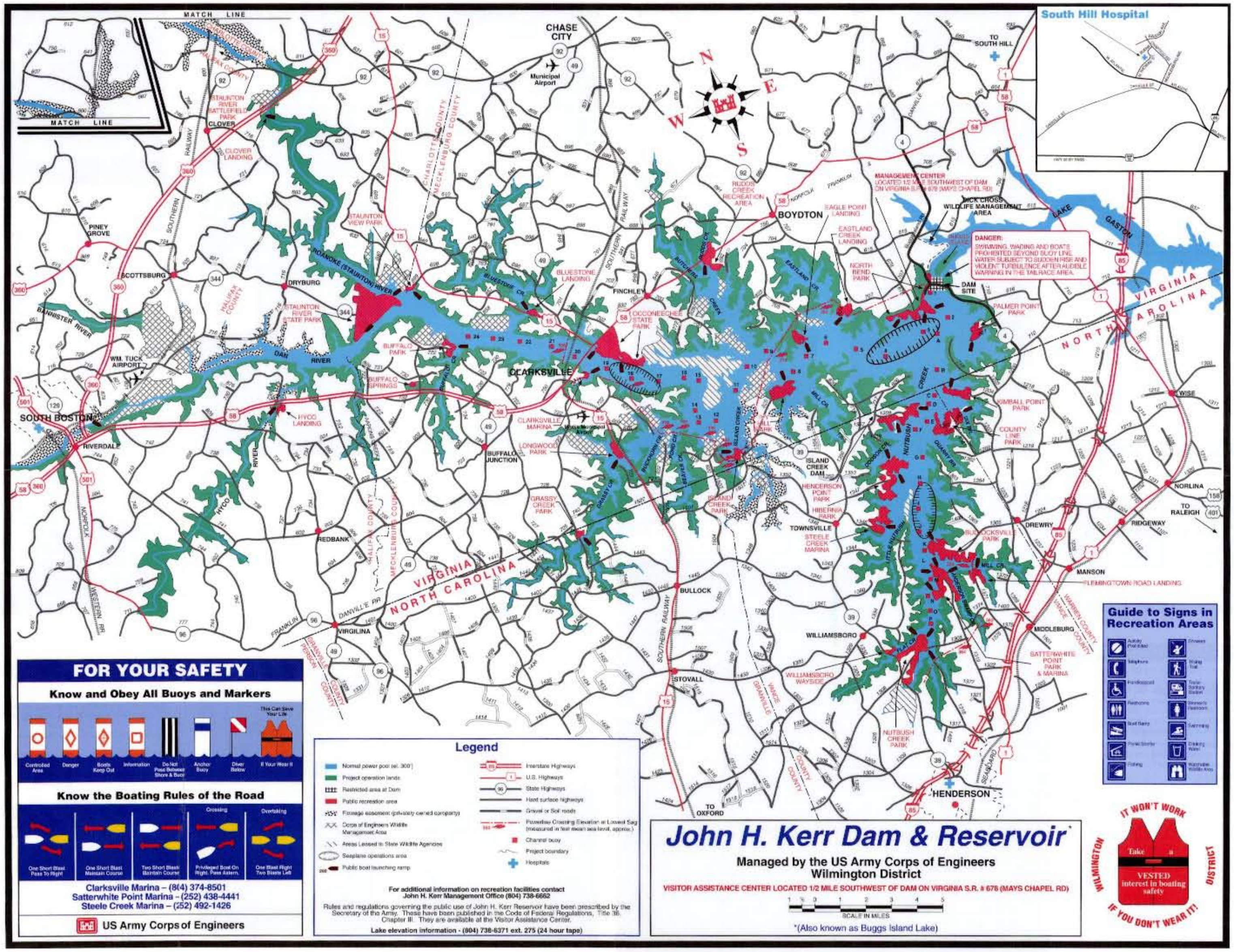
Franklin County Historic Landmarks

Historic Landmark	Location	Building/District #
Andrews--Moore House	95 Simon Collie Rd., Bunn	98001506
Baker Farm (Perdue)	SW of Bunn on SR 1720, Bunn	82001297
Bryson, Albert Swain, House	Pine Lane, Franklin	84000541
Cascine	S of Louisburg on SR 1702, Louisburg	73001342
Cascine (Boundary Increase)	N side of NC 1702, Louisburg	85003114
Clifton House and Mill Site	SR 1103, Royal	80002835
Cooke House	SW of Louisburg near jct. of SR 1114 and SR 1109, Louisburg	75001265
Cowee--West's Mill Historic District	Address Restricted, Franklin	00001569
Davis, Archibald H., Plantation (Cypress Hall)	SE of Louisburg off NC 581, Justice	750013266
Dean Farm	6 mi. E of Louisburg on NC 56, Louisburg	750013267
Franklin County Training School--Riverside Union School	53 W. River Rd., Louisburg	11001011
Franklin Presbyterian Church	45 Church St., Franklin	86003718
Franklin Terrace Hotel	67 Harrison Ave., Franklin	82003483
Franklinton Depot	201 E. Mason St., Franklinton	90001941
Fuller House	307 N. Main St., Louisburg	78001954
Green Hill House	S of Louisburg near jct. of SR 1760 and 1761, Louisburg	75001358
Harris, Dr. J. H., House	312 E. Mason St., Franklinton	75001360
Jeffreys, William A., House	SE of Youngsville on SR 1101, Youngsville	76001323
Jones--Wright House (Polly Wright House)	NC 1003 W side, 0.2 mi. S of jct. with NC 1252, Rocky Ford	92000149
Kearney, Shemuel, House	1 mi. S of Franklinton on U.S. 1, Franklinton	75001361
Laurel Mill and Col. Jordan Jones House	SW of Gupton at jct. of SR 1432 and 1436, Gupton	75001362
Locust Grove (Foster House)	N of Louisburg on U.S. 401, Ingleside	75001269
Louisburg Historic District	Roughly bounded by Allen Lane, Main and Cedar Sts., Franklin, Elm, and King St., Louisburg	87000041
Main Building, Louisburg College	Louisburg College campus, Louisburg	78001955
Massenburg Plantation	Address Restricted, Louisburg	75001270
Massenburg Plantation (Boundary Increase)	821 NC 561, Louisburg	0000025
Monreath	S of Ingleside on NC 39, Ingleside	75001264
Nequasee	Address Restricted, Franklin	80004598
Pendergrass Building	6 W. Main St., Franklin	91001469
Perry School	2266 Laurel Hill-Centerville Rd., Centerville	10001110
Perry, Dr. Samuel, House	E of Gupton on SR 1436, Gupton	75001263
Person Place	603 N. Main St., Louisburg	72000962
Person-McGhee Farm	US 1, Franklinton	79003343
Portridge	SR 1224, 0.3 mi. N of jct. with NC 56, Louisburg	90000351
Rose Hill	W side of US 401 S, Louisburg	06000339
Saint Agnes Church	27 Franklin St., Franklin	87000822
Savage, Dr. J. A., House (The Albion Academy)	124 College St., Franklinton	80002834
Siler, Jesse R., House	115 W. Main St., Franklin	82003484
Speed Farm	W side NC 1436 between NC 1432 and NC 1434, Gupton	91001907
Sterling Cotton Mill (Franklinton Cotton Mill)	SE jct. of Seabord RR tracks and E. Green St., Franklinton	96000568
Taylor, Archibald, House	Address Restricted, Wood	75001273
Taylor, Patty Person, House	Address Restricted, Louisburg	75001271
Vann, Aldridge H., House	115 N. Main St., Franklinton	07001373
Vine Hill	Address Restricted, Centerville	75001259
Wheless, Thomas and Lois, House	106 John St., Louisburg	07000887
Williamson House	401 Cedar St., Louisburg	75001272

Table C-4

Granville County Historic Landmarks

Historic Landmark	Location	Building/District #
Abrams Plains	NW of Stovall	79001711
Adoniram Masonic Lodge	Jct. of NC 1410 and NC 1300, Cornwall	88001253
Allen--Mangum House	NC 1700, Grissom	88000410
Amis, Rufus, House and Mill	Address Restricted, Virgilina	88000416
Blackwell, James, House	NC 1411, Cornwall	88000407
Bobbitt--Rogers House and Tobacco Manufactory District	Address Restricted, Wilton	88001262
Brassfield Baptist Church	NC 96 and NC 1700, Wilton	88001267
Brookland (added 1988 - District	NC 1443, Grassy Creek	88000412
Central Orphanage	Antioch Dr. and Raleigh Rd., Oxford	88001257
Edgewood	NC 1437, Grassy Creek	88000421
Ellixson, William, House	Address Restricted, Wilbourns	88000404
Elmwood	Address Restricted, Lewis	88000406
First National Bank Building	302 Main St., Creedmoor	88001254
Freeman, James W., House	NC 1623, Wilton	88000411
Granville County Courthouse	Main and Williamsboro Sts., Oxford	79001710
Harris--Currin House	Address Restricted, Wilton	88001258
Hart, Maurice, House (Rock-a-way)	NC 1430, Stovall	88000420
Hill Airy	S of Stovall, Stovall	74001349
Hunt, Joseph P., Farm	NC 1514, Dexter	88001265
Lawrence, John P., Plantation	NC 1700, Grissom	88001264
Littlejohn, Joseph B., House	219 Devin St., Oxford	88001268
Locust Lawn	Address Restricted, Oxford	88000422
Mount Energy Historic District	NC 1636 and NC 56, Mount Energy	88001266
Oak Lawn	Address Restricted, Huntsboro	88000408
Oliver--Morton Farm	NC 1417, Oak Hill	88001269
Oxford Historic District (Granville County Courthouse)	Roughly bounded by College, New College and Gilliam and Raliegh, Front, Broad and Goshen and Haves Sts.. Oxford	88000403
Paschall--Daniel House	Address Restricted, Oxford	88001263
Peace, John Mask, House (Bambro Plantation)	NC 1613, approx. 0.5 mi. SE of jct. with NC 1615 at Peace's Chapel, Fairport	3000301
Peace, John, Jr., House	NC 1627, Wilton	88000405
Puckett Family Farm	NC 1333, Satterwhite	88000423
Red Hill	NC 1501, Bullock	86001632
Rose Hill	NC 1442, Grassy Creek	88000415
Royster, John Henry, Farm	Address Restricted, Bullock	88001260
Royster, Marcus, Plantation	NC 96, Wilbourns	88000409
Salem Methodist Church	NC 1522, Huntsboro	88001259
Sherman, Elijah, Farm	US 158, Berea	88001256
Smith, William G., House	NC 1527, Bullock	88000417
Stovall, John W., Farm	NC 1507, Stovall	88001270
Sycamore Valley	NC 1400, Grassy Creek	88000419
Taylor, Archibald, Plantation House	5632 Tabbs Creek Rd., Oxford	1001132
Taylor, Col. Richard P., House	NC 1524, Huntsboro	88000414
Thorndale	213 W. Thorndale Dr., Oxford	88000413
Tunstall, Eldon B., Farm	NC 1500, Bullock	88001255
Wimbish, Lewis, Plantation	NC 1443, Grassy Creek	88000418
Winston, Obediah, Farm	NC 1638, Creedmoor	88001261



John H. Kerr Reservoir Recreation Opportunities

Kerr Lake Regional Water System Interbasin Transfer Request

Appendix D
OASIS Modeling Technical Memorandum

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Beverly Eaves Perdue, Governor

Dee Freeman, Secretary

N.C. Department of Environment and Natural Resources

Release: Immediate
Date: Jan. 20, 2011

Contact: Sarah M. Young
Phone: (919) 715-4939

Public meeting rescheduled for Roanoke River Basin

RALEIGH – An initial public meeting on state efforts to plan for future water use in the Roanoke River Basin, originally scheduled for Dec. 17, has been rescheduled for Jan. 26 in Reidsville.

The meeting will be from 9:30 a.m.-12:15 p.m. in the Advanced Technologies Building of Rockingham Community College, 560 County Home Road in Reidsville.

The meeting will enable the N.C. Division of Water Resources to start gathering information about the water users in the Roanoke River Basin. The state agency is developing a water resources plan and a hydrologic model that can be used by planners, developers and county officials in the Roanoke River basin. The Roanoke River Basin spans parts of 19 counties on or near the Virginia border, including parts of Rockingham, Stokes and Caswell counties.

The state Division of Water Resources is responsible for developing a water resources plan for each of the state's major river basins. Each plan is based on 50-year water use projections and uses a detailed hydrologic model that tracks all surface water by quantifying withdrawals, the return of treated wastewater to the basin and the impact of reservoir operating rules.

The development of a hydrologic model for the Roanoke River Basin is a key component of the final Roanoke River Basin Plan. State agencies use the hydrologic computer models to evaluate and make decisions about proposed water withdrawals, plan for increased water use due to growth and manage river basin water demands during a drought.

State officials have completed models for the Cape Fear and Neuse river basins and are working on models for the Broad and Tar-Pamlico basins. The hydrologic models will enable local governments to evaluate options for expected water needs in the basin during the next 50 years.

No prior registration is required for these meetings. People unable to attend can still watch the meeting by logging onto the live webcast of the meeting at https://DENR.ncgovconnect.com/DWRRoanoke. Please visit the website before the meeting to check for compatibility and then log in during the scheduled meeting times. When you join the meeting, type your name in the space labeled "guest." Please call (919) 501-4273 to listen to the presentations.

# # #

Diana Kees, Communications Director
Phone: (919) 715-4112
1601 Mail Service Center, Raleigh, NC 27699-1601
diana.kees@ncdenr.gov
Facebook: http://www.facebook.com/ncdenr
RSS feed: http://portal.ncdenr.org/web/opa/news-releases-rss
Twitter: http://twitter.com/NCDENR

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# # #

APPENDIX D
DRAFT TECHNICAL MEMORANDUM

CH2MHILL

Modeling Evaluation of the Effects of the Kerr Lake Regional Water Supply Interbasin Transfer

PREPARED FOR: Kerr Lake Regional Water System

PREPARED BY: CH2M HILL

DATE: January 10, 2011

Introduction

The Kerr Lake Regional Water System (KLRWS) is in the process of requesting a certificate for an increase in interbasin transfer (IBT) from the Roanoke River. In order to meet the regulatory requirements of the North Carolina General Statute 143-215.22L related to surface water transfers, an environmental impact statement (EIS) must be prepared and approved by the NC Environmental Management Commission (NC EMC). This technical memorandum (TM) is a resource document for the EIS and will be included as an Appendix to the EIS.

The Roanoke River Basin Hydrologic Model (RRBHM), developed by a contractor to the North Carolina Division of Water Resources (NCDWR), was used to evaluate the potential impacts from the increased water withdrawal and IBT. The purpose of the modeling was to evaluate the effects of an increased surface water withdrawal from John H. Kerr Reservoir (Kerr Lake) within the Roanoke River basin on key social, environmental, and economic indicators for the system. Evaluation of the IBT requires an analysis of potential water supply and demand under future conditions within a 50-year planning window. These demands are described in another Technical Memorandum (TM) entitled - *Demand and Discharge Projections for the Roanoke River Basin* (CH2M HILL, 2010), included as an attachment.

The RRBHM shall be approved by the NC EMC. To date, this process is not complete. The modeling results, presented herein and used for the purposes of evaluating the potential for impacts to the Roanoke River basin resulting from the proposed IBT in an EIS, are considered preliminary at this time.

Purpose of the TM

The purpose of this document is to describe:

- Key indicators used to measure social, environmental, and economic impacts for the basin
- The RRBHM model used for the evaluation of these key parameters
- Impacts of the proposed interbasin transfer on these key indicators

- Other conditions influencing these impacts such as potential variation due to climate change as well as management factors such as the water shortage response plans required in North Carolina for public water systems.

This TM will provide information on the modeling and the results. The analysis and discussion of how the results characterize the impacts is contained in the EIS.

Overview of the Proposed Transfer

The KLRWS currently provides water directly or indirectly to municipal and county systems in four counties and three river basins in northeastern North Carolina (Figure D-1). The water withdrawal for the system is from Kerr Lake on the Roanoke River. The owners of the KLRWS and primary bulk customers served by the system are City of Henderson, the City of Oxford, and Warren County, known as the "Partners." They also currently sell water to secondary bulk customers that include communities in Warren, Vance, Franklin, and Granville Counties. These include Warrenton, Norlina, Kittrell, and Franklin County with future sales to Granville County and the Vance County Water System. Franklin County then also sells water to Bunn, Lake Royale, and Youngsville, and while also obtaining additional supply from Franklinton and Louisburg in the Tar River basin. Of these water users, only the City of Henderson returns treated wastewater effluent to the Roanoke River basin. The system currently produces on average 6.5 million gallons per day (mgd) of finished water, and maximum day production approaches 8.5 mgd.

Water demand projections for the KLRWS were prepared in 2004 to evaluate future demands. These projections supported expansion of the Water Treatment Plant (WTP) to 20 mgd and the request for a reallocation of water supply storage in Kerr Lake, which was approved by the U.S. Army Corps of Engineers (USACE) in the 2005 Reallocation Report (USACE, 2005). The 2005 reallocation report approved a request by the City of Henderson for a reallocation of 20 mgd from the usable conservation pool storage at Kerr Lake for water supply. This supply corresponds to approximately 10,292 acre-feet (AF), bringing the total water supply storage allocation to 21,115 AF for all Kerr Lake agreements.

The KLRWS Partners recognize that an IBT certificate is required if this expansion in water treatment capacity is constructed because service areas and water sales occur outside the Roanoke River basin. The KLRWS currently has an IBT from the Roanoke River basin of approximately 5 mgd. KLRWS's grandfathered IBT is 10 mgd is to the Tar River basin and Fishing Creek subbasin as defined by NC General Statutes governing IBT [NCGS 143-215.22L] (NC General Assembly, 2009) and approved by the NCDWR. Future water supply planning shows a projected IBT of approximately 22.5 mgd by 2040 to the Tar River basin and 1.6 mgd to the Fishing Creek subbasin (EarthTech, 2008). The transfer to the Neuse River basin in Franklin County is currently below 0.3 mgd, and it is projected not to exceed 2.0 mgd by 2040 (CH2M HILL, 2010). This analysis supports the request for an increase in KLRWS's IBT from the Roanoke River to the Tar River basin, Fishing Creek subbasin, and the Neuse River basin.

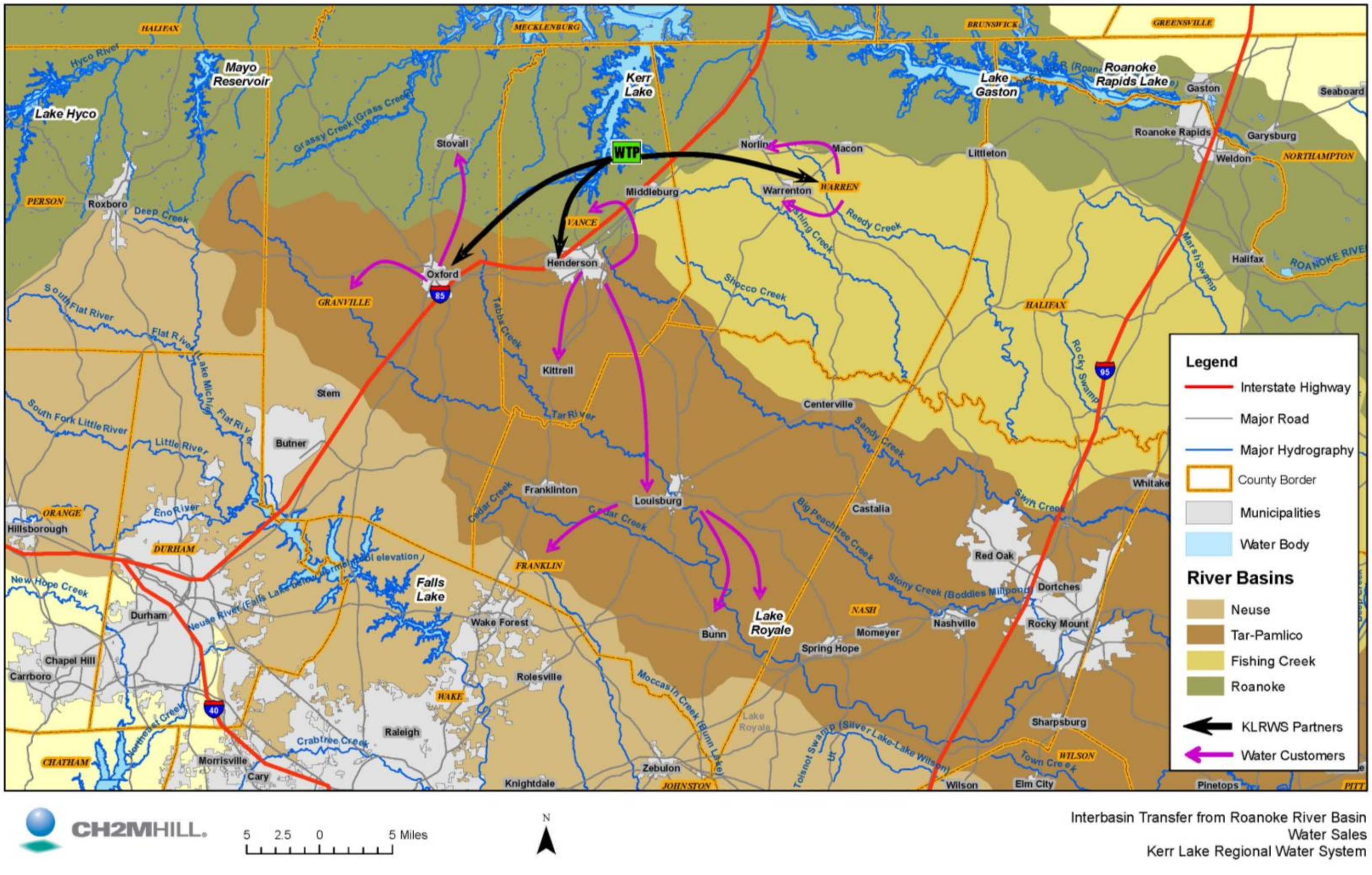

FIGURE D-1
Kerr Lake Regional Water System Partners and Customers

Hydrological Modeling Analysis

Hydrological Indicators

An EIS typically addresses a broad range of impact categories. The NC Administrative Code and guidance from various Federal agencies specify 15 to 20 resource categories that are evaluated. Impacts to these categories are a mixture of social, economic and environmental considerations. These impacts are typically described as being direct, secondary and/or cumulative impacts. This TM focuses on key indicators related to impacts in the Roanoke River basin that will be used to describe impacts in the EIS.

As part of the IBT EIS process and as required for the NC General Statues, a broad public notice of information on the transfer was distributed. A series of five public scoping meetings was also held to solicit input on issues to be evaluated in the EIS. Comments were requested specifically in regard to potential impacts of the transfer to be evaluated and alternatives to the transfer. This information is summarized in Section 1 of the EIS. For the purpose of the development of a hydrological model for the Roanoke River basin, the potential impacts and alternatives identified during scoping and in the public meetings are as follows:

- Potential Impacts Identified
  - Reduced water for downstream fisheries and recreation
  - Inability of communities to obtain future water supply for growth
  - Reduced lake property values from lower lake water levels
  - Impacts to recreation and tourism due to decreased lake level
  - Precedent setting such that other communities can transfer water out of the basin
- Potential Alternatives Identified
  - No growth
  - No water sales
  - Obtain water from other sources
  - Return of wastewater to the basin

In addition, the NCGS 143-215.22L includes a number of criteria that need to be considered by the EMC in the source basin including the necessity and reasonableness of the amount of surface water to be transferred and the cumulative impact on the source river basin. The primary consideration is the determination of detrimental effects on the source river basin. The effects must be considered for the present and the reasonably foreseeable future and include impacts to public, industrial, economic, recreational, and agricultural water supply needs, wastewater assimilation, water quality, fish and wildlife habitat, electric power generation, navigation, and recreation. For the purposes of this analysis, a 50-year planning period is being used.

A hydrological model for a river basin can be used to assess changes in hydrological features for current and future conditions based on a time series of hydrological inputs to the basin. Key features that the model can estimate are river flows at various points within the river basin, reservoir water levels, and changes in hydroelectric power generation. These indicators can be used to evaluate impacts in the categories identified above or can be used with other tools or information to describe these impacts.

Background on the RRBHM

Kerr Lake is part of a hydrologically linked system of rivers and reservoirs in the Roanoke River basin (Attachment I). The Roanoke River begins in the Blue Ridge Mountains of northwestern Virginia and flows in a generally southeastern direction for 400 miles, entering North Carolina through Kerr Lake. From Kerr Lake, it flows into Lake Gaston and Roanoke Rapids Lake, and on through the coastal plain before emptying into the Albemarle Sound in eastern North Carolina. Only 36 percent of the basin is within North Carolina, with the remaining 64 percent located in Virginia.

This system is modeled using the OASIS water resources program which combines graphical representations of components such as river sections, demands, and withdrawals with logical statements which describe their behavior. These statements, including operational rules, demands values, and elevation-storage relationships are evaluated within a linear programming environment to determine the state of each component within the system (Hydrologics, 2006).

Water use information was originally compiled in 1989 for use in evaluating impacts to be considered with various Federal Energy Regulatory Commission (FERC) relicensing efforts in the Roanoke River basin. Additional efforts were undertaken for the North Carolina Striped Bass Management Board to compile information on consumptive use in the basin (NC DWR, 1991). This comprehensive effort is also the basis of the information used in the first OASIS model of the basin, developed in 1997 (NC DWR, 2010).

The 1997 model was organized by reservoir and type of facility. The model includes Smith Mountain, Leesville, Philpott, Kerr, Gaston, and Roanoke Rapids Reservoirs. Hyco Lake and Mayo Lake were not modeled as discrete entities. However, the demands from the thermal power plants were included in the model. The facility types included Public Water Supply (PWS), Irrigation (IRR), Self-Supplied Industry (SSI), and Thermal Power (TP). Agriculture was not explicitly included in the model. Rather, agricultural use is implicitly included in the inflow time series that are used to drive the model. While extensive information was used as the basis of the original model, this information was aggregated so that demands and discharges were represented by a single node related to each reservoir. Figure D-2 shows a schematic of the original model. This structure provided limited spatial resolution. In addition, the water use numbers used in the original model were prior to wide spread reporting of water use, and in many cases were generalized estimates.

NCDWR updated its 1997 OASIS model in conjunction with the developer of the OASIS software program (Hydrologics, Inc.) to evaluate flow and reservoir elevation impacts of various water supply withdrawals and discharges in the Roanoke River basin. The model includes withdrawals and discharges of at least 100,000 gallons per day (gpd, or 0.1 mgd). A schematic of the revised model is provided in Figure D-3, which shows each reservoir represented by a blue triangle, depicting it as an aggregation point. The red squares represent demands, and the yellow circles represent discharges. CH2M HILL obtained the OASIS model from NCDWR to evaluate the hydrologic impacts of the proposed IBT on water resources in the Roanoke River basin. This model was used to establish the baseline scenario and a number of future scenarios within the 50-year planning window which could be used to evaluate potential changes in system reservoir levels, instream flow, and power generation as a result of the IBT.

NCDWR and Hydrologics were in the process of updating the model as CH2M HILL was working with the Partners on early stages of the IBT Certificate process. CH2M HILL worked with NCDWR and Hydrologics to verify the accuracy of the draft model. In addition, CH2M HILL performed an independent review and provided recommendations to NCDWR on March 8, 2010. Hydrologics, under contract to NCDWR, modified the draft model to create the model used in this evaluation. The following section describes the information and process used to verify the RRBHM inputs.

Model Use for Evaluating IBT

A process to evaluate the potential changes in the key impact indicators of water levels (elevation), flows, and power generation that may occur as a result of the IBT was developed by CH2M HILL in collaboration with NCDWR. The approach for this process was based on NCDWR's RRBHM, which uses the OASIS water resources optimization software. The analysis included development of an assessment strategy, estimation of future water use, revision of the RRBHM, and evaluation of differences under a number of future scenarios with and without the increased IBT. CH2M HILL met with NCDWR to discuss the strategy for evaluating the proposed increased IBT.

The IBT analysis is based on the comparison of the key hydrological indicators under various future conditions to describe impacts for the EIS and assess the statutory criteria that must be considered by the EMC. Future conditions of importance that were identified in discussions with NC DWR and through input provided through the scoping meetings include:

- Future North Carolina water demands
- Future inflows based on changes in hydrology resulting from climate change
- Increased IBT as a result of future requests for water supply storage and interbasin transfer

The revised RRBHM did not include projections for future water use. It was therefore necessary to estimate demands and discharges in the basin to evaluate the changes in water resources under existing (2010), baseline (when grand-fathered IBT is projected to be reached (2015), 2030 (when the maximum day demand IBT is equivalent to the allocated storage), requested 30-year IBT (2040), and 50-year planning cycle (2060) timeframes. CH2M HILL collected information on existing and projected demands and returns for the entire Roanoke River basin. These demands and returns, including sources for all information, are summarized in a companion TM entitled *Demand and Discharge Projections in Roanoke River Basin* (CH2M HILL, 2010).

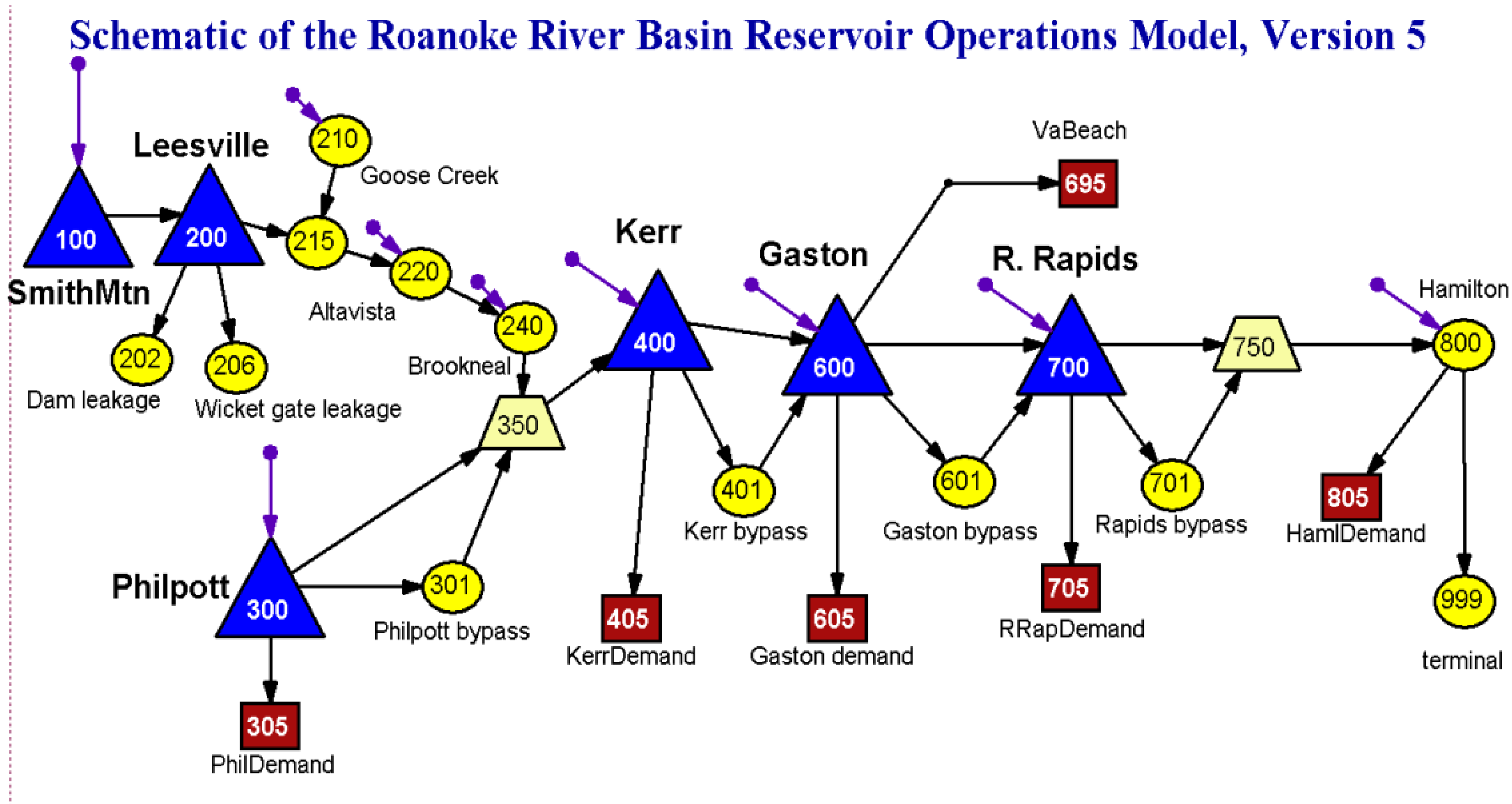

FIGURE D-2
Schematic of Original (1989) Roanoke River Basin Hydrologic Model Entities and Relationships

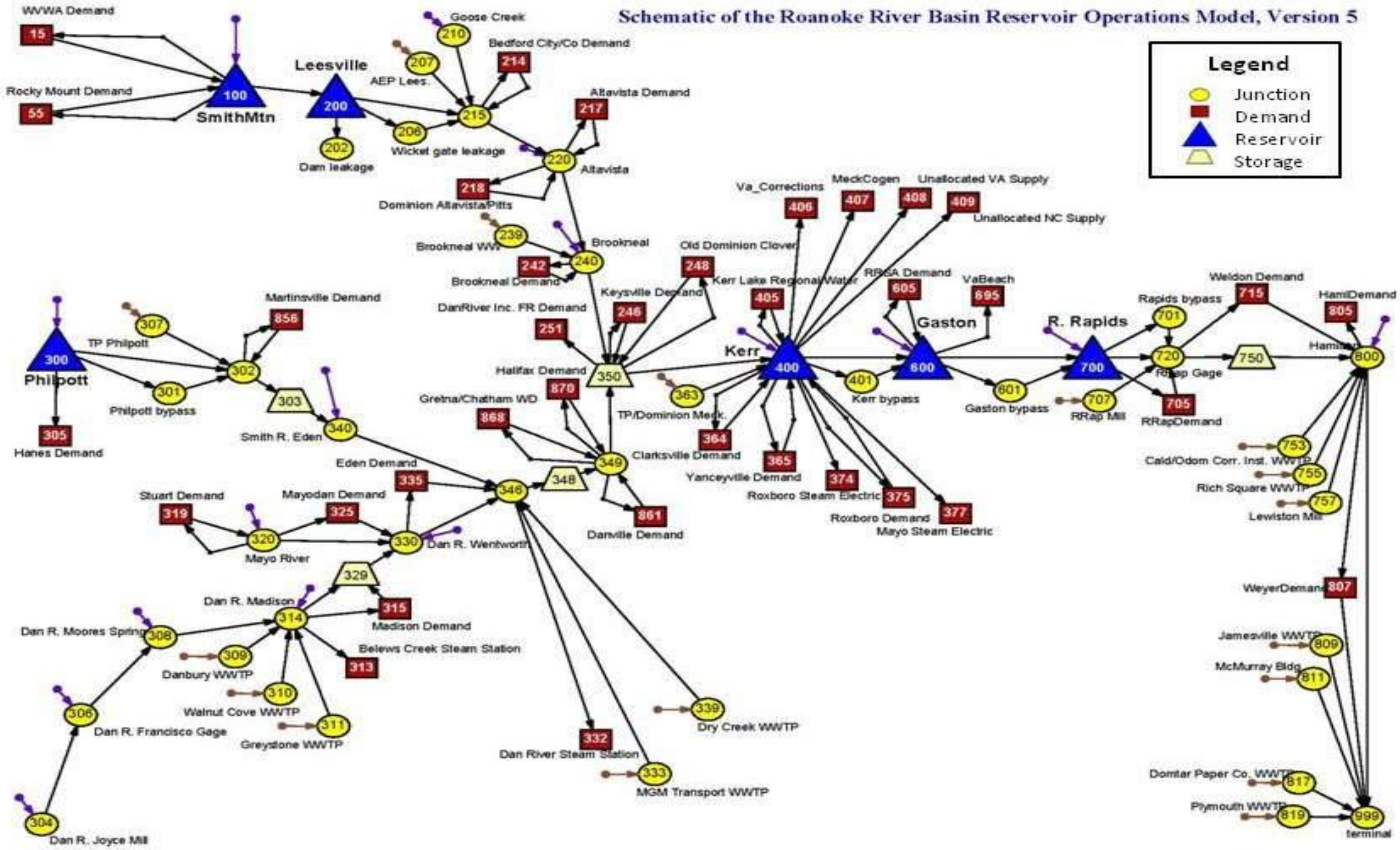

FIGURE D-3
Schematic Showing the Roanoke River Basin Hydrologic Model Entities and Relationships

Data Sources

Demand and discharge entities evaluated were based on a preliminary draft of the OASIS model and a number of additional sources. Table D-1 shows the sources of data for both current and future demand estimations. A more detailed description of these sources is provided in Attachment II.

TABLE D-1
Data Sources For Current And Future Demands and Discharges

Entity Type	Model Classification	State	Current Demand/Discharge Data Source	Future Demand/Discharge Data Source
Municipalities/ Authorities	Public Water Supply (PWS)	NC	NCDWR Local Water Supply Plans	Local Water Supply Plans
		VA	Virginia Department of Environmental Quality (VADEQ) Various websites	US Census data VA State projections
Agriculture	Irrigation (IRR)	NC	Implicitly included	Assume Constant
		VA	Implicitly included	Assume Constant
Industry/Rock Quarries	Self-supplied Industry (SSI)	NC	NCDWR Registered Withdrawals	Assume Constant
		VA	VADEQ Various websites	Assume Constant
Power Plants	Thermal Power plants (TP)	NC	NCDWR	Assume Constant
		VA	VADEQ	Assume Constant

Current and Future Demands and Discharges

Demand summary information was calculated based on the total demands by class and the average flow measured below the Roanoke Rapids Dam from 1953 – 2009 at United States Geological Survey (USGS) gage 02080500. Only data recorded since the beginning of 1953 were considered relevant, because construction of the reservoirs in the system has changed flow patterns. Agricultural demands were included for comparison and were determined based on the estimates used in the original RRBHM (NCDWR, 1989).

A "Remaining" category was computed by subtracting the demands from the average flow at the USGS gage. This flow category is probably understated, since a significant amount of the withdrawals are actually returned to the basin. However, the Remaining category is useful for putting the magnitude of the withdrawals into perspective. Summaries of the basinwide demands as compared to the remaining basin flows are presented in Table D-2 and Figures D-4 and B-5.

TABLE D-2
Comparison of Predicted Demands (mgd)

Category	2010 (Baseline)	2030	2040	2060
Public Water Supply	110.9	127.5	134.2	157.7
Additional Interbasin Transfer[1]	0.0	10.0	10.0	10.0
Industrial	38.2	38.2	38.2	38.2
Thermal Power	35.6	35.6	35.6	35.6
Agriculture	33.2	33.2	33.2	33.2
Remaining Surface Water[2]	4,863.1	4,841.50	4,834.8	4,811.3

[1]IBT beyond the current IBT (2010) or grandfathered IBT of 10 mgd (after ~2015)
[2] As measured at USGS gage 02080500 below Roanoke Rapids Dam.

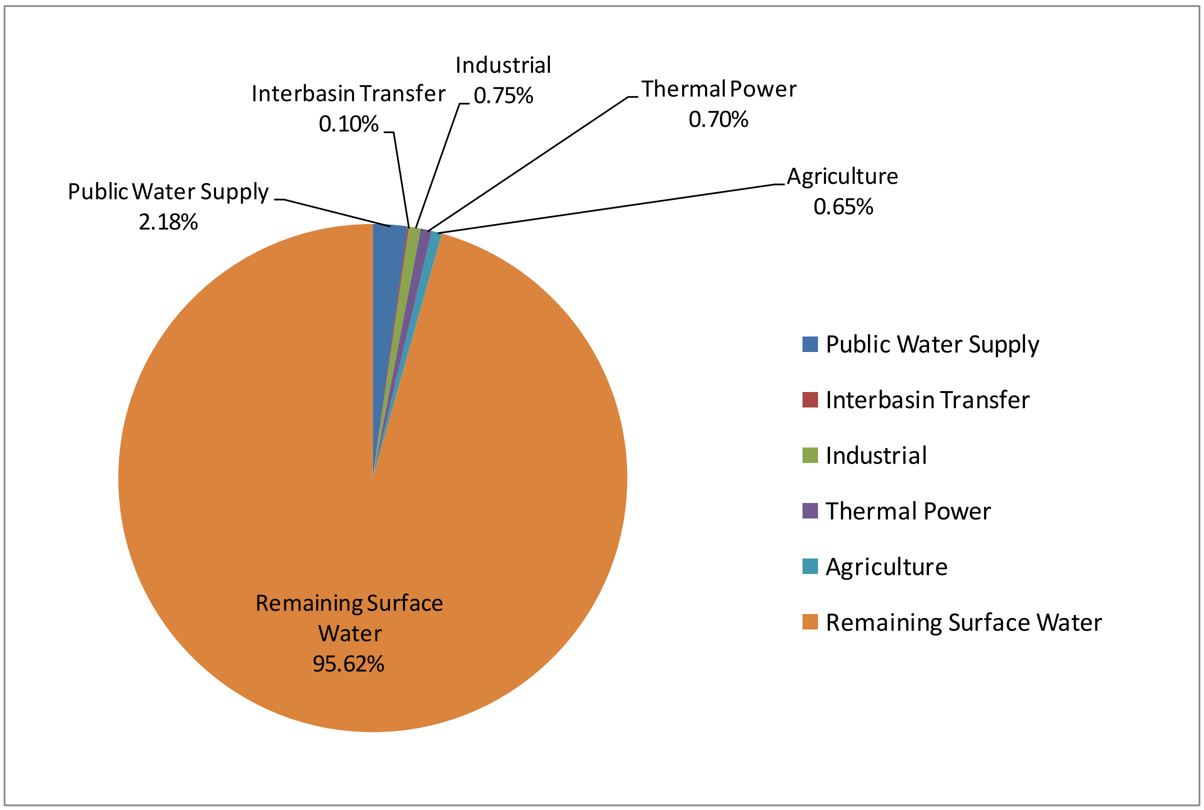

FIGURE D-4
Comparison of Water Demands and Remaining Basin Flow for 2010

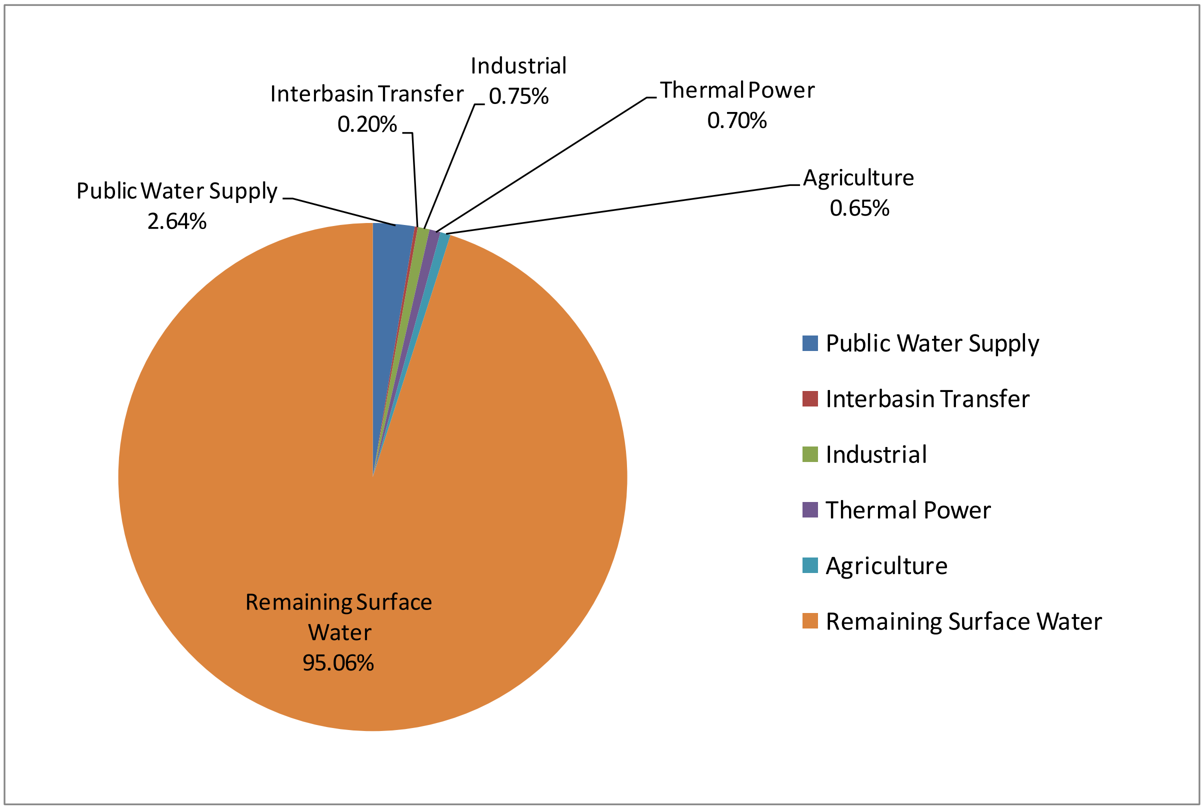

FIGURE D-5
Comparison of Water Demands and Remaining Basin Flow for 2040

As Figures D-4 and B-5 show, the totaled water demands in the basin are approximately 4 percent in 2010 and approximately 5 percent in 2040. The KLRWS, including the grandfathered IBT, accounted for only approximately 0.1 percent of the average flow in the system in 2010. By 2040, the total KLRWS portion would be approximately 0.5 percent.

Model Review

As described above, the original model was revised based on more current demand and discharge information. Hydrologics incorporated these changes into a revised model and performed a model calibration effort. The model results were reviewed using 2007 demands and discharges. A comparison of discharges for the last decade is provided in Figure D-6.

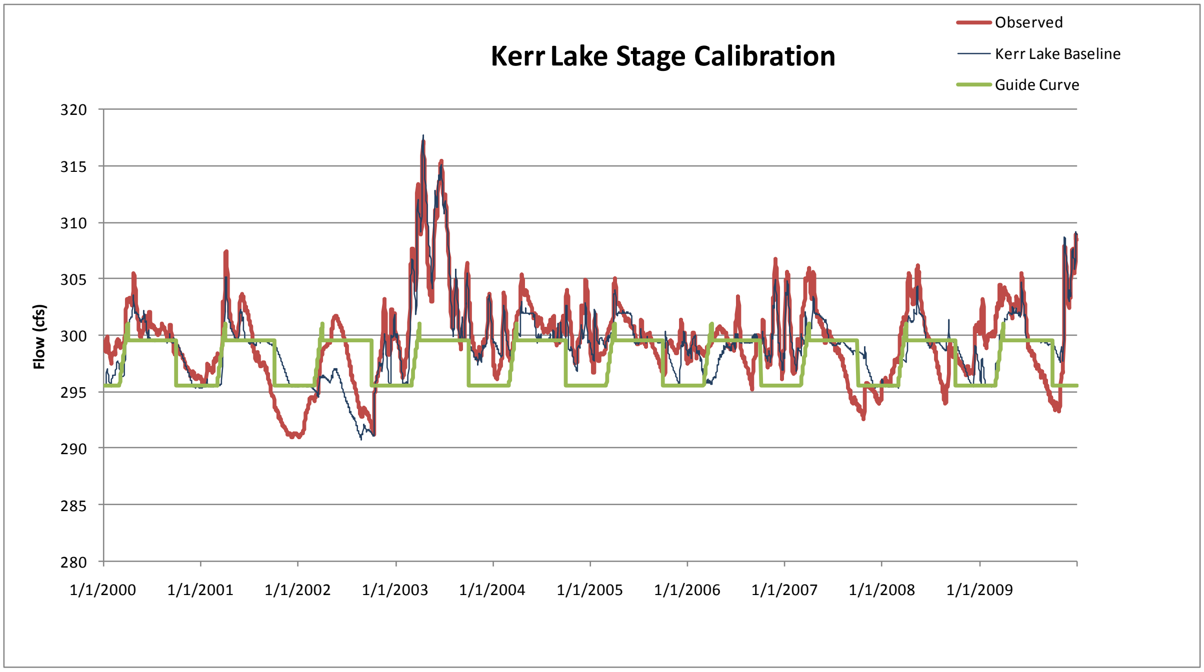

FIGURE D-6
Evaluation of Model Calibration

In general, the model accurately replicates the measured flow. The system is very dynamic and Kerr Lake level is allowed to vary more than the lower reservoirs. For this reason, the actual discharges often do not follow the guide curves, as shown in Figure D-7. In many cases, the model forces discharges to match the guide curves more closely than is actually occurring, causing a discrepancy between the measured flow and the modeled flow.

The following is an excerpt (Whisnant et al., 2009) describing the operation of Kerr, Gaston, and Roanoke Rapids Reservoirs.

> *Reservoir elevation at Kerr Dam is increased during spring and early summer months relative to the rest of the year; this is to provide for spring anadromous fish spawning downstream and less average inflow during the summer. Striped bass in particular require high water conditions during the spring to move up the river to spawning grounds. The elevated guide curve in late spring provides for the larger-than-usual minimum releases required out of downstream Roanoke Rapids Dam to achieve such conditions. During the winter and early spring, the guide curve shows lower storage values at Kerr Reservoir in order to provide flood control capacity for high spring flows (Kerr Dam Water Control Plan, 1995).*

> *In general, Gaston Dam is operated as "run-of-Kerr," i.e. the timing and amount of releases made from Gaston Dam generally mirror those made from the Kerr Dam upstream. Dominion is required by the Federal Energy Regulatory Commission (FERC) to maintain lake elevation fluctuation at Lake Gaston to within approximately 1 foot at all times except during flood events and spawning season, when the limits are 4 feet and 2 feet, respectively.*

> *Roanoke Rapids Dam is not operated as 'run-of-Kerr,' i.e. the storage and subsequent re-release of water released upstream from Kerr Dam and Gaston Dam is commonplace at Roanoke Rapids Dam. Dominion is obligated to maintain lake fluctuation at Roanoke Rapids within approximately 5 ft. at all times. With a wider operational lake elevation band and the ability to*

re-regulate Kerr Dam releases, Dominion has some flexibility in operating Roanoke Rapids Dam to optimize hydropower generation.

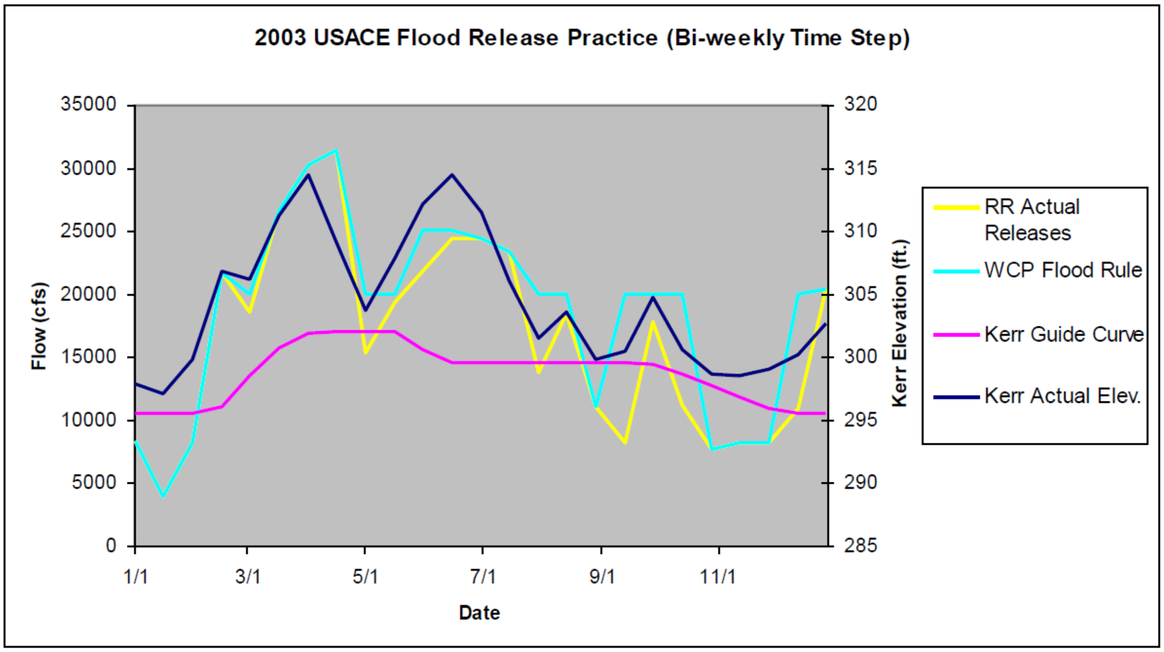

Figure 4b. USACE flood release practice in 2003 (wet hydrologic year). Portions of the plot where the WCP flood release rule (light blue) and Roanoke Rapids outflow (yellow) diverge (both are visible) represent bi-weekly periods where the average outflow from Roanoke Rapids Dam was less than the flood release stipulated in the WCP.

FIGURE D-7
Comparison of Kerr Lake Measured Discharge and Guide Curve
Source: *Whisnant et al., 2009*

Future Projections

Projections to 2060 were made for PWS components using relationships to known demands and population projections through 2050. Irrigation, industrial, and power plant demands and discharges were assumed to be constant throughout the study period, which extends to 2060. See the TM entitled *Demand and Discharge Projections in Roanoke River Basin* (CH2MHILL, 2010) in Attachment II for more information.

Model Structure

Once the entities were identified and demand and discharge numbers were established, CH2M HILL worked with the NCDWR and Hydrologics to identify entities which were spatially related using the model structure presented in Figure D-3. For example, the withdrawal and discharge for the Town of Eden, NC are associated with a single node. These associated entities were used by Hydrologics to specify the final model structure.

The revised model greatly increases the spatial resolution of the model. As part of the update, Hydrologics also extended the simulation period to include the timeframe from

January 1930 through December 2009. This period covers a wide range of hydrologic conditions, including the severe droughts in the early 1930s, early 1950s, late 1960s, and the recent droughts in the last decade.

Demands and discharges are specified in the model, typically as monthly values. The model can predict instream flow and reservoir storage for each component of the model structure on a daily, weekly, or monthly basis. Hydrological analyses were run on a daily basis for the IBT analysis.

In addition to tracking flow and storage, the model estimates the power generated by the hydropower facilities in the Roanoke River system, including Smith Mountain, Kerr, Gaston, and Roanoke Rapids Reservoirs. Based on guidance from Hydrologics, power generation results were evaluated on a weekly basis.

Analysis of Potential IBT Influences on Key Indicators

The revised model was used to evaluate the impacts of the proposed increased IBT under future conditions. The primary scenarios that were evaluated were for demands in 2030, 2040, and 2060. The 2030 timeframe coincides with when the allocation from the lake is projected to be required on a maximum daily demand basis. The 2040 timeframe coincides approximately with the time when the proposed IBT, on an average daily demand basis, is exhausted. The 2060 timeframe meets the NCDWR’s requirement for a 50-year planning period.

A number of primary scenarios were developed: a baseline (2010), a run focused on exhaustion of the grandfathered IBT, and a baseline and IBT run for 2030, 2040, and 2060 demands. The baseline runs simulate the water balances in the Roanoke River based on the withdrawals and discharges described in the TM entitled *Demand and Discharge Projections in Roanoke River Basin* (CH2MHILL, 2010) for 2030, 2040, and 2060. These runs include the grandfathered IBT but do not include the proposed IBT. The IBT runs are identical with the exception that an additional demand, based on the timeframe, is added to the KLRWS withdrawal for each of the future scenarios. A significant fraction is returned to the basin as wastewater discharge, with the remainder being removed from the system. Additional scenarios were developed to test the sensitivity of the system to Water Supply Response Plans (WSRP) and global climate change (GCC). These are described following the comparison of the primary scenarios. A summary of the scenarios is provided in Table D-3.

PRELIMINARY RESULTS – MODEL AND DEMAND PROJECTIONS UPDATES ARE POSSIBLE

TABLE D-3
Summary of OASIS Scenario Components

	Scenario									
Component	2010 (baseline)	2030	2030 IBT	2040	2040 IBT	2060	2060 IBT[3]	GCC positive[3]	GCC negative[3]	WSRP[3]
Grandfathered IBT	Y[1]	Y	Y	Y	Y	Y	Y	Y	Y	Y
Additional IBT	N	N	Y	N	Y	N	Y	Y	Y	Y
Climate change impacts	N	N	N	N	N	N	N	Y	Y	N
Water Shortage Response Plans	N	N	N	N	N	N	N	N	N	Y
Scenario Basis	2010	2030	2030	2040	2040	2060	2060	2060	2060	2060
Modeled IBT Amount (mgd)[2]	5.0	10.0	15.8	10.0	20.1	10	20.1	20.1	20.1	20.1
KLRWS Average Day Demand, non- IBT (mgd)	2.9	4.2	4.2	4.5	4.5	6.2	6.2	6.2	6.2	6.2
Total Basin Average Day Demand (mgd)	222.9	234.5	244.5	241.2	251.2	264.7	274.7	274.7	274.7	274.7[4]

[1] KLRWS is currently using a portion of its grandfathered IBT. This existing condition is used as the baseline. Full use of grandfathered IBT (maximum day) is not expected until approximately 2015.

[2] IBT amounts are modeled as average daily demand for long range water supply planning.

[3] The proposed IBT Certificate amount is likely to be reached prior to 2060. It is assumed that KLRWS will continue to have increasing demands in-basin demands but the IBT would be managed not to exceed the IBT Certificate currently being requested.

[4] The WSRP is in effect only during drought period. The impact of the WSRP on Total Basin Average Daily demand was not calculated.

Each scenario was run using the RRBHM, and then the baseline and IBT scenario results were compared for each timeframe. For many of these scenarios – two baselines are shown; baseline based on 2010 water use and the baseline for the year the scenario IBT is projected to be met. The model was run on a daily timestep using the "Guide Curve" release rules as the guidelines for operation of the reservoirs since this set of rules includes the drought protocols. Procedures used in the modeling analyses included the "Virginia Beach Accounting" "Spawning Releases", and "Betterment Policy".

Numerical and graphical methods were used to evaluate the differences which might occur as a result of the IBT. The following metrics were evaluated:

- Reservoir level (elevation) at each of the six reservoirs in the system
- Discharge below each of the six reservoirs in the system (instream flow)
- Power generation at each of the hydropower reservoirs

These indicators were evaluated by running the scenarios and doing a direct day to day comparison of reservoir elevation and discharge for each scenario group, e.g., 2010 baseline vs. 2030 baseline vs. 2030 IBT. The results are tabulated for each scenario group and timeseries plots are provided in a few instances to further illustrate the similarities or differences that were calculated.

Detailed results for each scenario are included in the attachments to this TM and generally include the following results:

- Lake elevation
    - Comparison of baselines scenarios – 2010, 2030, 2040 and 2060
    - Comparison of 2030 baseline and 2030 IBT
    - Comparison of 2040 baseline and 2040 IBT
    - Comparison of 2060 baseline and 2060 IBT
        - Entire simulation
        - 2000s droughts
        - Elevation duration
        - Blow up of elevation duration
- Lake Outflow (same)
- Power Generation (same)

The following is a brief discussion of model results. Analyses specific to different environmental resources are included in the EIS.

Reservoir Elevation

The results for the 2030, 2040, and 2060 baseline and IBT scenarios were compared to evaluate if changes would occur to reservoir elevations. Long term results were compared to determine whether there was an impact to reservoir level. Elevations during drought periods, discussed in more detail below, were also evaluated. A summary of the average reservoir elevations and differences for the long-term and recent drought periods is provided in Table D-4. The differences for each reservoir are calculated by subtracting the daily elevation predicted under the IBT scenario from the baseline scenario for the water use projected for that same year. The average difference is determined by taking the average of the daily differences. A negative difference indicates that the IBT scenario has a higher elevation, and a positive difference indicates that the baseline has a higher value.

The average difference in elevation for the reservoirs was zero for the 2030, 2040, and 2060 scenarios. Kerr Lake was the only reservoir that showed any differences, albeit slight, during the exceptional drought periods. The model runs simulate the operation of the reservoirs based on the guide curves specifies for each reservoir. This operational mode tends to maintain the reservoir level by regulating releases. For this reason, average lake elevation is usually the exact same. In the case of the 2002 drought, Kerr Lake did show a slight difference in elevation of 0.1 feet. Because of the drought, the elevation falls below the guide curve and the discharge is maintained at the same for the IBT and non-IBT. This results in a slightly lower elevation in the IBT scenario. For the 2007 drought, the elevation is occasionally above the guide curve and the impact is to discharge instead of elevation.

Graphical comparisons of reservoir elevations were created to allow for evaluation of changes that may result from the IBT. As noted above, no difference in average elevation is seen between the baseline and IBT scenarios. A long-term comparison of 2040 reservoir elevations for Smith Mountain, the most upstream reservoir, is provided in Figure D-8. Figure D-9 provides the long-term comparison of elevation for Kerr Lake for both scenarios. At this scale, no difference is seen, though slight positive and negative short-term differences do occur.

Figure D-10 provides a comparison of the simulated 2040 reservoir elevations during the extreme drought period seen in the 2000-2009 period. A review of the plots and data show that the reservoir level is drawn down below 292 feet in the baseline and IBT scenarios for the same period of time, 80 days. The duration of the drawdown is the same with the elevation in IBT scenario being slightly lower (< 6 inches) than the baseline scenario. A comparison of the 2040 reservoir elevations for Lake Gaston and Roanoke Rapids Reservoir is provided in Figure D-11 and Figure D-12.

A duration plot of Kerr Lake reservoir elevation for the 2040 baseline and IBT scenarios is provided in Figure D-13. This plot shows the percent of time that the reservoir level falls below a certain level. Figure D-13 shows that difference in frequency that IBT scenario is lower than the baseline scenario is minimal.

TABLE D-4
Evaluation of Changes in Reservoir Elevation for Baseline and Proposed IBT Scenarios

Scenario Comparison	Results	Smith Mountain	Leesville	Philpott	Kerr	Gaston	Roanoke Rapids
2030	Average Baseline Elevation (feet)	794.6	600.0	972.5	299.8	200.0	132.0
	Average Difference	0.0	0.0	0.0	0.0	0.0	0.0
	Average Elevation during 2002 Drought	791.2	600.0	972.7	291.8	200.0	132.0
	Average Difference during 2002 Drought	0.0	0.0	0.0	0.1	0.0	0.0
	Average Elevation during 2007 Drought	792.9	600.0	971.7	296.1	200.0	132.0
	Average Difference during 2007 Drought	0.0	0.0	0.0	0.0	0.0	0.0
2040	Average Baseline Elevation (feet)	794.6	600.0	972.5	299.8	200.0	132.0
	Average Difference	0.0	0.0	0.0	0.0	0.0	0.0
	Average Elevation during 2002 Drought	791.3	600.0	972.7	291.8	200.0	132.0
	Average Difference during 2002 Drought	0.0	0.0	0.0	0.1	0.0	0.0
	Average Elevation during 2007 Drought	793.0	600.0	971.7	296.1	200.0	132.0
	Average Difference during 2007 Drought	0.0	0.0	0.0	0.0	0.0	0.0
2060	Average Baseline Elevation (feet)	794.6	600.0	972.5	299.8	200.0	132.0
	Average Difference	0.0	0.0	0.0	0.0	0.0	0.0
	Average Elevation during 2002 Drought	791.3	600.0	972.7	291.9	200.0	132.0
	Average Difference during 2002 Drought	0.0	0.0	0.0	0.1	0.0	0.0
	Average Elevation during 2007 Drought	793.0	600.0	971.7	296.1	200.0	132.0
	Average Difference during 2007 Drought	0.0	0.0	0.0	0.0	0.0	0.0

2002 Exceptional Drought Period - 6/18/2002 through 10/15/2002
2007 Exceptional Drought Period - 10/16/2007 through 3/10/2008

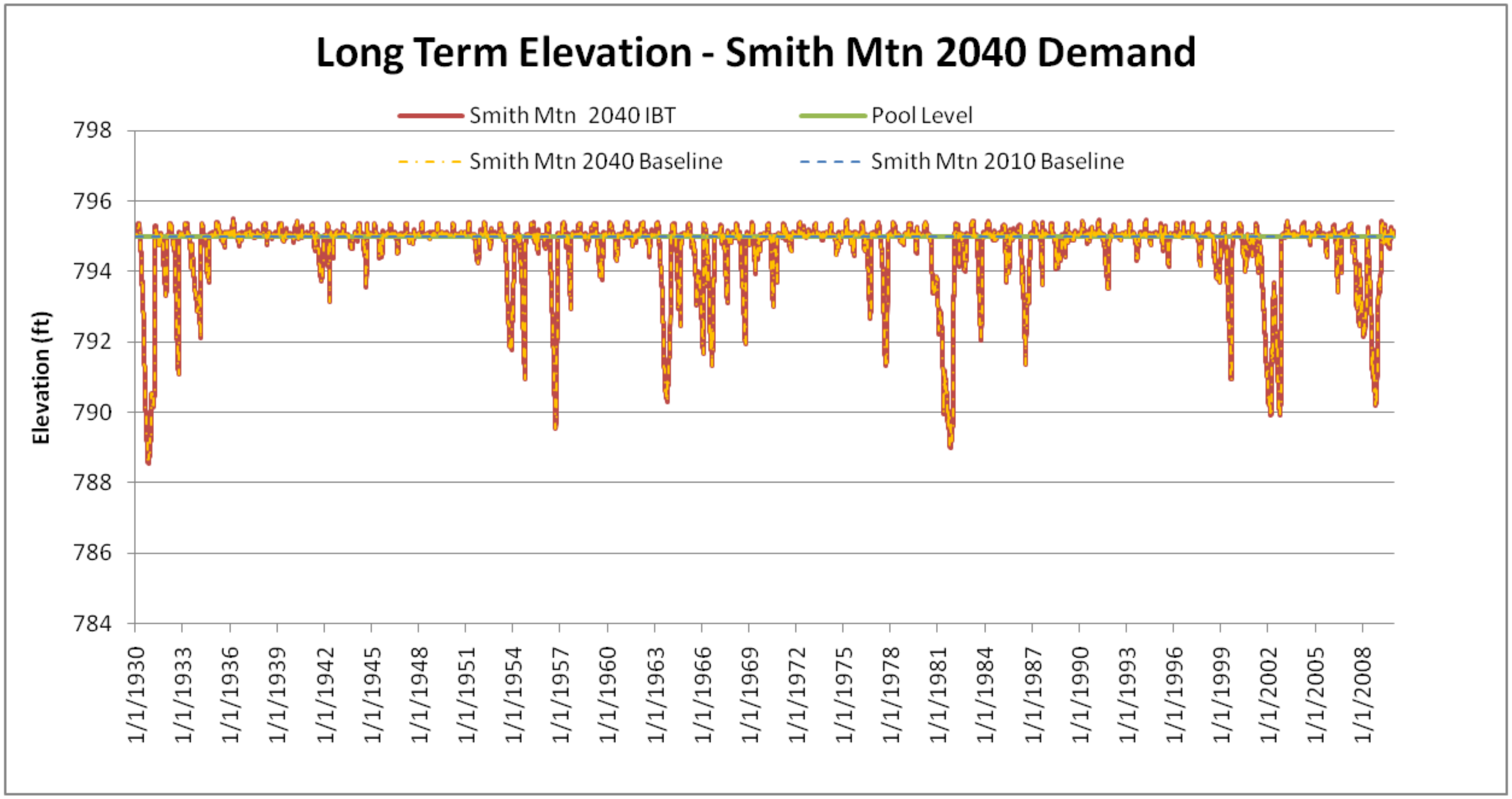

FIGURE D-8
Long-term Comparison of Smith Mountain Lake Elevation for 2040 Scenarios

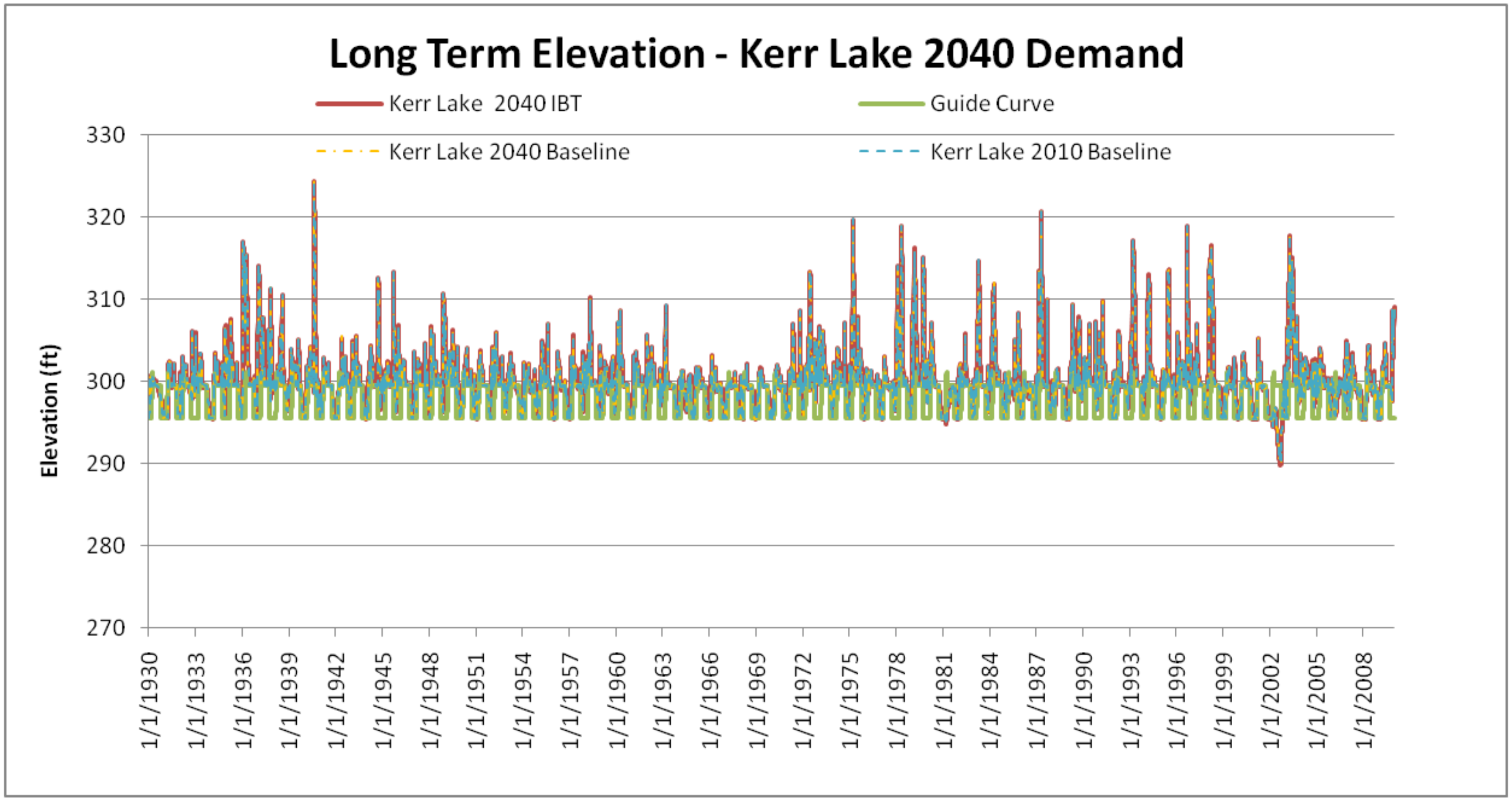

FIGURE D-9
Long-term Comparison of Kerr Lake Elevation for 2040 Scenarios

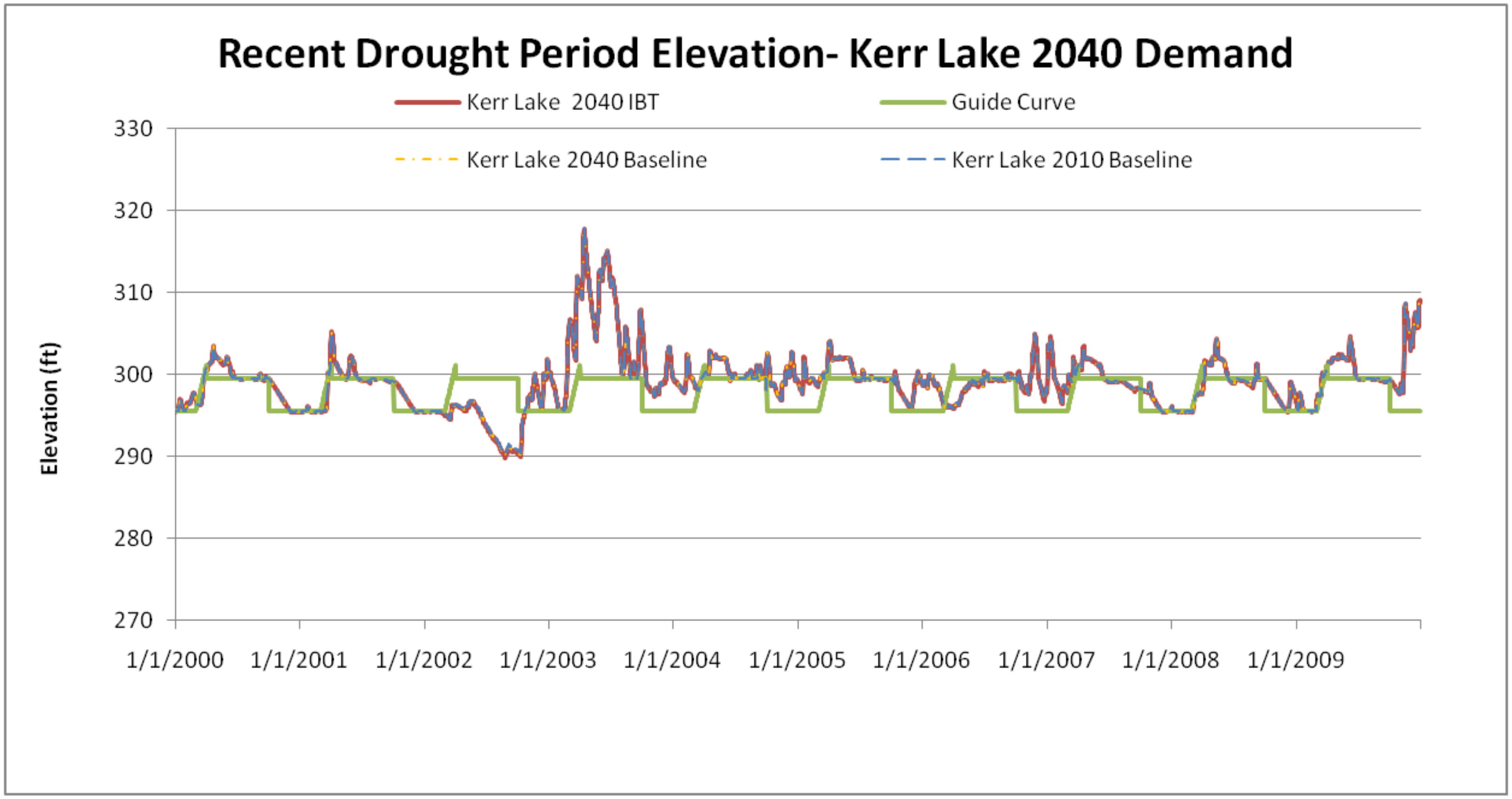

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FIGURE D-10
Comparison of Differences in Kerr Lake Elevation during the Recent Droughts for the 2040 Scenario

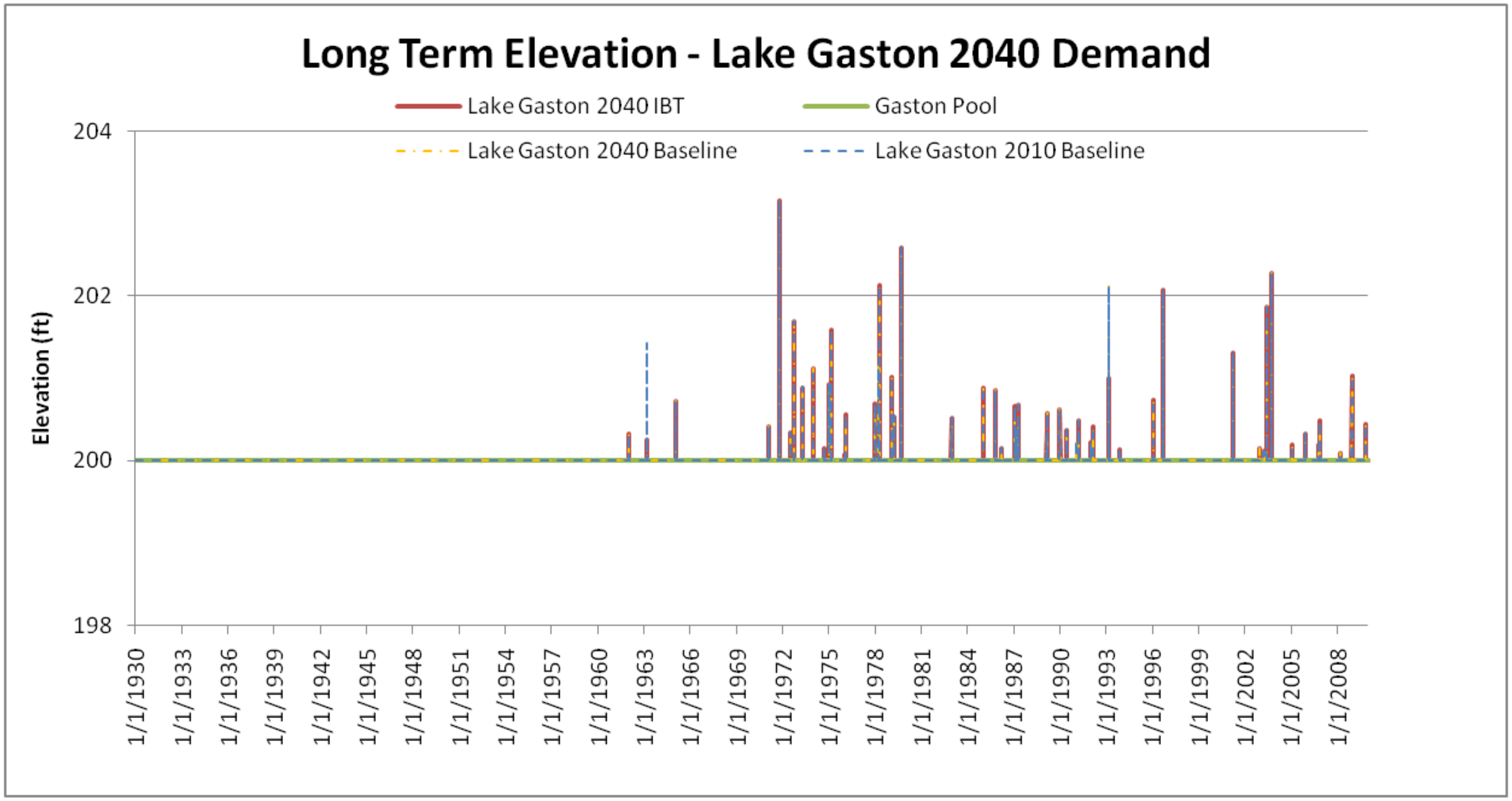


FIGURE D-11
Comparison of Lake Gaston Elevation for 2040 Scenarios

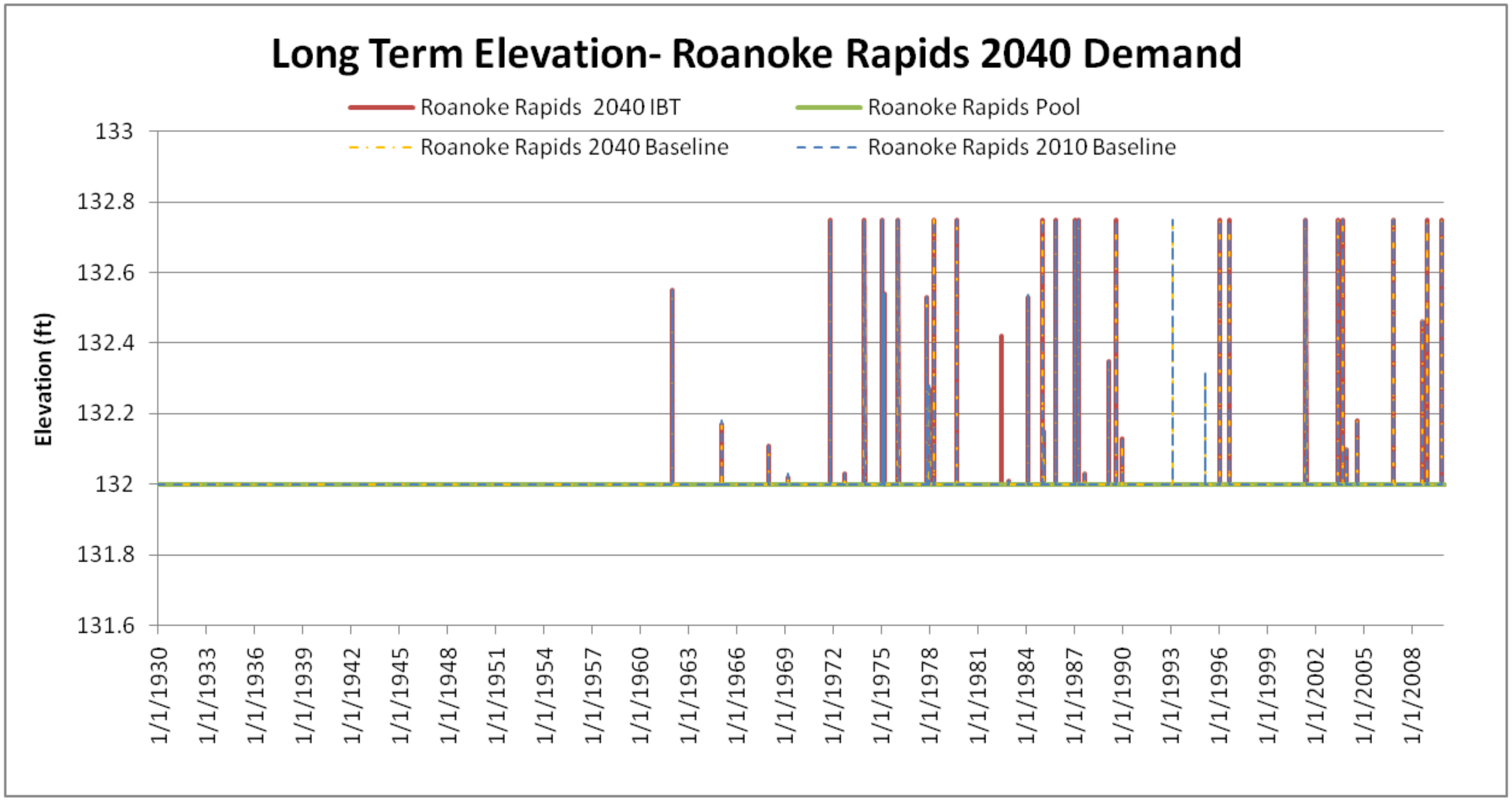


FIGURE D-12
Comparison of Roanoke Rapids Reservoir Elevation for 2040 Scenarios

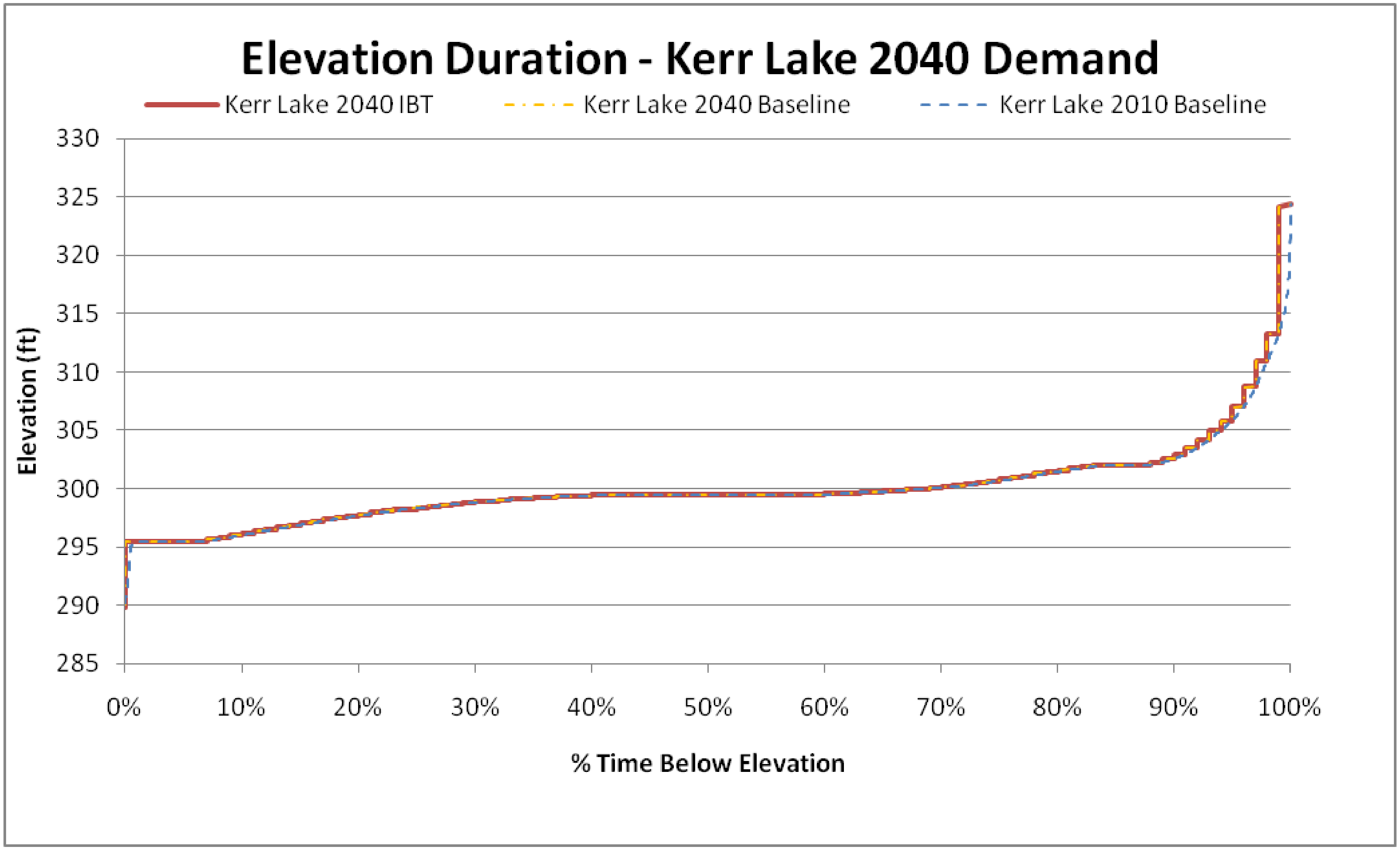


FIGURE D-13
Complete Elevation-Duration Curve for 2040 Kerr Lake Scenarios

Discharges (Instream Flow)

A comparison of discharges under the baseline and IBT scenarios was also performed for the 2030, 2040, and 2060 demand conditions. No difference is seen in the average discharge, or reservoir release, from the upstream Smith Mountain, Leesville, and Philpott Reservoirs. This indicates that the proposed IBT would not require upstream releases to maintain the elevation of the lower reservoirs, even during periods of drought.

As shown in Table D-5, the average discharge from Kerr Lake under the 2030 IBT scenario is approximately 8.8 cubic feet per second (cfs) lower than under the baseline scenario. This suggests that the model generally "chooses" to maintain lake level versus maintaining the same discharge rate for the two scenarios. A difference of 8.8 cfs is approximately 0.1 percent of the average discharge from Kerr Lake. This increases to approximately 0.2 percent for the 2060 scenario. A comparison of the 2040 reservoir release results for Kerr Lake is provided in Figure D-14. A similar difference in reservoir release is seen in Lake Gaston and Roanoke Rapids Reservoir, since the flow from these reservoirs is directly related to the release from Kerr Lake.

The 2002 drought period shows no difference in discharge for any of the reservoirs for the 2030, 2040, or 2060 scenarios. As noted previously, the reservoir elevation for Kerr Lake falls below the guide curve during the drought and the reservoir is operated to maintain flow by regulating discharge. The 2007 drought shows a decrease in discharge ranging from 15.9 cfs (0.5 percent of drought flow) to 32.4 cfs (0.9 percent of drought flow). Figure 17 shows the discharge rate from Kerr Lake for the 2040 baseline and IBT scenarios.

A flow duration curve for Kerr Lake was generated to evaluate the percentage of time that a given flow is met or exceeded. This is helpful in directly comparing changes in flow regimes. The complete flow duration curve for the current flows, 2030 baseline, and IBT scenarios is provided in Figure D-15 and an expanded curve examining the lowest 5 percent of the curve is shown in Figure D-16. Little difference is seen between the baseline and IBT scenarios.

The model includes code designed to replicate the operating rules supporting the striped bass fishery below Roanoke Rapids. Minimum discharges of 5,550 cfs are required for the period between April 1 and June 15, with a brief increase to 8,350 cfs for the period from April 26 through May 4. The change in reservoir elevation related to this drawdown period can be seen in the guide curve shown in Figure D-10. The striped bass fishery requirements are met in the model in both the baseline and IBT runs. This results in a small drawdown in the IBT scenario, but since the period is brief and the withdrawal is small compared to the average discharge, no discernible difference is seen in the elevation comparisons.

TABLE D-5

Evaluation of Changes in Reservoir Discharge for Baseline and Proposed IBT Scenarios

Scenario Comparison	Results	Smith Mountain	Leesville	Philpott	Kerr	Gaston	Roanoke Rapids
2030	Average Baseline Discharge (cfs)	1,729.2	1,412.0	241.1	7,459.6	7,979.8	7,687.8
	Average Difference	0.0	0.0	0.0	8.8	8.8	8.8
	Average Discharge during 2002 Drought	795.8	472.3	22.1	1,817.9	2,020.4	1,692.6
	Average Difference during 2002 Drought	0.0	0.0	0.0	0.0	0.0	0.0
	Average Discharge during 2007 Drought	988.9	669.9	124.6	3,334.1	3,677.9	3,369.3
	Average Difference during 2007 Drought	0.0	0.0	0.0	15.9	16.0	16.0
2040	Average Baseline Discharge (feet)	1,730.8	1,413.6	241.1	7,460.1	7,979.5	7,687.6
	Average Difference	0.0	0.0	0.0	15.6	15.6	15.6
	Average Discharge during 2002 Drought	795.8	472.3	22.1	1,818.6	2,020.4	1,692.6
	Average Difference during 2002 Drought	0.0	0.0	0.0	0.0	0.0	0.0
	Average Discharge during 2007 Drought	988.9	669.9	124.6	3,331.5	3,674.7	3,366.1
	Average Difference during 2007 Drought	0.0	0.0	0.0	28.4	28.4	28.4
2060	Average Baseline Discharge (feet)	1,733.9	1,416.8	241.1	7,464.4	7,981.1	7,699.7
	Average Difference	0.0	0.0	0.0	17.8	17.8	17.8
	Average Discharge during 2002 Drought	795.8	472.3	22.1	1,809.6	2,008.8	1,692.8
	Average Difference during 2002 Drought	0.0	0.0	0.0	0.0	0.0	0.0
	Average Discharge during 2007 Drought	988.9	669.9	124.6	3,341.0	3,681.5	3,382.5
	Average Difference during 2007 Drought	0.0	0.0	0.0	32.3	32.4	32.3

2002 Exceptional Drought Period - 6/18/2002 through 10/15/2002
2007 Exceptional Drought Period - 10/16/2007 through 3/10/2008

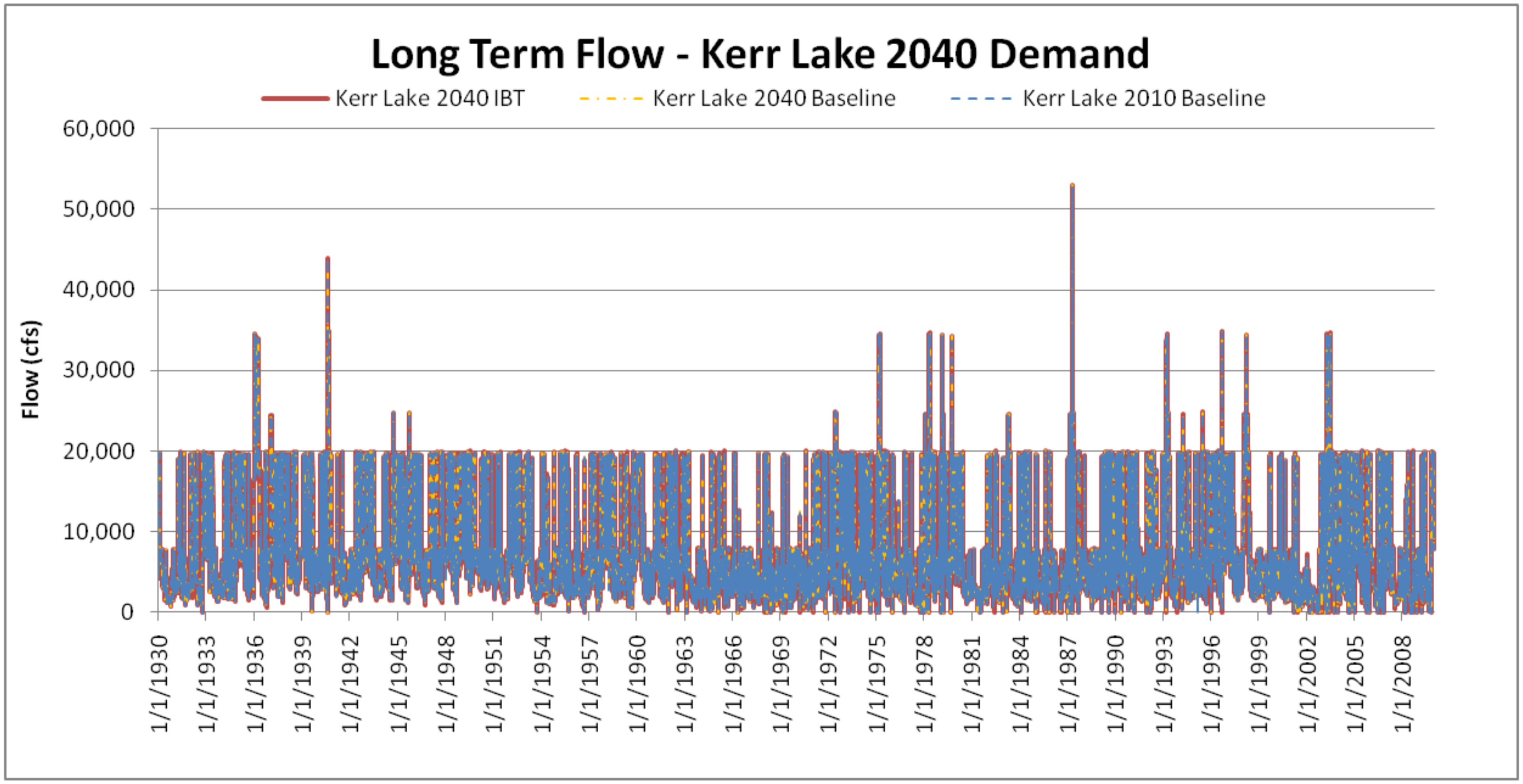


FIGURE D-14
Long-term Comparison of Kerr Lake Releases for 2040 Scenarios

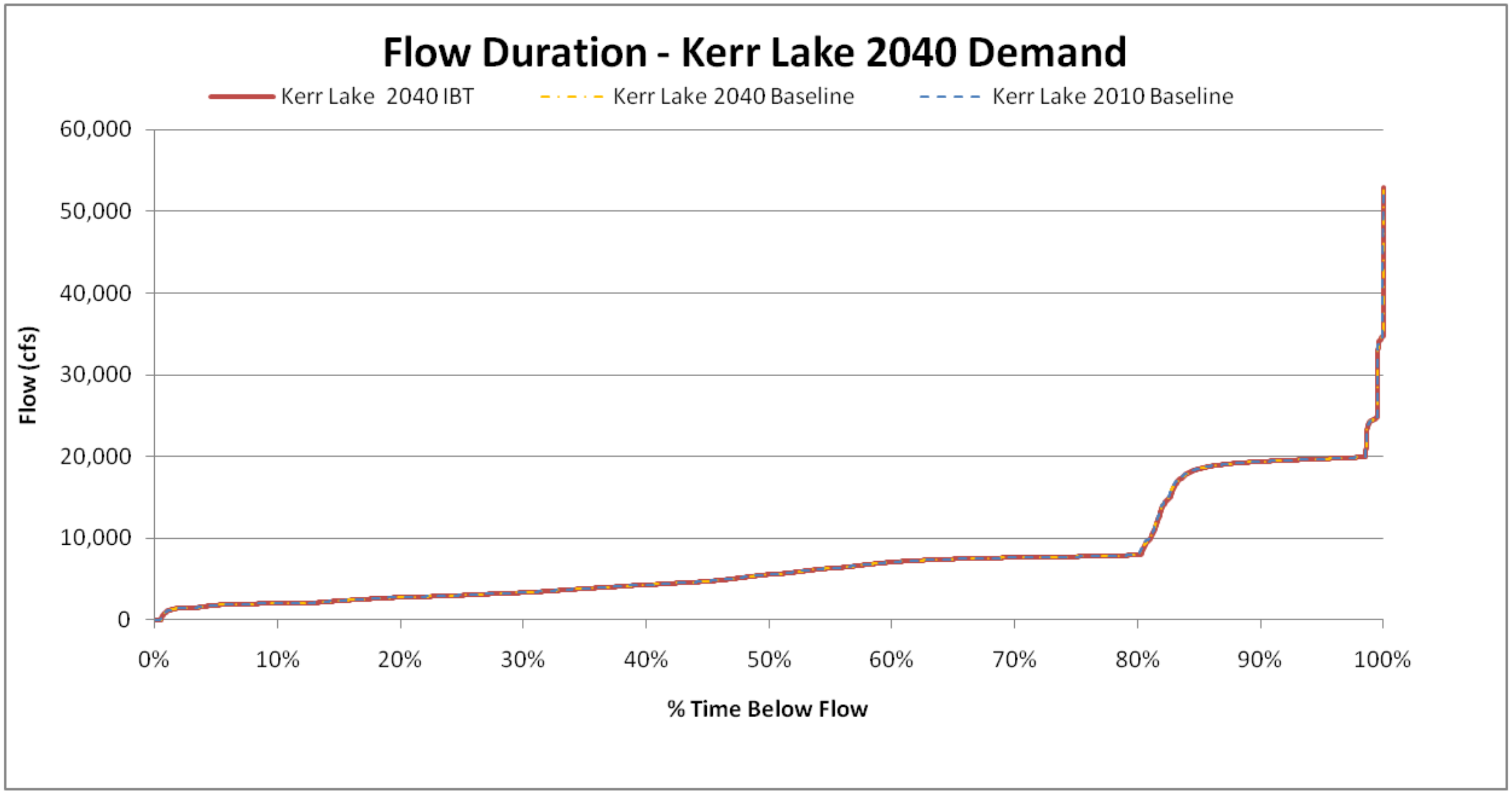


FIGURE D-15
Flow Duration Curve for Kerr Lake Discharge for 2040 Scenarios

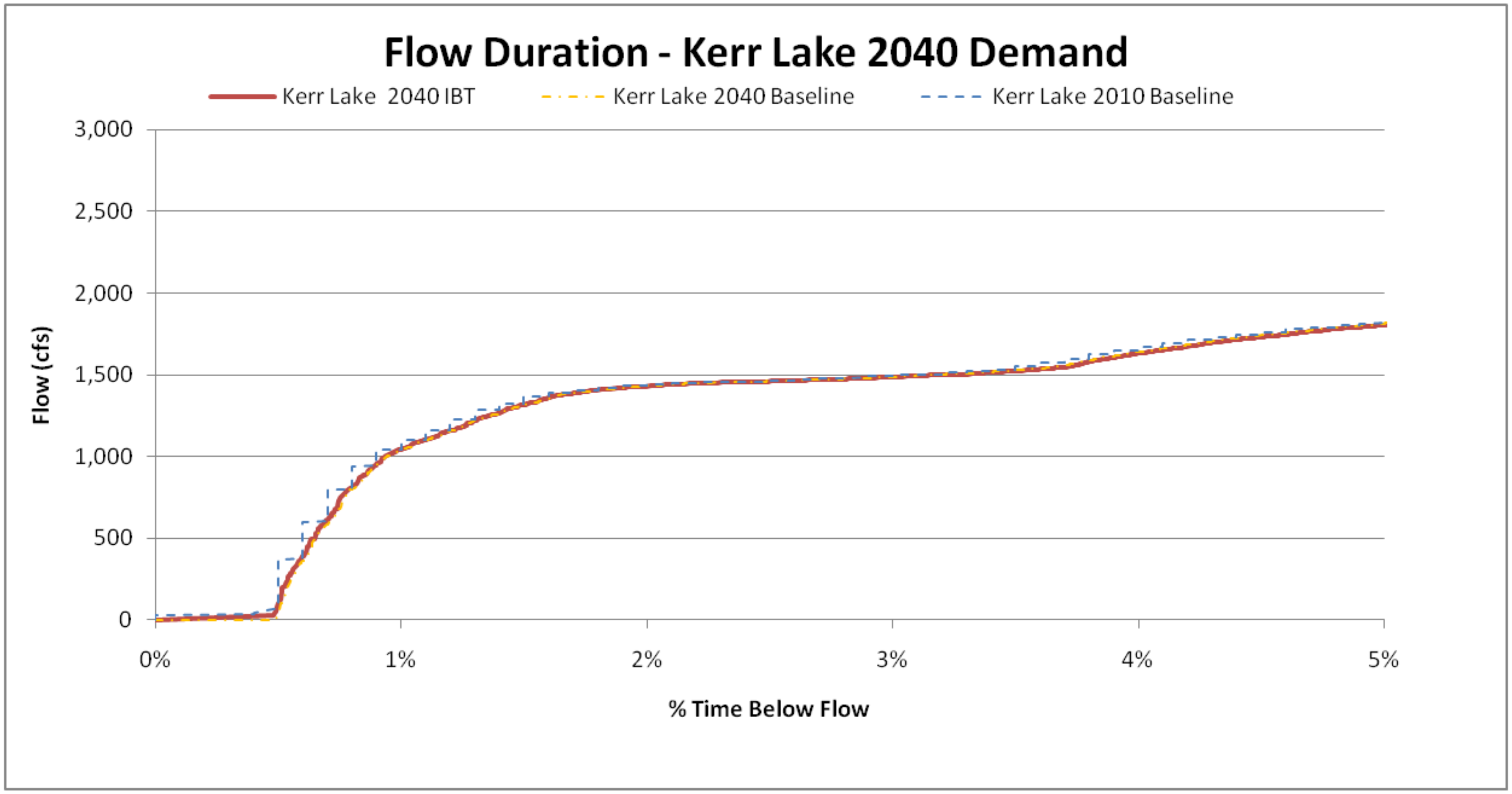


FIGURE D-16
Flow Duration Curve (Low Flow Area) for Kerr Lake Discharge for 2040 Scenarios

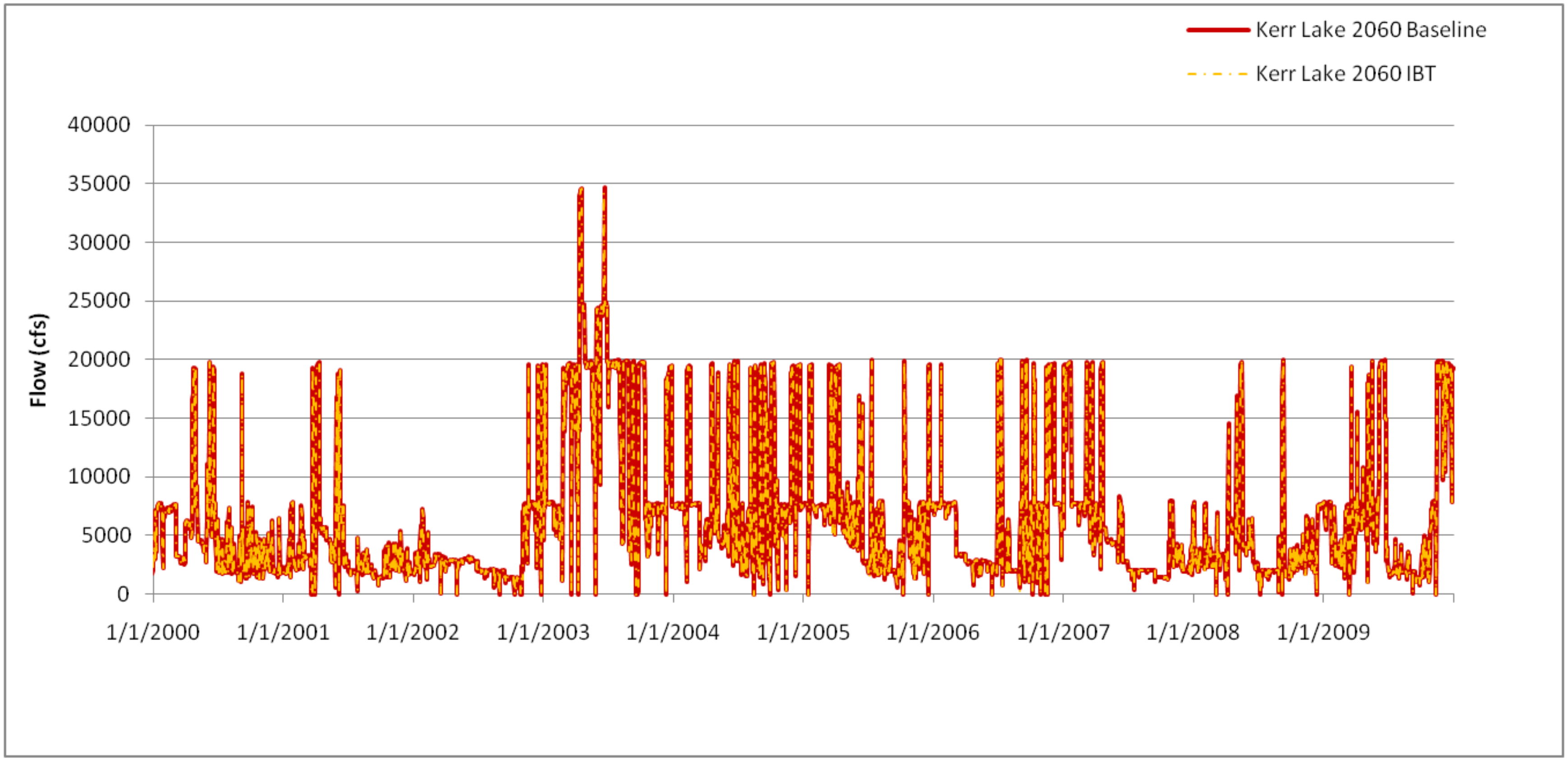


FIGURE D-17
Kerr Lake Discharge During Recent Drought Period for 2040 Scenarios

Power Generation

As noted above, releases from the three upstream reservoirs are the same between scenarios. For this reason, power generation is also equal. No impacts or changes to power generation would occur in the upstream reservoirs as a result of the increased IBT.

The differences in generation for the three lower reservoirs are provided in Table D-6. Results for the upper reservoirs are not currently generated by the RRBHM. An average daily change of 4.9 megawatt-hours (MWh) is seen in power generation from Kerr Lake (approximately 1,600 MWh annually). To put this in perspective, the total annual generation from the Kerr Lake Hydropower station is 426,749 MWh (Whisnant et al., 2007). Thus the decrease in discharge results in a small decrease in power generation, equivalent to approximately 0.5 percent of the average generation. Based on the 2005 USACE allocation report, the value of a MWh over the life of the project is $33.51. This equates to a daily loss in revenue of less than $164.20 at each generation facility and an annual loss in revenue of $59,932 at each facility. A comparison of the 2040 power generation differences during the last decade is provided in Figure D-18.

TABLE D-6

Evaluation of Changes in Power Generation for Baseline and Proposed IBT Scenarios

Scenario Comparison	Results	Kerr	Gaston	Roanoke Rapids
2030	Average Baseline Power (MWe)	1,000.3	789.4	846.3
	Average Difference	4.9	3.4	2.2
	Average Elevation during 2002 Drought	533.1	434.6	410.9
	Average Difference during 2002 Drought	52.1	43.8	41.3
	Average Elevation during 2007 Drought	450.4	381.5	377.2
	Average Difference during 2007 Drought	0.9	0.6	0.6
2040	Average Baseline Power (MWe)	997.6	787.3	846.5
	Average Difference	-0.2	-0.1	-0.4
	Average Elevation during 2002 Drought	488.2	393.2	374.1
	Average Difference during 2002 Drought	-2.8	-0.1	-1.9
	Average Elevation during 2007 Drought	448.9	382.2	377.1
	Average Difference during 2007 Drought	1.4	1.0	1.1
2060	Average Baseline Power (MWe)	993.0	783.8	845.9
	Average Difference	4.4	3.2	2.8
	Average Elevation during 2002 Drought	496.8	392.9	386.1
	Average Difference during 2002 Drought	-0.2	0.0	-0.9
	Average Elevation during 2007 Drought	515.9	431.8	432.5
	Average Difference during 2007 Drought	68.6	51.3	55.8

2002 Exceptional Drought Period - 6/18/2002 through 10/15/2002
2007 Exceptional Drought Period - 10/16/2007 through 3/10/2008

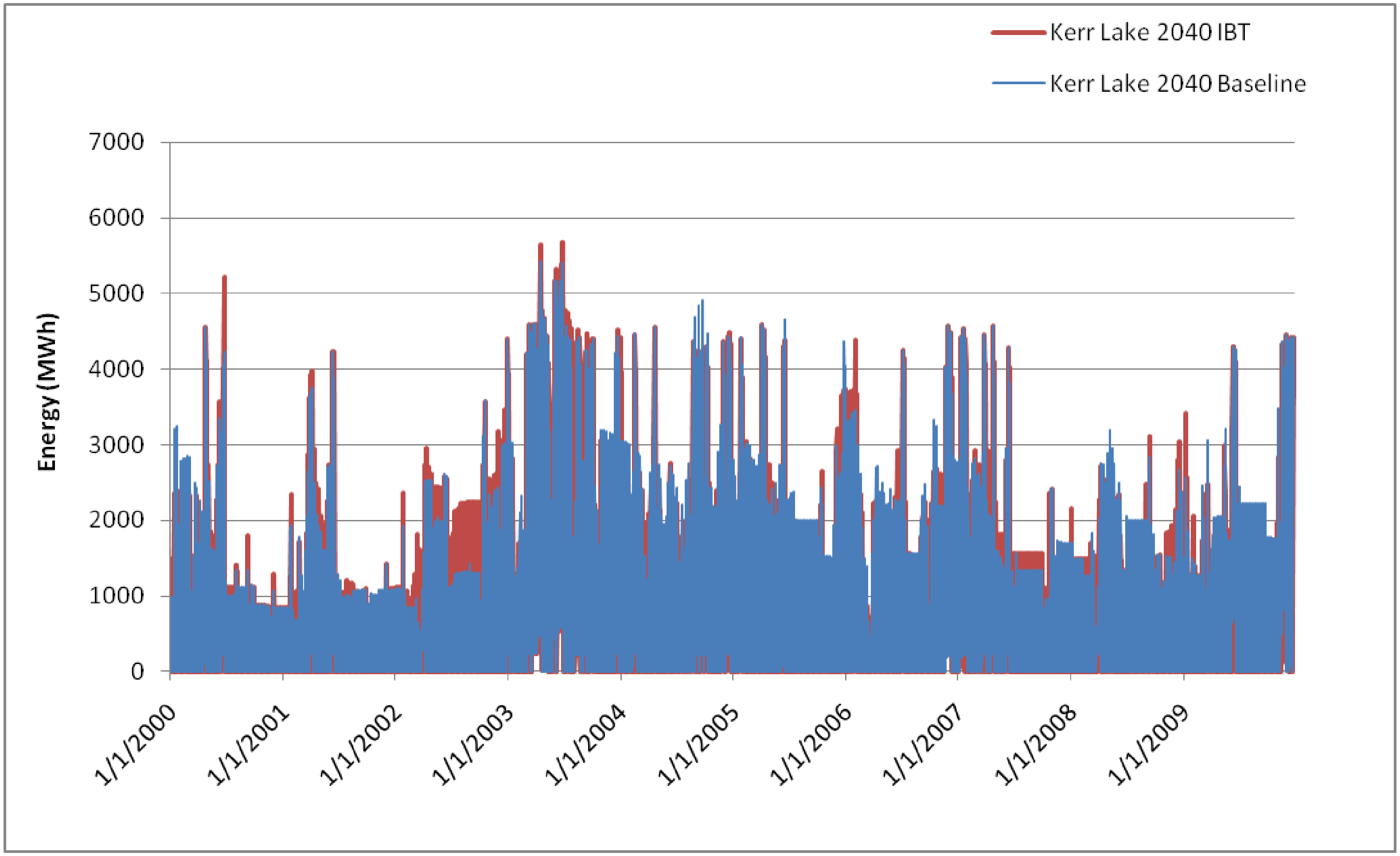


FIGURE D-18
Example Differences in Kerr Lake Power Generation for 2030 Scenarios

Drought Conditions

In the last ten years, North Carolina experienced two of the most extreme droughts on record. These droughts occurred from approximately August 2001 through March 2003 and March 2007 through November 2009 (See Figure D-19). Both droughts included periods of exceptional drought, the most extreme drought classification. While the 2007-2009 drought had a slightly longer duration, a review of the model output indicates that the 2001 – 2003 drought resulted in the lowest overall lake level during the recent drought period (See Figure D-10).

The model results for the 2060 baseline and IBT runs were reviewed over the period of exceptional drought for the 2001 through 2003 drought. Figure D-20 illustrates that a difference of less than half of one foot occurs during this extreme drought. The duration of the draw down is not changed as a result of the IBT withdrawal.

The releases from Kerr Lake were also reviewed for this period to determine whether the releases were scaled back to maintain the lake level. Figure D-21 shows that releases were reduced equally for both scenarios during the exceptional drought period. A final check was performed on the elevation discharge from Smith Mountain Lake to verify that the model was not causing increased releases from upstream dams to maintain the level of Kerr Lake. The results of the elevation and discharge comparison for the extreme drought period in 2060 are provided in Figure D-22 and Figure D-23.

Water Shortage Response Plans

Each municipality is required to have a Water Shortage Response Plan (WSRP) to guide conservation of water during dry to extreme drought conditions. These plans typically assign a suggested reduction in demand based on a set of triggers such as streamflow or reservoir level. The plans for the municipalities in NC were reviewed to determine the reductions and triggers specified by each. Many of the entities used site specific triggers such as the distance from the source waters level and the intake to determine whether a drought was occurring. This type of information is not tracked in the OASIS model. The KLRWS uses Kerr Lake water level as a trigger which is tracked in the model and can be used to evaluate the impacts of the implementation of WSRPs. The KLRWS triggers and reductions are provided in Table D-13.

TABLE D-13
Kerr Lake Regional Water Supply Water Shortage Response Summary

Drought Level	Demand Reduction	Trigger
0	0%	Kerr Lake water level above 292’
1	5%	Kerr Lake water level nears 292’
2	10%	Kerr Lake water level nears 290’
3	40%	Kerr Lake water level nears 285’
4	50%	Kerr Lake water level at or below 280’

The triggers specified in the KLRWS plan were used as an overall trigger for all water supplies in the basin to test the sensitivity of supply to these rules. The reservoir elevation is readily tracked in the model and can be considered an indicator of supply across the basin. The majority of the entities follow a less stringent demand reduction for levels 3 and 4. Therefore, using the KLRWS trigger for the entire system is somewhat more conservative than using the individual plans. A comparison of the 2060 baseline, 2060 IBT, and 2060 with the WSRP rules is provided in Figure D-24. The application of the WSRPs results in a small, upwards shift (<2 inches) in elevation resulting in the conservation of approximately 8,000 – 10,000 ac-ft of water.

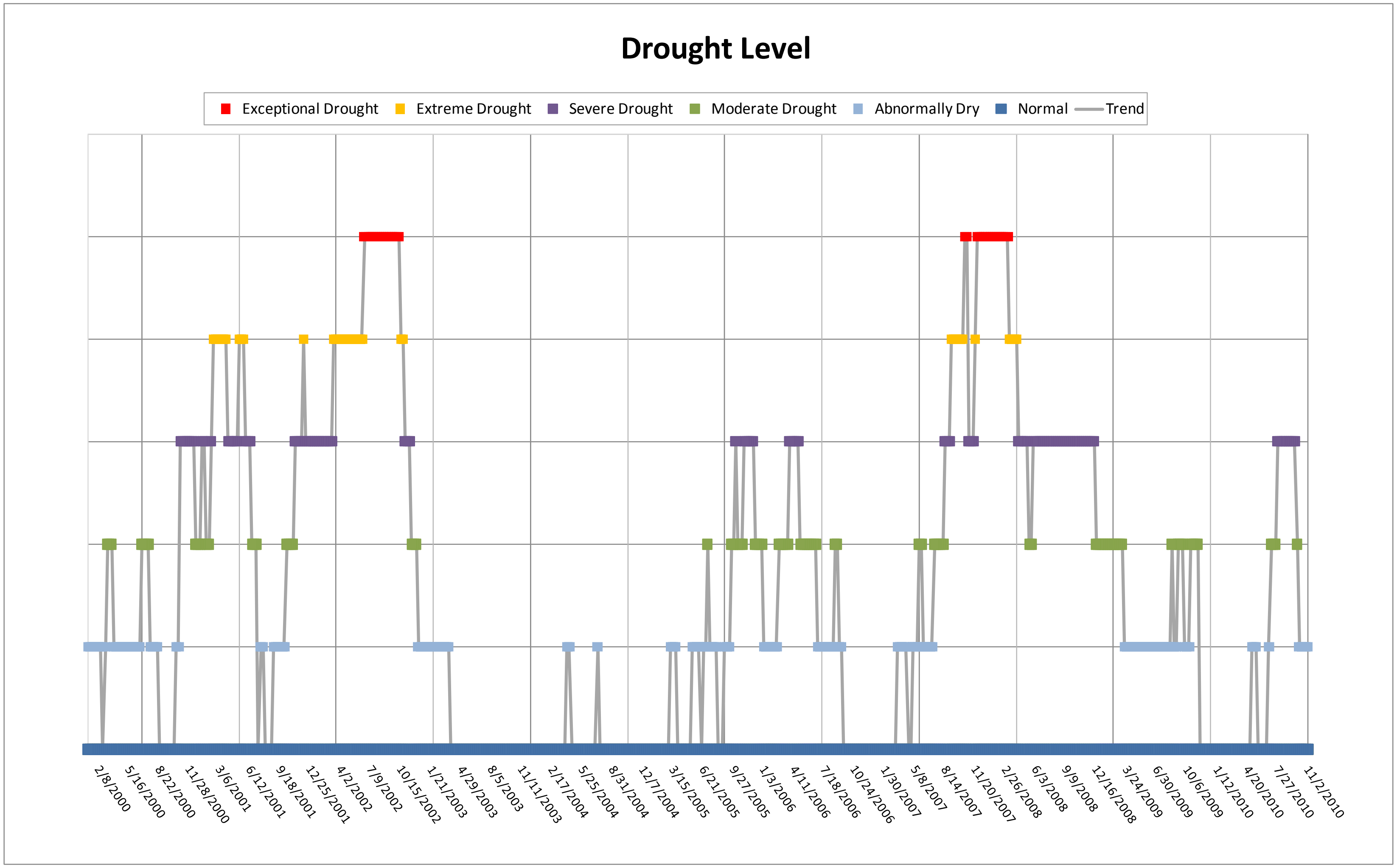
Global Climate Change

Changes in global climate conditions can potentially impact water supply if atmospheric temperatures increase and rainfall patterns change. This topic is being studied by numerous international agencies with many having projections of changes to precipitation and temperature.

Predictions for potential changes in precipitation and temperature for the Roanoke River basin were generated using an "ensemble" of model results. This approach has been used in numerous studies to present the range of conditions that the different models predict. In addition to the range of models which exist, different "emission" scenarios are run using the models. These quantify factors such as expect change in greenhouse gas releases, future energy sources, and conservation. The ensemble of models was run for the A1B scenario, a moderate emission scenario that neither predicts a continuation of current emission increases nor a widespread adoption of alternative energy sources.

Results for predicted changes in precipitation for the Kerr Lake area are presented in Figure D-25. The results show that precipitation in the next 90 years is expected to increase by 53 mm/yr to 147 mm/yr with a mean increase of 93 mm/yr. For the 50 year study period through 2060, precipitation increases are expected to range from 35 to 100 mm/yr with a mean increase of 61 mm/yr.

If the mean result is used as the most likely outcome, these predictions suggest that long-term water supplies may increase by approximately five percent. However, temperatures are also expected to increase as shown in Figure D-26. The *Climate Change Impacts in the United States (*Karl et. al., 2009) suggests that in general meteorology will become more extreme with more intense rainfall periods and more extreme drought periods. Based on the model results and the conclusions from the climate change report, a set of sensitivities runs were performed to determine the impacts on water supply in the Roanoke River basin. The total inflow to the system was adjusted to a +10 percent level and a – 10 percent level. Results are shown in Figure D-27 and Figure D-28. The potential impacts due to climate change are considerably larger than the changes which may result from the IBT. Obviously, much uncertainty is associated with predictions of impacts due to climate change. The results of the analysis do show that while lake level estimates are sensitive to climate factors, the net difference in water level during the 50-year planning period is less than two feet in the negative direction and four feet in the positive direction.



Source: Division of Water Resources Drought Monitoring Program

FIGURE D-19
Drought Level for the Roanoke River Basin

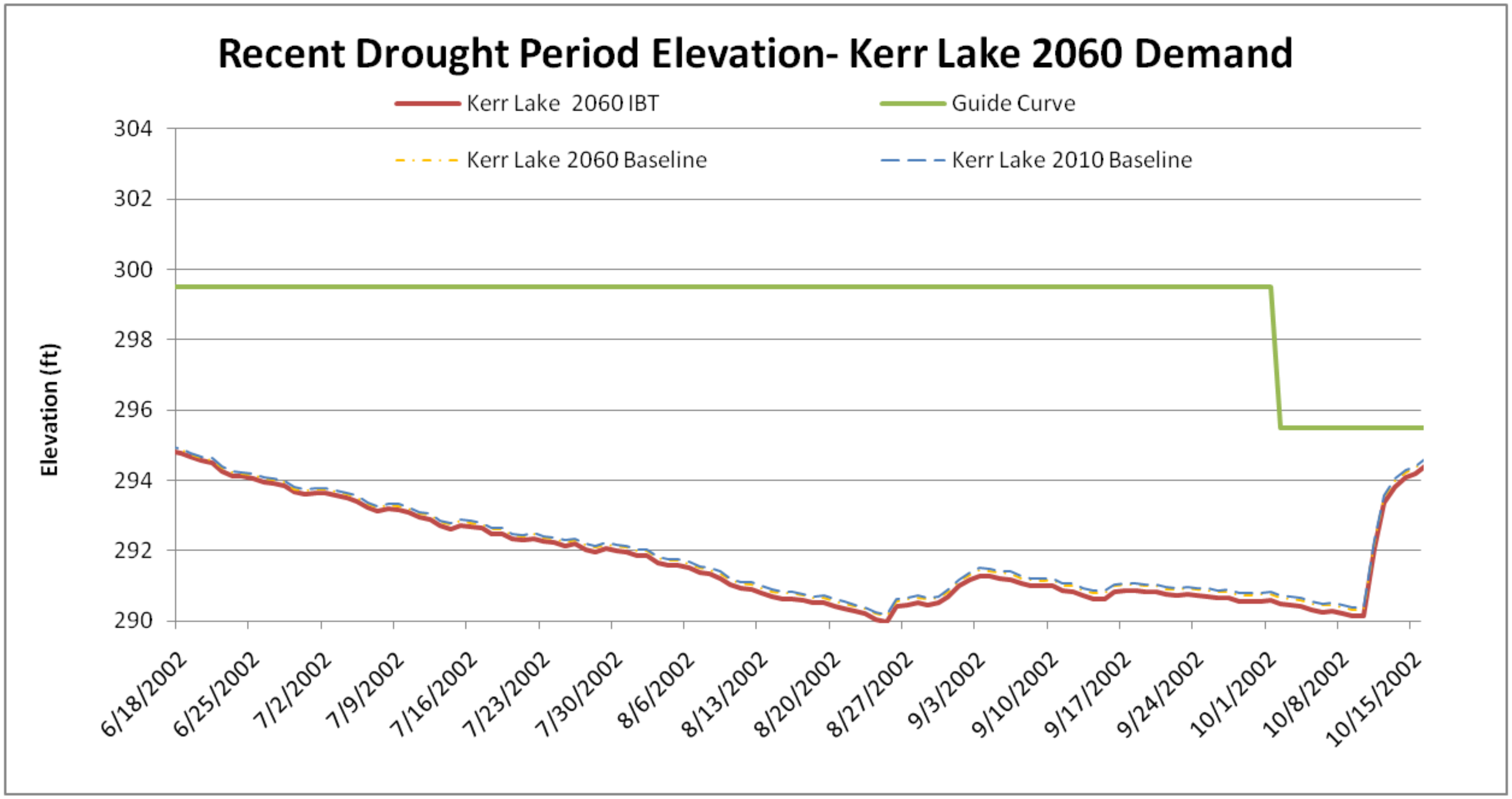


FIGURE D-20
Kerr Lake Elevation during 2002 Exceptional Drought Period (2060 Scenario)

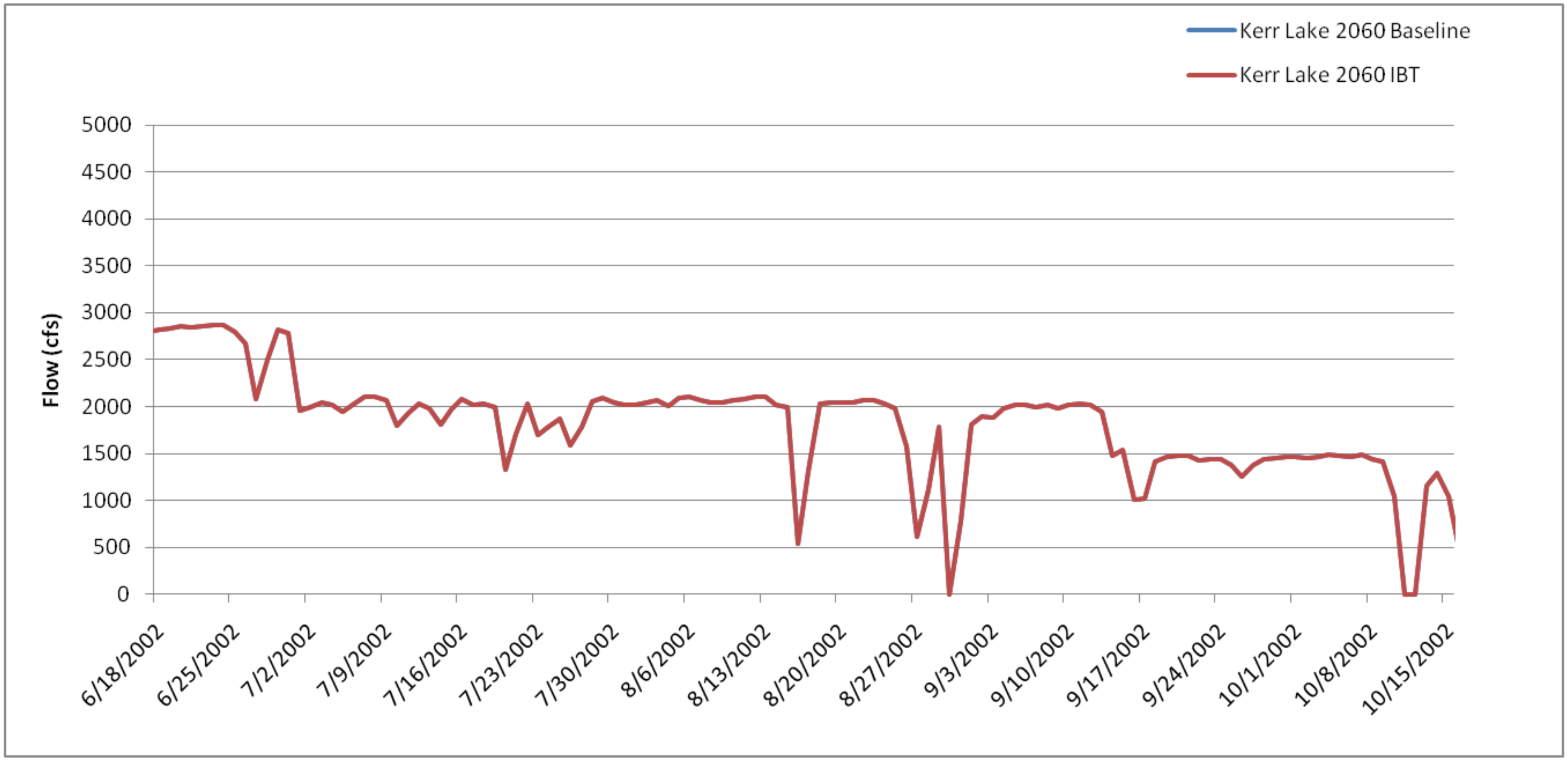


FIGURE D-21
Kerr Lake Releases during 2002 Exceptional Drought Period (2060 Scenario)

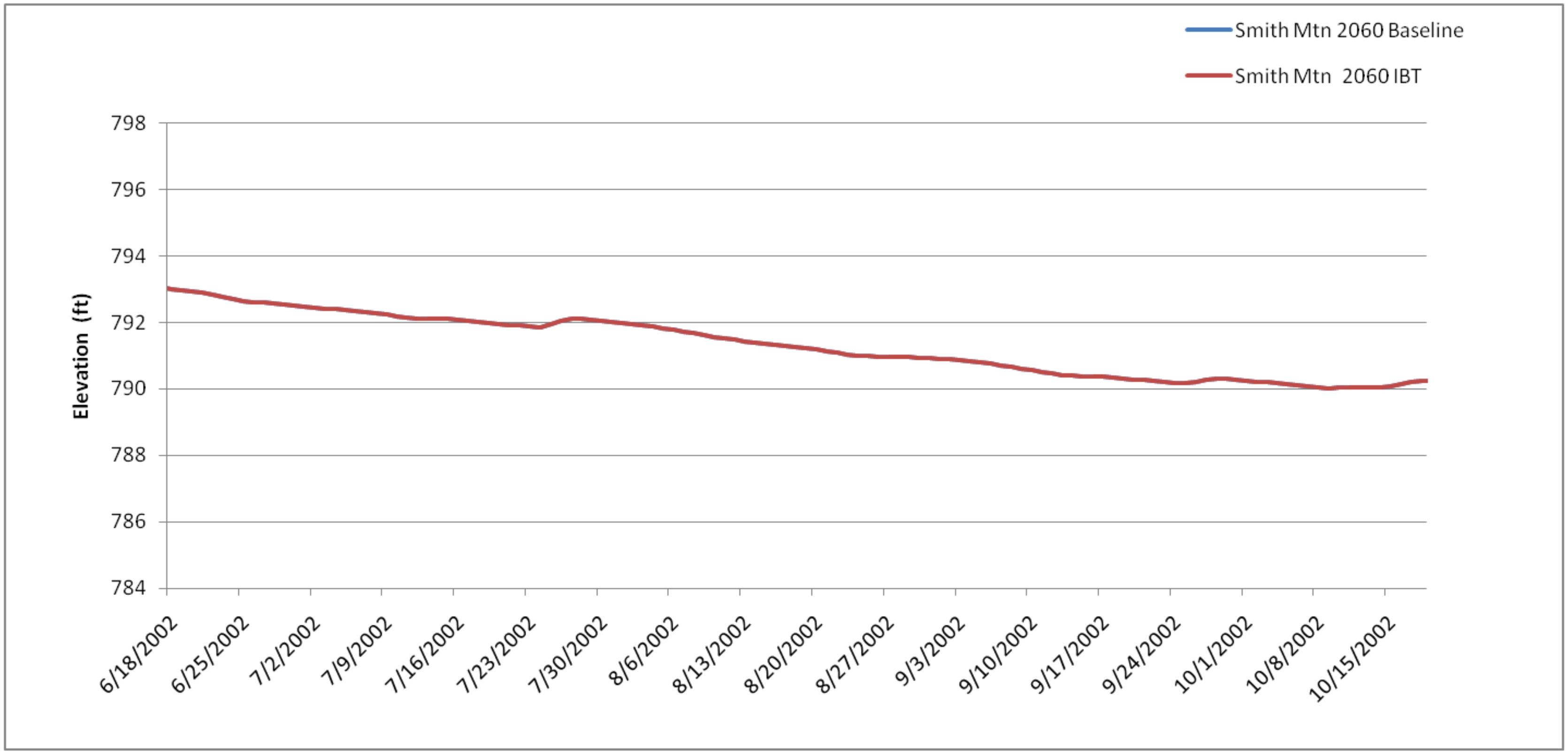


FIGURE D-22
Evaluation of Upstream Reservoir (Smith Mountain Lake) Elevation during Exceptional Drought

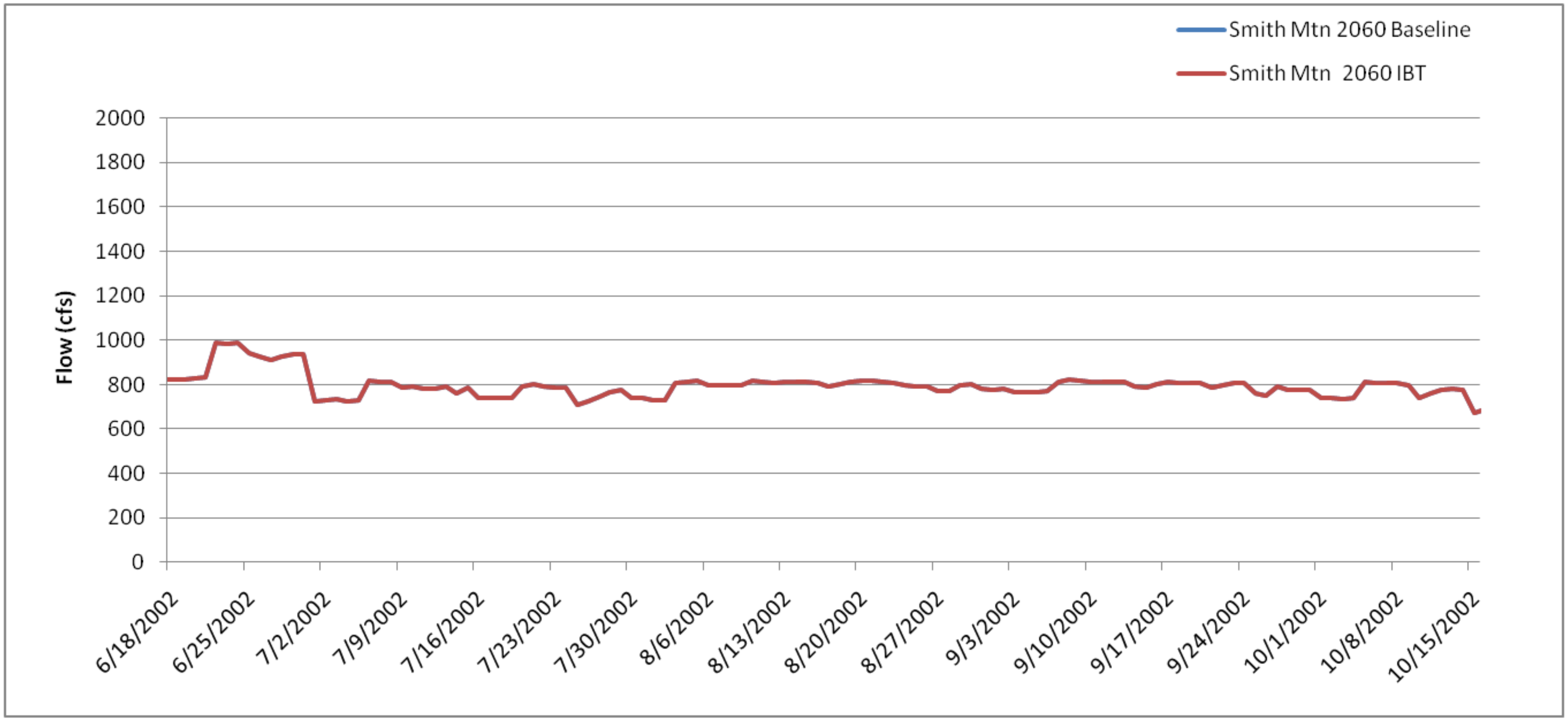


FIGURE D-23
Evaluation of Upstream Reservoir (Smith Mountain Lake) Discharge during Exceptional Drought

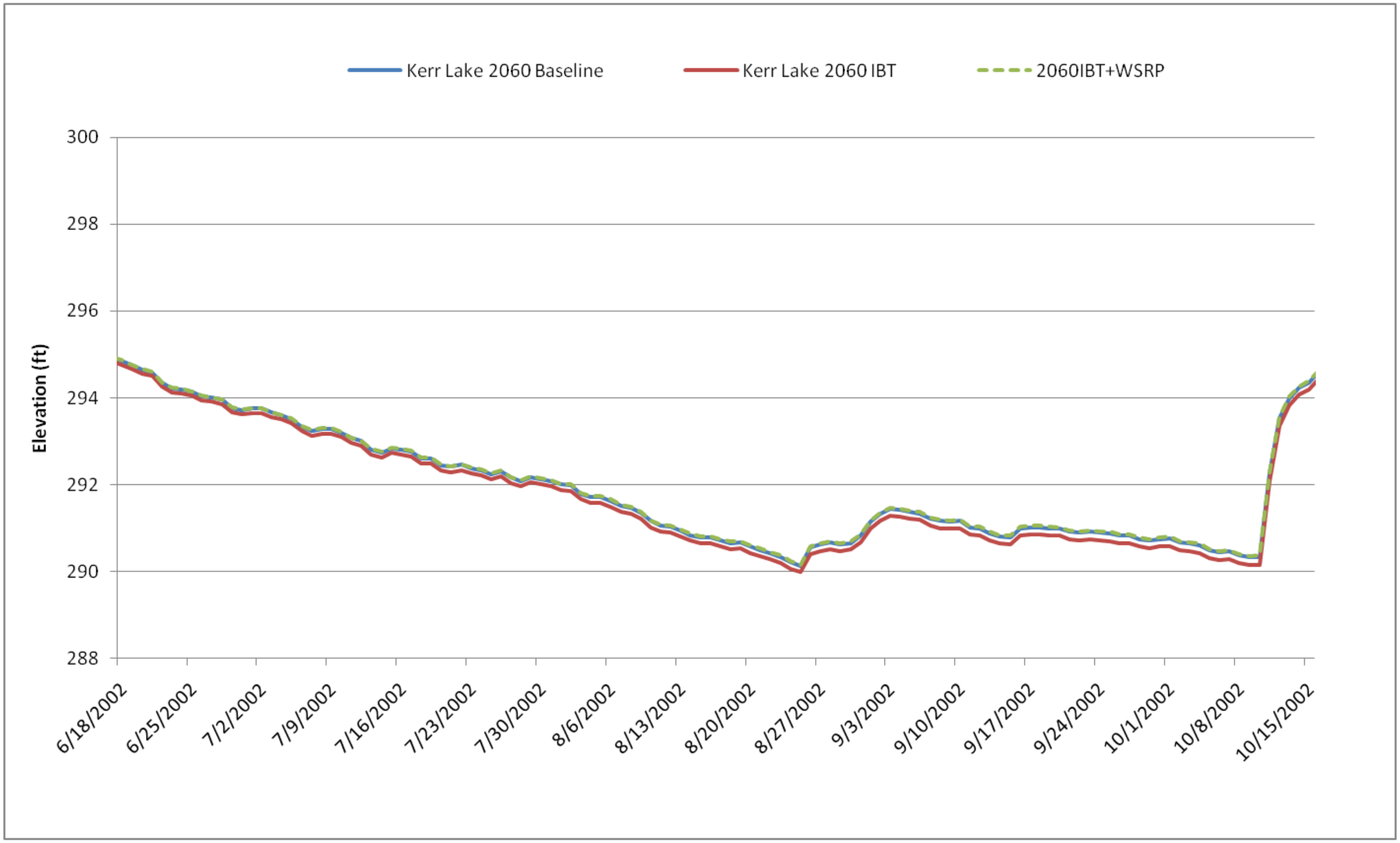


FIGURE D-24
Kerr Lake Elevation during 2002 Exceptional Drought Period (2060 Scenario) including WSRPs

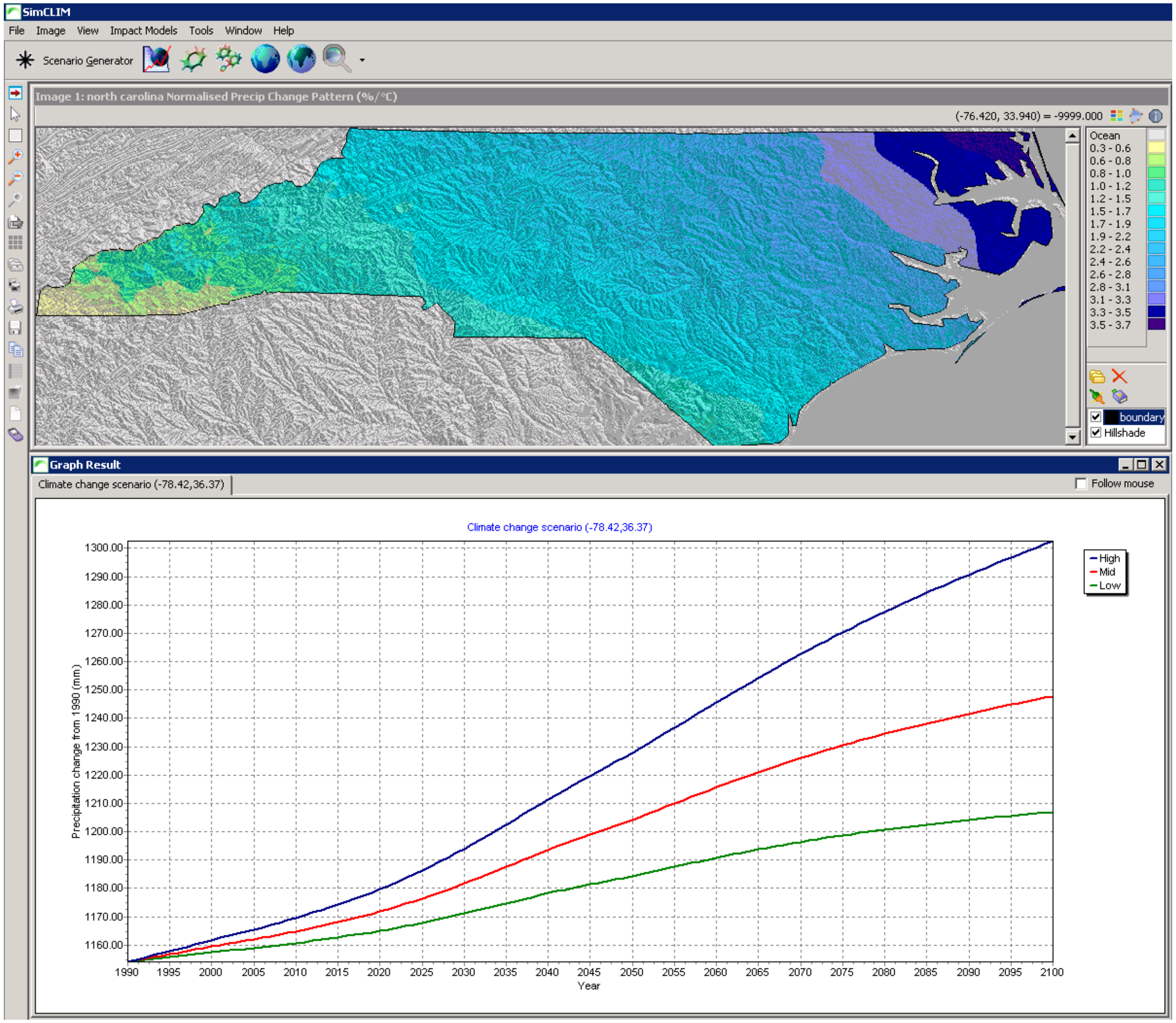


FIGURE D-25
Predicted Change in Precipitation for Henderson, NC.

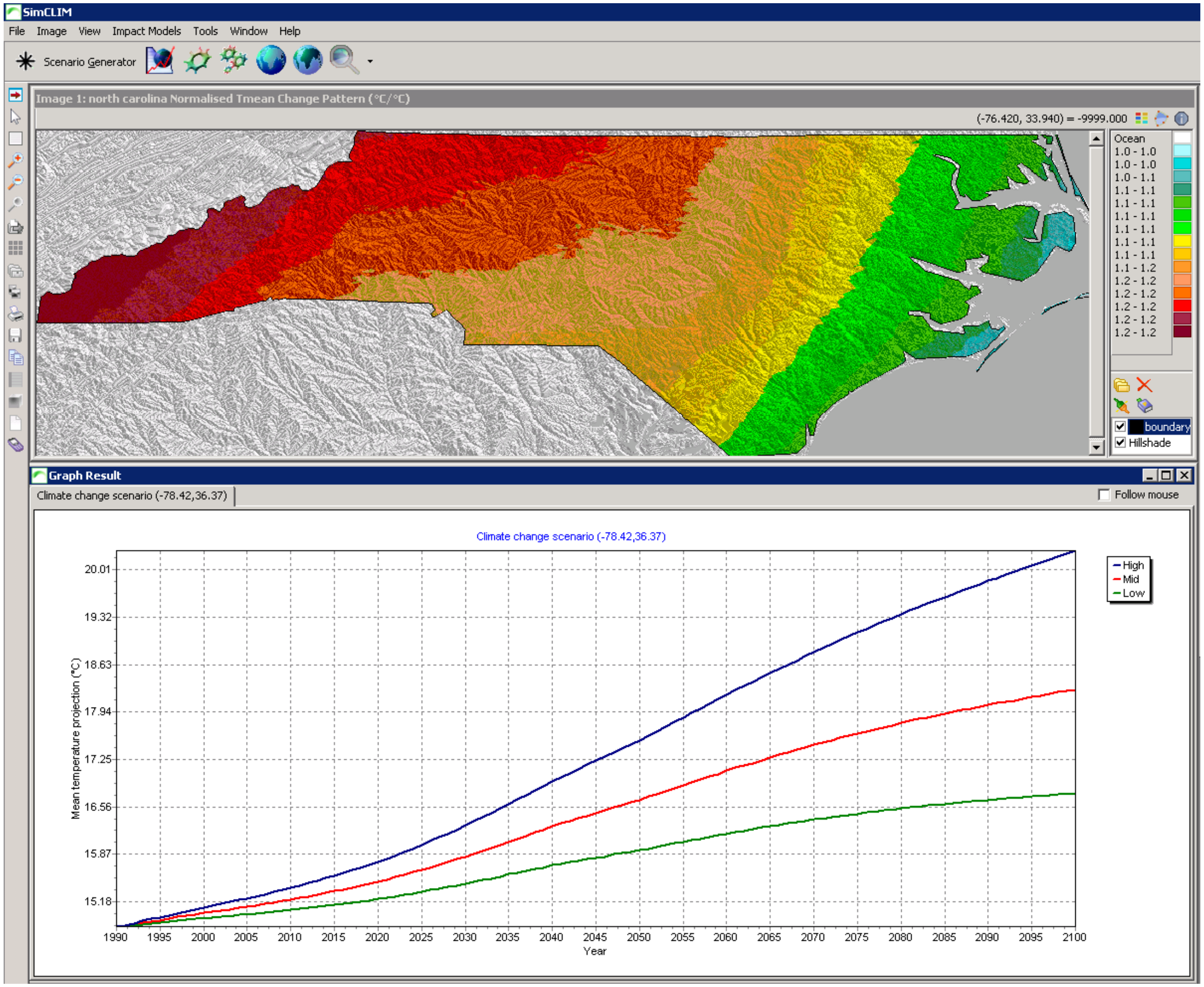


FIGURE D-26
Predicted Change in Temperature for Henderson, NC.

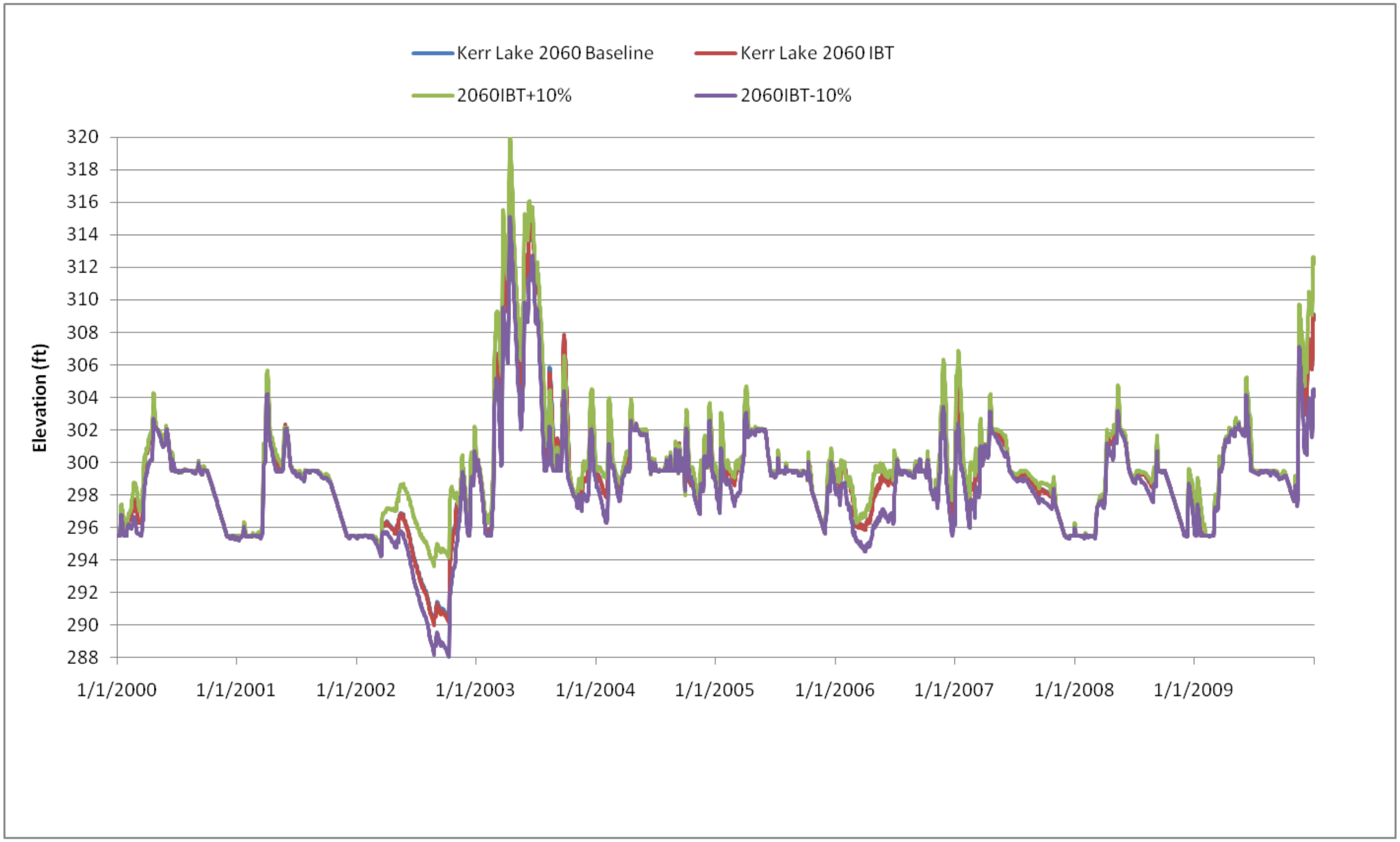


FIGURE D-27
Comparison of 2060 Baseline, 2060 IBT, and Climate Change Runs for 2000 - 2009

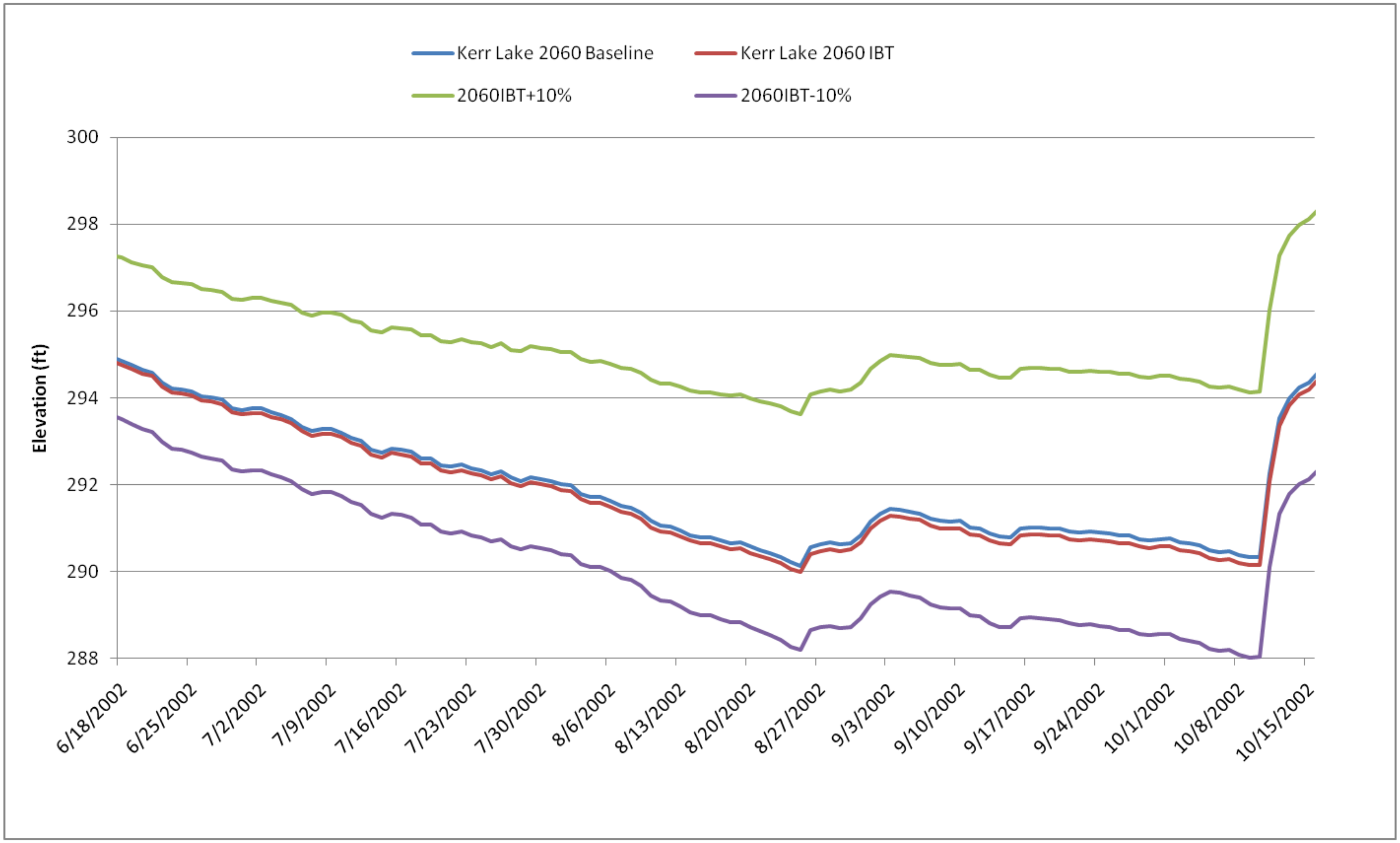


FIGURE D-28
Comparison of 2060 Baseline, 2060 IBT, and Climate Change Runs during 2002 Exceptional Drought Period

Summary and Conclusions

The RRBHM was used to evaluate the hydrologic impacts of the proposed IBT on water resources in the Roanoke River basin. This model was used to establish the baseline scenario and a number of future scenarios which could be used to evaluate potential changes in system reservoir levels, instream flow, and power generation as a result of the IBT.

Changes to elevation levels for all reservoirs in the system were minimal for all scenarios. Similarly, the change in reservoir releases was less than 0.5 percent under all scenarios. Changes in power generation were also minimal. The requested increase in IBT and withdrawal by the KLRWS is very small compared to the average releases for Kerr Lake. It is for this reason that an increased transfer of water out of the Roanoke River basin as part of the IBT would be expected to have a negligible social, environmental, and economic impacts to stakeholders in the basin.

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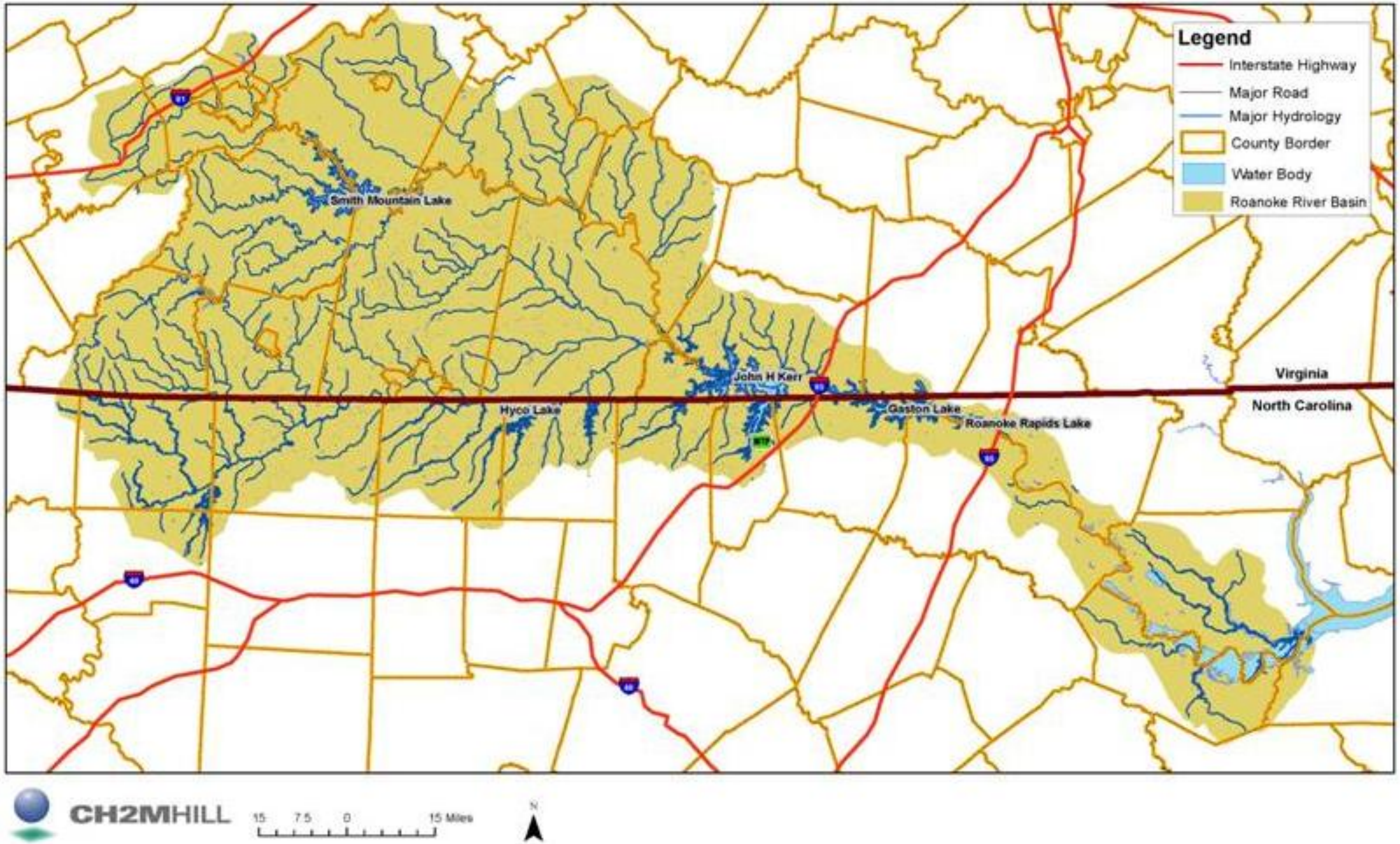
ATTACHMENT I

Roanoke River Basin Map


Legend
Interstate Highway
Major Road
Major Hydrology
County Border
Water Body
Roanoke River Basin
Smith Mountain Lake
John H Kerr
Hyco Lake
Gaston Lake
Roanoke Rapids Lake
Virginia
North Carolina
15 7.5 0 15 Miles
N

ATTACHMENT II

Demand and Discharge Projections in Roanoke River Basin

Demand and Discharge Projections for the Roanoke River Basin

PREPARED FOR: North Carolina Division of Water Resources

PREPARED BY: CH2M HILL on behalf of the Kerr Lake Regional Water System

DATE: June 16, 2010

Introduction

The Kerr Lake Regional Water System (KLRWS) is in the process of requesting a certificate for an interbasin transfer (IBT) from the Roanoke River. The Roanoke River Basin Hydrologic Model (RRBHM), developed by a contractor to the North Carolina Division of Water Resources (NCDWR), was used to evaluate the potential impacts from the IBT as described in the Technical Memorandum (TM) entitled *Evaluation of Roanoke River Basin Water Supply in Relation to a Kerr Lake Regional Water Supply Interbasin Transfer* (CH2M HILL, 2010). The purpose of the modeling effort was to determine the effects of the proposed IBT withdrawal from the John H Kerr Reservoir (Kerr Lake), within the Roanoke River Basin, on system reservoir levels, instream flow and power generation.

This effort involved collecting data for a large geographical area, depicted in Figure 1, including two states with different reporting requirements. North Carolina demand projections were based on Local Water Supply Plans provided by NCDWR. The Virginia Department of Environmental Quality (VADEQ) provided historic demand data which was correlated to US Census population projections to develop demand projections.

Evaluation of the proposed IBT required a forecast of potential water supply and demand under future conditions within a 50-year planning period. This TM describes the process used to forecast withdrawals and discharges through the year 2060.

Background

KLRWS currently provides water directly or indirectly to municipal and county systems in four counties and four river basins [as defined in N.C.G.S. 143-22G(1)] in northeastern North Carolina. The water supply for the system is Kerr Lake, an impoundment of the Roanoke River. The owners of KLRWS and primary bulk customers served by the system are the City of Henderson, the City of Oxford, and Warren County, known as the "Partners" They also currently sell water to secondary bulk customers that include communities in Warren, Vance, Franklin, and Granville Counties. These include current sales to the towns of Warrenton, Norlina, and Kittrell, and Franklin County, with future sales to Granville County, Vance County Water System, and the Triangle North Business Parks. Franklin County then also sells water to the towns of Bunn, Lake Royal, and Youngsville.

The system currently produces on average 6.5 million gallons per day (mgd) of finished water. Maximum day production approaches 8.5 mgd. KLRWS currently has a maximum day IBT from the Roanoke River Basin of approximately 5 mgd, which is less than their grandfathered IBT of 10 mgd (letter dated April 22, 1998). The projected IBT by 2040 is approximately 22.5 mgd to the Tar River Basin and 1.6 mgd to the Fishing Creek Subbasin. The transfer to the Neuse River Basin is currently below 0.3 mgd, and is projected not to exceed 2.0 mgd by 2040.

Approach

Kerr Lake is part of a hydrologically linked system of rivers and reservoirs in the Roanoke River Basin (see Figure 1). The Roanoke River begins in the Blue Ridge Mountains of northwestern Virginia and flows in a generally southeastern direction for 400 miles, entering North Carolina through Kerr Lake. From Kerr Lake, it flows into Lake Gaston and Roanoke Rapids Lake, and on through the coastal plain before emptying into the Albemarle Sound in eastern North Carolina. Only 36 percent of the basin is within North Carolina, with the remaining 64 percent located in Virginia.

NCDWR has developed an OASIS model, in conjunction with the developer of the software (Hydrologics), to evaluate river flow and reservoir elevation impacts of various water supply withdrawals and discharges in the Roanoke River Basin. The model includes all withdrawals and discharges of at least 100,000 gallons per day (0.1 mgd). A schematic of the model is provided in Figure 2. CH2M HILL obtained the OASIS model from NCDWR to evaluate the hydrologic impacts of the proposed IBT on water resources in the Roanoke River Basin. This model was used to establish the baseline scenario and a number of future scenarios which could be used to evaluate potential changes in system reservoir levels, instream flow, and power generation as a result of the IBT.

Future Demand Scenarios

Water demand and wastewater discharge estimates for the years 2020, 2030, 2040, 2050, and 2060 were compiled or projected based on available data. The baseline model includes all withdrawals and discharges of at least 100,000 gallons per day under current conditions.

Demand and discharge projections for these entities were developed for each of the 10-year increments. A more detailed description of the model structure and entities included in the model are provided in the TM referenced above (CH2M HILL, 2010). The baseline run was used as the structure for the future scenarios. The only changes to the runs from the baseline condition are the projected demands and discharges, as described in the following sections.

Data Sources

The determination of entities to be evaluated was based on a preliminary draft of the model, data provided by NCDWR and VADEQ, and additional research. Table 1 shows the sources of data for both current and future demand and discharge estimates. A more detailed description of these sources is provided in Appendix A.

Public water supply information for North Carolina was derived primarily from Local Water Supply Plans (LWSPs). These documents provided water demand projections through 2050 for North Carolina PWSs. When available, Draft 2008 LWSPs were used. Although these are considered draft documents at present, they do provide a current estimate of water use and the most recent demand projections. Fortunately, all the significant municipalities in the North Carolina portion of the Roanoke River Basin have submitted 2008 LWSPs to the State. Baseline municipal demands and discharges for Virginia were derived from a spreadsheet provided by VADEQ describing historical demands and discharges.

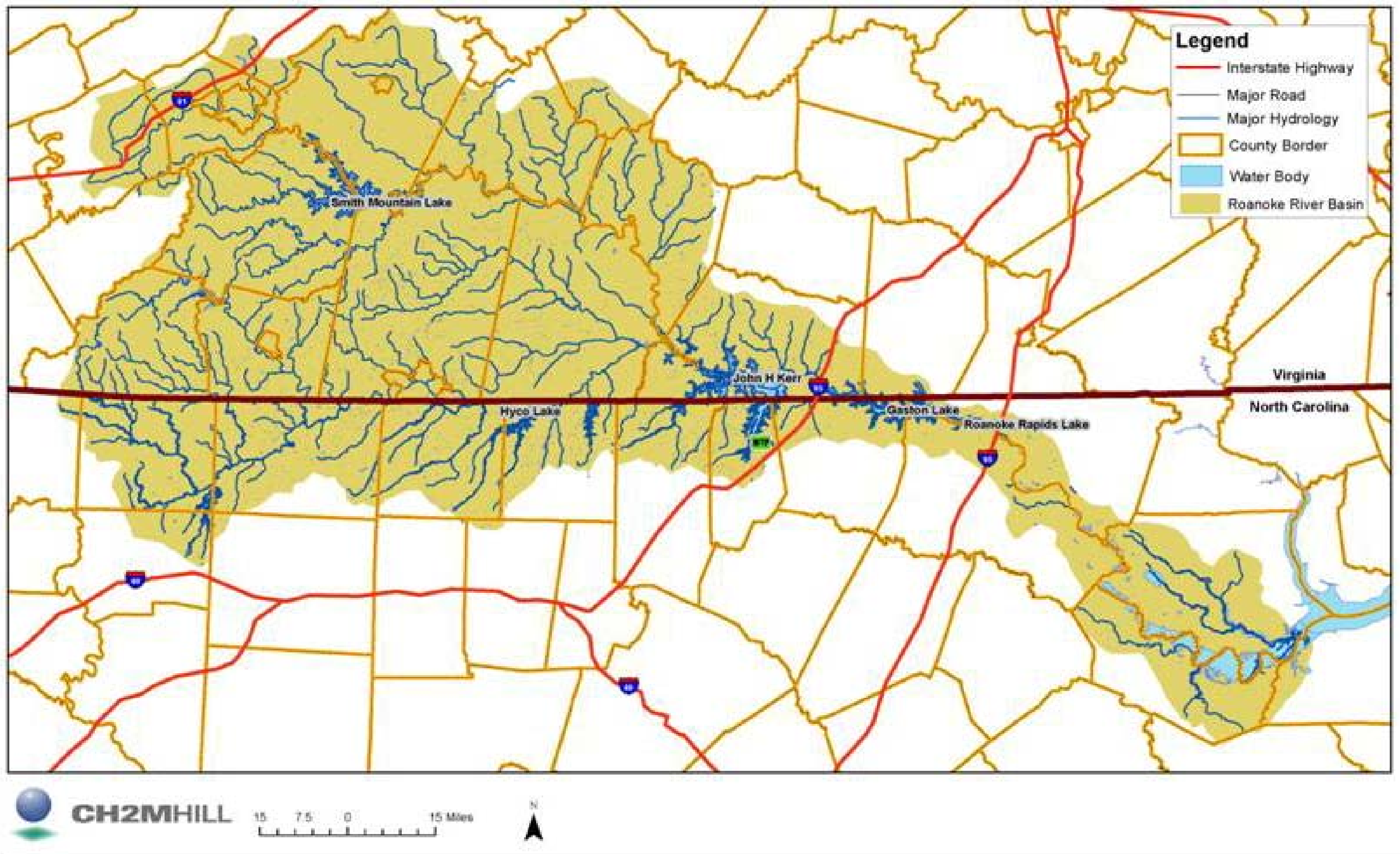


FIGURE 1
Roanoke River Basin Hydrologic Features

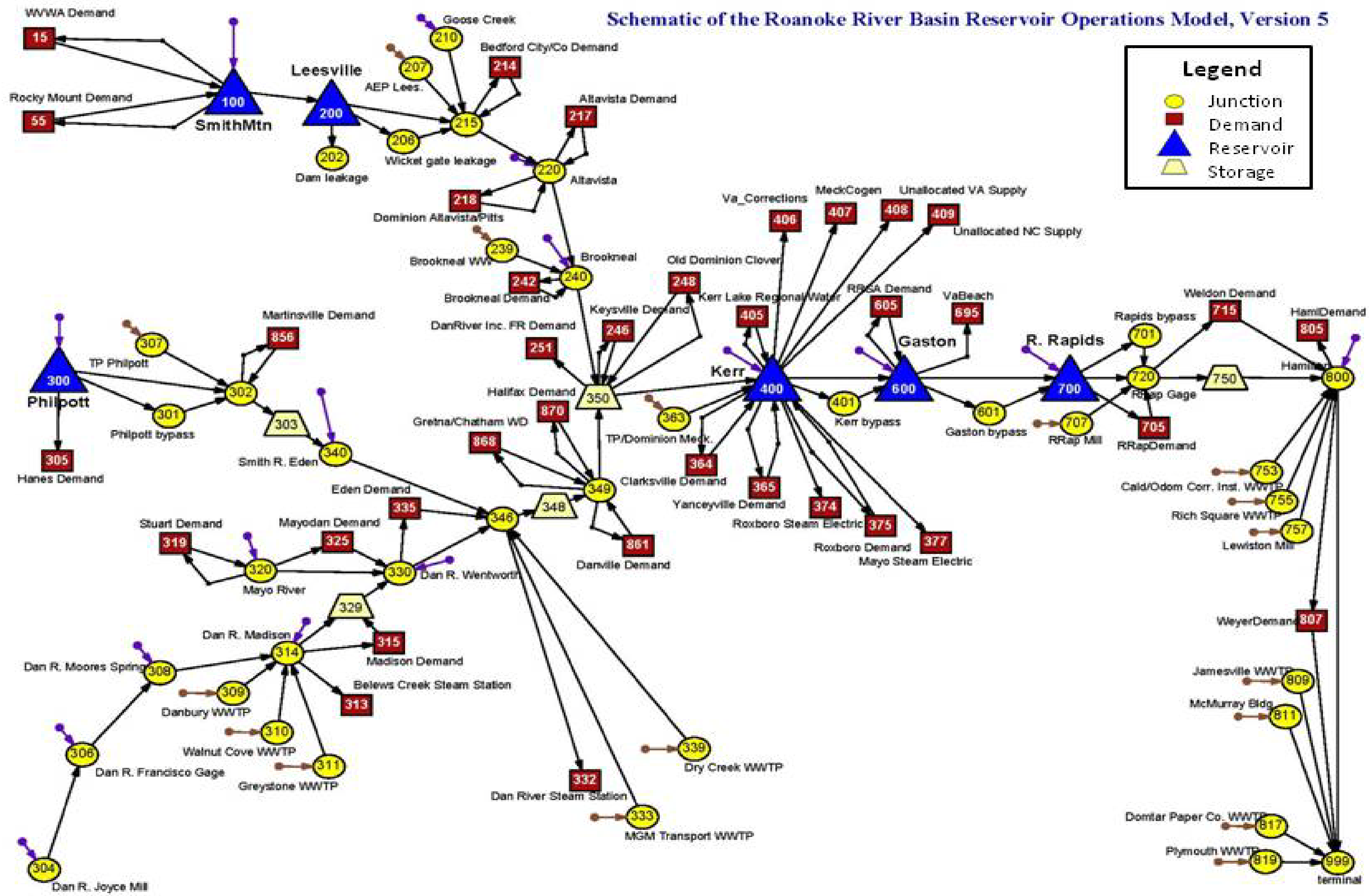


FIGURE 2
Schematic Showing the Roanoke River Basin Hydrologic Model Entities and Relationships

TABLE 1
Data Sources for Current and Future Demand and Discharge Estimations

Entity Type	Model Classification	State	Current Demand/Discharge Data Source	Future Demand/Discharge Data Source
Municipalities/ Authorities	Public Water Supply (PWS)	NC	NCDWR Local Water Supply Plans	Local Water Supply Plans
		VA	VADEQ Various websites	US Census data VA State projections
Agriculture	Irrigation (IRR)	NC	Implicitly included	Assume Constant
		VA	Implicitly included	Assume Constant
Industry/Rock Quarries	Self-supplied Industry (SSI)	NC	NCDWR Registered Withdrawals	Assume Constant
		VA	VADEQ Various websites	Assume Constant
Power Plants	Thermal Power Plants (TP)	NC	NCDWR	Assume Constant
		VA	VADEQ	Assume Constant

As noted in Table 1, water uses by agricultural entities are implicitly included in the model. During model development, Hydrologics quantified the demands and withdrawals above each calibration point and adjusted the model nonpoint source inflows to account for net losses in the basin. These included agricultural irrigation, evapotranspiration, and irrigation returns. For the future scenarios, the current relationships were assumed to also apply.

Industrial demands and discharges for North Carolina were compiled from water withdrawal information provided by NCDWR. Baseline industrial demands and discharges for Virginia were derived from a spreadsheet provided by VADEQ describing historical demands and discharges. The North Carolina and Virginia demands and discharges were compared with corresponding demands and discharges in the original model to verify the completeness of the list of entities.

Future Projections

One aspect of the IBT evaluation was to evaluate changes in water resources in the Roanoke River Basin with respect to future demands. This section describes the methods used to quantify the projected municipal demands and discharges for the future scenarios. The methodologies used were adapted to fit different data available from North Carolina and Virginia; therefore, the methodologies used are presented by state. As noted previously, agricultural, industrial, and power demands and associated discharges were maintained at current levels.

North Carolina

Public Systems

The 2008 LWSPs project water demand on 10-year intervals though 2050. For this reason, linear regressions were used to extrapolate to 2060 demands. Table 2 below shows the demand projections for the primary PWSs in the North Carolina portion of the Roanoke River Basin.

TABLE 2
NC Public Water Suppliers' Projected Demands (mgd)

Entity Name	2008	2010	2020	2030	2040	2050	2060[a]
Eden	8.20	11.34	11.50	9.62	9.86	10.03	10.20
Halifax County	8.47	9.76	10.46	10.64	10.64	10.64	10.64
KLRWS	6.54	8.37	14.49	19.94	24.66	29.38	34.10
Madison	0.61	1.41	2.17	2.58	3.03	3.34	3.65
Mayodan	0.65	1.31	1.43	1.56	1.70	1.86	2.02
Roanoke Rapids	5.08	6.92	6.88	6.84	6.80	6.76	6.72
Roxboro	2.84	4.80	5.00	5.20	5.50	5.75	6.00
Weldon	4.37	3.71	3.77	3.70	2.86	2.93	3.01
Yanceyville	0.36	0.48	0.64	0.88	1.08	1.26	1.45

Source: NC Draft 2008 LWSPs
[a] Extrapolated demand projections
[b] KLRWS projections were provided by EarthTech IBT projections

It is also important to project wastewater demands for dischargers. The LWSPs include annual average daily discharge (AADD) of wastewater discharge for the year the plan was submitted. For an entity with a Draft 2008 LWSP, discharge projections were determined by calculating their discharge as a percentage of demand in the base year of 2008 and holding this ratio constant through 2060. Table 3 shows the factor of discharge as a percentage of demand. The percentage calculated in Table 3 was used to project discharge through 2060, as seen in Table 4.

For those that discharge all or a portion of their wastewater to the Roanoke River basin, the discharge is important for estimating IBT and evaluating impacts with the RRBHM. For communities that discharge to a receiving basin, this estimate is important for evaluating future impacts of the transfer in the receiving basins.

TABLE 3
Discharge Projection Factors Based on 2008 LWSPs

Entity Name	Total Demand (mgd)	Discharge (mgd)	Percent Return
City of Eden	8.20	6.69	81.7%
City of Henderson	6.54	2.56 [a]	39.1%
Town of Mayodan	0.65	1.03 [b]	158.2%
Roanoke Rapids Sanitary District	5.08	4.00	78.8%
City of Roxboro	2.84	1.86	65.4%
Town of Weldon	4.37	0.94	21.5%
Town of Yanceyville	0.36	0.28	78.9%
Town of Madison	0.61	0.02 b	3.3%

Source: NC Draft 2008 LWSP and EarthTech IBT projections
[a] The majority of the entities partnered with KLWRS discharge their wastewater to the Tar River Basin. The City of Henderson is the only entity that discharges back to the Roanoke River Basin. The discharge reported for KLRWS comes from the Kerr Lake Regional WTP (0.12) and the Henderson WRF (2.44). Discharge projections are based on EarthTech IBT projections.
[b] Wastewater from the Town of Madison is also handled by the Mayodan Wastewater Treatment Plant (WWTP)

TABLE 4
NC Public Water Supply NPDES Permit Holders and Discharge Projections

		Discharge Projections by Year (mgd)					
Permit Holder	**Permit Name**	**2010**	**2020**	**2030**	**2040**	**2050[a]**	**2060[a]**
Eden	Dry Creek WWTP	0.31	0.32	0.26	0.27	0.28	0.28
Eden	Mebane Bridge WWTP	8.95	9.07	7.59	7.78	7.91	8.05
Henderson	Henderson WRF	2.54	2.88	3.10	3.41	3.72	4.02
Henderson	Kerr Lake Regional WTP	0.15	0.26	0.36	0.45	0.54	0.63
Mayodan	Mayodan WWTP	1.97	2.15	2.34	2.56	2.80	3.04
Mayodan	Mayodan WTP	0.05	0.06	0.06	0.07	0.07	0.08
Roanoke Rapids Sanitary District	Roanoke Rapids WWTP	5.45	5.43	5.39	5.36	5.33	5.29
Roxboro	Roxboro WWTP	3.14	3.27	3.40	3.60	3.76	3.92
Weldon	Weldon WWTP	0.80	0.81	0.80	0.62	0.63	0.65
Yanceyville	Yanceyville WWTP	0.32	0.43	0.59	0.73	0.86	0.98
Yanceyville	Yanceyville WTP	0.05	0.07	0.10	0.12	0.14	0.16
Madison	Town of Madison WWTP	0.05	0.07	0.08	0.10	0.11	0.12

Source: NC Draft 2008 LWSPs and EarthTech IBT projections
[a] Extrapolated discharge projections

A number of smaller municipalities did not have 2007 or 2008 LWSPs. Coincidentally, these PWS do not withdraw surface water from the Roanoke River Basin, since they use groundwater for supply, but they do discharge to the basin. For these municipalities, discharges were determined using their 2002 LWSP data. Year 2040, 2050, and 2060 returns were projected using the same linear regression approach as computed for 2008 LWSPs. Table 5 shows the projected discharges for the PWS entities that do not directly withdraw from the Roanoke River Basin.

There are a few PWS entities in North Carolina that do not develop their own LWSPs, but were considered based on their inclusion in the 1989 model and conversations with NCDWR. The Department of Correction at Odom, in Orange County, NC, and the Caledonia WWTP in Halifax County, NC were recommended for inclusion. Their projections were developed using the same method for NC entities with a LWSP, but based on a 2002 LWSP for Orange County and a 2008 LWSP for Halifax County.

TABLE 5
Discharge Projections Based on NC 2002 LWSP

	Discharge Projections by Year (mgd)							
WWTP	**2002**	**2007[a]**	**2010**	**2020**	**2030**	**2040[a]**	**2050[a]**	**2060[a]**
Lewiston-Woodville	0.07	0.09	0.10	0.09	0.09	0.09	0.09	0.09
Plymouth	0.58	0.48	0.41	0.41	0.41	0.41	0.41	0.41
Walnut Cove	0.19	0.20	0.20	0.22	0.24	0.27	0.29	0.32
Williamston	0.89	1.10	1.23	1.33	1.45	1.56	1.68	1.79
Windsor	0.34	0.36	0.36	0.34	0.36	0.37	0.38	0.39

Source: NC 2002 LWSP
[a] Extrapolated discharge projections

Irrigation, Industry, and Power Plants

For non-PWS components, several sources were evaluated to verify the demands and discharges; however, no projections were made. As noted above, water use for agriculture, industrial, and power entities were held constant. Declining agricultural activity and industrial production suggest that these demands may be decreasing in the future. Although power production may increase in the future, current technologies have significantly reduced water use and in many cases, a new generation facility will replace older facilities, with a net decrease in water demand. The consumption from these facilities was assumed to be constant. For those entities with demands and discharges that could not be verified by additional data sources conservatively, the values used in the 1989 model were incorporated. Appendix B contains a list of NC and VA Self-Supplied Industry (SSI) and Power Plant (TP) entities that were included in the model update. Below is a list of the some of the sources used for evaluating non-PWS demands and discharges; more detailed information for these sources is provided in Appendix A:

- NCDWR Registered Withdrawal Annual Reports
- NC Division of Water Quality (NCDWQ) Basinwide Information Management System (BIMS) Reports

- U.S. Environmental Protection Agency (USEPA) Permit Compliance System (PCS) database of National Pollutant Discharge Elimination System (NPDES) Permits
- NPDES Discharge Monitoring Reports (DMRs)
- Central Coastal Plain Capacity Use Area (CCPCUA) Query

Virginia

Virginia is currently establishing a program that requires the development of Water Supply Plans (WSPs). Draft reports for municipalities with a population of more than 15,000 are expected to be released in the near future. WSPs for smaller municipalities are not required until November 2010. For Virginia PWS components historical withdrawal and discharge data were provided by VADEQ. Per capita rates for withdrawals and discharges were based on these data and the 2007 population and these rates were used with population projects to project future water demand and associated discharges. This approach assumes that future demand is primarily a function of residential growth. Additional research was done to clarify components of the original model and validate data received from VADEQ. One of the main documents used for data validation was the 2003 Comprehensive Economic Development Strategy (CEDS) for the Virginia Western Piedmont Economic Development District.

Population Projections

The Virginia Workforce Connection website houses US Census data for 1990 and 2000, as well as Virginia population projections on a county and city level for 2010, 2020, and 2030. A population growth rate was determined using Years 1990 and 2030. This growth rate was then calculated as a percentage of population in 2000, K_a in Equation 1.

Equation 1. *Population growth rate as a percentage of population in the year 2000*

$$K_{a_{2000}} = \frac{\Delta P}{\Delta T} = \frac{(P_2 - P_1)}{(T_2 - T_1)\cdot P_{2000}}$$

In Equation 1, P_2 represents the year being projected and P_1 represents the previous data point. For the purpose of estimating K_a, an average was calculated for the change in population over various 10-year intervals. Once the growth rate was calculated, the population was projected using Equation 2.

Equation 2. *Population projection as a function of growth rate*

$$P_2 = K_{a_{2000}} \cdot P_{a_{2000}} \cdot (T_2 - T_1) + P_1$$

This method was applied for all counties and cities containing a demand or discharge as provided by VADEQ, as seen in Appendix C.

Demand and Discharge Projections

Baseline demands were compiled based on information from VADEQ and the original Roanoke River Basin model. Discharge information was compiled from the USEPA's PCS database and information provided by VADEQ. VADEQ data contained records for each year that the discharge or demand was reported as being over 0.1 mgd. The average ratio of demand and discharge to population was assumed to remain constant throughout the planning period. Projections were made using Equation 3.

Equation 3. *Demand and discharge projection as a function of population*

$$D_2 = D_1 \times \left(P_2 / P_1 \right)$$

Table 6 shows the Virginia PWS withdrawals evaluated, their base year demand, data source, the city or county associations made for projection purposes, and the demand and discharge projections for each of those entities.

TABLE 6
Virginia PWS Demand Projections

Entity Name	Withdrawal (mgd)	Source	Association	Projection (mgd) 2002	2007	2010	2020	2030	2034	2040	2050	2060
Altavista Service Area – Roanoke River	1.22	VADEQ	Altavista	1.22	1.22	1.24	1.29	1.35	1.37	1.4	1.46	1.51
Altavista Service Area – Reed Creek	0.4	VADEQ	Altavista	0.40	0.40	0.41	0.42	0.44	0.45	0.46	0.48	0.49
Bedford (City) Water Treatment Plant (WTP) – Big Otter River	0.17	VADEQ	Bedford City	0.17	0.17	0.17	0.17	0.17	0.16	0.16	0.16	0.16
Bedford (City) WTP – Stoney Creek Reservoir	1.13	VADEQ	Bedford City	1.13	1.13	1.12	1.1	1.1	1.1	1.09	1.09	1.08
Blackwater River WTP	1.02	2003 CEDS	Rocky Mount	1.02	1.11	1.14	1.27	1.39	1.44	1.51	1.64	1.76
Brookneal WTP	0.14	VADEQ	Brookneal	0.14	0.14	0.14	0.15	0.16	0.16	0.16	0.17	0.18
Chatham WTP	0.42	VADEQ	Chatham	0.42	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.50
Clarksville WTP	0.28	VADEQ	Clarksville	0.28	0.28	0.28	0.29	0.30	0.30	0.30	0.31	0.32
Danville Industrial WTP	0.94	VADEQ	Danville City	0.94	0.94	0.92	0.93	0.94	0.92	0.90	0.86	0.83
Danville WTP	7.78	VADEQ	Danville City	7.78	7.78	7.64	7.67	7.72	7.61	7.43	7.13	6.84
Gretna WTP	0.21	VADEQ	Gretna	0.21	0.21	0.21	0.22	0.23	0.23	0.23	0.24	0.25
Halifax (Town)	0.17	VADEQ	Halifax	0.17	0.17	0.18	0.18	0.19	0.19	0.19	0.20	0.20
High Point Service Area	0.16	VADEQ	Bedford County	0.16	0.16	0.17	0.19	0.21	0.22	0.23	0.26	0.28
Keysville WTP	0.14	VADEQ	Charlotte County	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
Martinsville WTP	4.13	VADEQ	Martinsville City	4.13	4.13	4.04	3.92	3.92	3.86	3.77	3.61	3.46

TABLE 6
Virginia PWS Demand Projections

Entity Name	Withdrawal (mgd)	Source	Association	Projection (mgd)								
				2002	2007	2010	2020	2030	2034	2040	2050	2060
Roanoke River Service Authority (RRSA) – Lake Gaston	1.41	VADEQ	Mecklenburg County	1.41	1.41	1.41	1.42	1.43	1.44	1.46	1.50	1.54
Salem WTP	4.20	VADEQ	Salem City	4.20	4.20	4.18	4.15	4.15	4.16	4.17	4.19	4.20
South Boston WTP	1.842	1989 Model	South Boston	1.84	1.88	1.90	1.96	2.02	2.04	2.08	2.14	2.20
Stuart WTP	0.28	VADEQ	Patrick County	0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.29	0.30
VA Beach	25.20	VADEQ	Virginia Beach	25.20	25.20	25.95	27.25	28.57	29.15	30.02	31.47	32.91
Western Virginia Water Authority (WVWA) - Falling Cr/Beaverdam Cr WTP	0.70	VADEQ	Roanoke County	0.70	0.70	0.71	0.77	0.82	0.84	0.87	0.92	0.97
WVWA –Roanoke City - Carvins Cove	8.41	VADEQ	Roanoke City	8.41	8.41	8.28	8.11	8.11	8.04	7.93	7.75	7.57
WVWA - Spring Hollow WTP	4.86	VADEQ	Roanoke County	4.86	4.86	4.96	5.32	5.69	5.83	6.05	6.40	6.76

Table 7 shows the Virginia discharge entities evaluated, the data source for the base year discharge, the city or county associations made for projection purposes, and the discharge projections for each of those entities.

TABLE 7
Virginia PWS Discharge Projections

Name	Discharge (mgd)	Source	Association	Projection (mgd)								
				2002	2007	2010	2020	2030	2034	2040	2050	2060
Altavista WWTP	2.14	VADEQ	Altavista	2.14	2.14	2.17	2.26	2.36	2.40	2.45	2.55	2.65
Appomattox Trickling Filter Plant	0.13	VADEQ	Appomattox	0.13	0.13	0.13	0.13	0.14	0.14	0.15	0.15	0.16
Bedford (City) WWTP	0.99	VADEQ	Bedford City	0.99	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.95
Briarwood Village Mobile Home Park Sewage Treatment Plant (STP)	0.11	VADEQ	Albemarle County	0.11	0.11	0.12	0.13	0.15	0.15	0.16	0.18	0.19
Brookneal Town - Falling River Lagoon	0.11	VADEQ	Brookneal	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.13	0.13
Brookneal Town - Staunton River Lagoon	0.10	VADEQ	Brookneal	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.12	0.13
Brookneal WTP	0.17	VADEQ	Brookneal	0.17	0.17	0.18	0.18	0.19	0.19	0.20	0.21	0.21
Campbell County CWS - Rustburg Service Area	0.10	VADEQ	Campbell County	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.12
Chatham WWTP	0.31	VADEQ	Chatham	0.31	0.31	0.31	0.32	0.33	0.33	0.34	0.35	0.36
Clarksville WWTP	0.26	VADEQ	Clarksville	0.26	0.26	0.26	0.26	0.27	0.27	0.28	0.28	0.29
Dan River - Schoolfield Complex	0.19	VADEQ	Danville City	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.17	0.16
Danville WTP	0.41	VADEQ	Danville City	0.41	0.41	0.40	0.40	0.41	0.40	0.39	0.38	0.36
Danville WWTP	5.49	VADEQ	Danville City	5.49	5.49	5.39	5.41	5.45	5.37	5.24	5.03	4.83
Department of Correction - Baskerville	0.33	VADEQ	Mecklenburg County	0.33	0.33	0.33	0.33	0.33	0.34	0.34	0.35	0.36
Ferrum Town - Sewage Treatment Plant	0.17	VADEQ	Franklin County	0.17	0.17	0.18	0.20	0.21	0.22	0.23	0.25	0.27

TABLE 7
Virginia PWS Discharge Projections

Name	Discharge (mgd)	Source	Association	Projection (mgd) 2002	2007	2010	2020	2030	2034	2040	2050	2060
Gretna WTP	0.20	VADEQ	Gretna	0.20	0.20	0.2	0.21	0.22	0.22	0.22	0.23	0.23
Gretna WWTP	0.15	VADEQ	Gretna	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.17	0.17
Henry Co PSA	0.22	VADEQ	Henry County	0.22	0.22	0.21	0.21	0.21	0.21	0.20	0.20	0.20
Keysville WWTP	0.13	VADEQ	Charlotte County	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
Mecklenburg Co Schools Bluestone High School	1.16	VADEQ	Mecklenburg County	1.16	1.16	1.16	1.17	1.18	1.19	1.21	1.24	1.27
Montgomery County Public Service Authority (PSA) - Elliston-Lafayette WWTP	0.12	VADEQ	Montgomery County	0.12	0.12	0.12	0.12	0.13	0.14	0.14	0.15	0.16
Rocky Mount	0.82	VADEQ	Rocky Mount	0.82	0.82	0.84	0.93	1.02	1.06	1.12	1.21	1.30
RRSA - WTP	0.15	VADEQ	Mecklenburg County	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16
RRSA - Roanoke County Service Area	0.22	PCS	Roanoke County	0.22	0.23	0.24	0.25	0.27	0.28	0.29	0.30	0.32
South Hill WWTP	0.93	VADEQ	South Hill	0.93	0.93	0.94	0.96	0.99	1.00	1.01	1.03	1.06
Shawsville Sewage Treatment Plant	0.12	VADEQ	Montgomery County	0.12	0.12	0.12	0.13	0.13	0.14	0.14	0.15	0.16
South Boston - Maple Ave WWTP	1.57	VADEQ	South Boston	1.57	1.57	1.59	1.64	1.68	1.70	1.73	1.78	1.83
Stuart STP	0.26	VADEQ	Patrick County	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.27	0.27
WVWA - Carvins Cove Water Filtration Plant (FP)	0.44	VADEQ	Roanoke County	0.44	0.44	0.45	0.48	0.52	0.53	0.55	0.58	0.62
WVWA – Water Pollution Control Plant	63.75	VADEQ	Roanoke County	63.75	63.75	65.15	69.87	74.69	76.56	79.37	84.06	88.74

Irrigation, Industry, Power Plants

For non-PWS components, where no projection was made in the 1989 NCDWR model, the consumption was assumed to be constant. Additional research, including the USEPA's Permit Compliant System, was performed to verify current demands and discharges. Appendix B contains a list of NC and VA SSI and TP entities recommended for the model update.

Summary

Table 8 below shows a summary of all demands and discharges for the Roanoke River basin for the planning period.

TABLE 8
Total Demands and Discharges for the Roanoke River Basin (mgd)

Total Demands and Discharges for the Roanoke River Basin (mgd)								
	2007	**2010**	**2020**	**2030**	**2034**	**2040**	**2050**	**2060**
Demand	258	270	280	286	289	293	300	308
Discharge	175	183	190	195	197	201	208	214
Net Demand	83	87	90	92	92	92	93	94

References

Virginia Department of Environmental Quality. 2003. Comprehensive Economic Development Strategy. Prepared for the Virginia Western Piedmont Economic Development District.

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NCDWR Draft 2008 Local Water Supply Plans, Sub-basin search - Roanoke River (14-1) http://www.ncwater.org/Water_Supply_Planning/Local_Water_Supply_Plan/search.php. Accessed by Toya Ogallo, 8, February, 2010

NCDWR Water Withdrawal and Transfer Registration Annual Water Use Reports, http://www.ncwater.org/Permits_and_Registration/Water_Withdrawal_and_Transfer_Registration/report. Accessed January, 2010

NC Division of Water Quality (NCDWQ) Basinwide Information Management System (BIMS), Permit Reports, http://h2o.enr.state.nc.us/bims/reports/reports.html. Accessed September 2009.

U.S. Environmental Protection Agency (USEPA) Permit Compliance System (PCS) database of National Pollution Discharge Elimination System (NPDES) permits, http://www.epa.gov/enviro/html/pcs/pcs_query_java.html. Accessed June 2009 through April 2010

Virginia Workforce Connection, Decennial Census and State Demographer Projections http://www.vawc.virginia.gov/analyzer/populatchoice.asp?cat=HST_DEMOG&session=populat&time=&geo=/. Accessed March 2009.

Appendix A
Data Sources Used in Demand and Discharge Projections

Model Classification	State	Source	Data - General	Data – Specific	Access/Contact	Date Accessed/ Received
General	NC VA	USEPA	Water Discharge Permits Permit Compliance System Database	Various queries by facility name and NPDES ID	http://www.epa.gov/enviro/html/pcs/pcs_query_java.html	July 2009 – March 2010
	NC	NCDWR	List of NPDES dischargers in Roanoke River Basin	Active_Roanoke_NPDES.xls	E-mail correspondence with Steve Nebiker, Hydrologics	September 28, 2009
	VA	VADEQ	Surface Water Withdrawals Virginia Pollutant Discharge Elimination System (VPDES) Individual Permits Nonmetallic mining VPDES Permits	Henderson_030110.xls	E-mail correspondence with Jason Ericson, VADEQ, Office of Ground and Surface Water Supply Planning	March 1, 2010
PWS	NC	NCDWR	2002 LWSPs	Lewiston-Woodville, Plymouth, Walnut Cove, Williamston, Windsor	http://www.ncwater.org/Water_Supply_Planning/Local_Water_Supply_Plan/search.php	July and August 2009
			2008 Draft LWSPs	Yanceyville, Eden, Halifax, Hamilton, Kerr Lake, Madison, Mayodan, Roanoke Rapids, Roxboro, Warrenton, Weldon	E-mail correspondence with Toya Ogallo, NCDWR, River Basin Management Section	February 8, 2010
	VA	CEDS	2003 Report for West Piedmont Economic Development District	Danville-Chatham, Martinsville-Henry, Hurt-Gretna, Rocky-Mount Boones Mill, Stuart-Patrick Springs	http://www.wppdc.org/	January 2010
Self-supplied Industry (SSI)	NC	NCDWR	2007 Water Withdrawal and Transfer Registration – Annual Water Use Report	Roanoke Rapids Mill, Perdue Farms, Reidsville Quarry, Shelton Quarry, Greystone Quarry, Transco	http://www.ncwater.org/Permits_and_Registration/Water_Withdrawal_and_Transfer_Registration/report	January 2010
			Central Coastal Plain Use Area	Query of Registered Facilities - Domtar	http://www.ncwater.org/Permits_and_Registration/Capacity_Use/Central_Coastal_Plain/	January 2010
Thermal Power plants (TP)	NC	NCDWR	Surface Water Withdrawals Reported to NCDWR under GS143-215.22H	DE_PE NC Power Plant Withdrawals.xlsx	Compiled by D. Rayno of NCDWR from Water Withdrawal Registration data submitted to NCDWR, Sent via e-mail by Steve Nebiker of Hydrologics	September 28, 2009

Appendix B
Non-PWS Demands and Discharges in NC and VA

ATTACHMENT II - APPENDIX B

Non-PWS Demands and Discharges in NC and VA

State	Type	Reservoir	Name	1989 Model	Source	Withdrawal	Discharge
NC	SSI	Kerr	ITG/Burlington Demand		NC DWQ	1.63	2.01
NC	SSI	Roanoke Rapids	RRapMill		2008 Reg Withdrawal Report	19.80	21.14
NC	SSI	Albermarle	SSI - Bertie County		1989 Model	0.36	-
NC	SSI	Hamilton	SSI - Halifax County		1989 Model	1.30	0.00
NC	SSI	Albermarle	SSI - Martin - Weyerhaeuser		1989 Model	11.58	-
NC	SSI	Kerr	SSI - Rockingham - MillerCoors WWTP		NC DWQ	-	1.79
NC	SSI	Albermarle	SSI - Washington -Domtar		CCPCUA and PCS DMR	64.43	34.30
NC	TP	Kerr	TP - Person - Mayo Steam Electric		2008 Reg Withdrawal Report	7.9 (net)	-
NC	TP	Kerr	TP - Rockingham -Dan River Steam Station		2008 Reg Withdrawal Report	1.9 (net)	-
NC	TP	Kerr	TP - Stokes -Belews Creek Steam Station		2008 Reg Withdrawal Report	12.7 (net)	-
NC	TP	Albermarle	TP -Washington County		1989 Model	11.6 (net)	-
VA	SSI	Smith Mountain	Adams Construction Co - Fowler Sand Plant		VA DEQ	-	1.08
VA	SSI	Smith Mountain	Boxley Materials Company - Blue Ridge		VA DEQ	-	0.67
VA	SSI	Kerr	Boxley Materials Company - Fieldale Plant		VA DEQ	-	1.25
VA	SSI	Kerr	DAN RIVER INC		VA DEQ	0.96	0.37
VA	SSI	Smith Mountain	Koppers Ind Demand		VA DEQ	1.00	-
VA	SSI	Smith Mountain	NORFOLK SOUTHERN CORP		VA DEQ	1.76	-
VA	SSI	Smith Mountain	SSI - Bedford - Blue Ridge Wood Preserving Inc		VA DEQ	-	0.18
VA	SSI	Kerr	SSI - Campbell - BOXLEY MATERIALS COMPANY - LAWYERS ROAD PLANT		VA DEQ	0.86	-
VA	SSI	Kerr	SSI - Campbell - BOXLEY MATERIALS COMPANY - LAWYERS ROAD PLANT		VA DEQ	0.18	-
VA	SSI	Smith Mountain	SSI - Franklin - Ronile Incorporated		VA DEQ	-	0.11
VA	SSI	Smith Mountain	SSI - Franklin - THE WATER FRONT - GOLF COURSE		VA DEQ	0.12	-
VA	SSI	Smith Mountain	SSI - Franklin - TSO of Virginia		VA DEQ	-	0.17
VA	SSI	Kerr	SSI - Henry - BASSETT FURNITURE INDUSTRIES		VA DEQ	0.16	-
VA	SSI	Kerr	SSI - Henry -BOXLEY MATERIALS COMPANY - MARTINSVILLE PLANT		VA DEQ	0.18	-
VA	SSI	Kerr	SSI - Henry -BOXLEY MATERIALS COMPANY - MARTINSVILLE PLANT		VA DEQ	0.26	-
VA	SSI	Kerr	SSI - Henry -CPFILMS INC - Fieldale Plant		VA DEQ	1.14	0.62
VA	SSI	Philpott	SSI - Patrick HANES BRANDS INC		VA DEQ	0.14	0.35
VA	SSI	Kerr	SSI - Pittsylvania - TUSCARORA COUNTRY CLUB		VA DEQ	0.11	-
VA	SSI	Kerr	SSI - Pittsylvania - VIRGINIA ELECTRIC		VA DEQ	0.61	-
VA	SSI	Kerr	SSI - Pittsylvania -Corning Inc - Danville		VA DEQ	-	0.14
VA	SSI	Smith Mountain	SSI - Roanoke - Kinder Morgan Southeast Terminals LLC - Roanoke		VA DEQ	-	0.13
VA	SSI	Smith Mountain	SSI - Roanoke - Marathon Petroleum Company LLC - Roanoke Terminal		VA DEQ	-	0.18

State	Type	Reservoir	Name	1989 Model	Source	Withdrawal	Discharge
VA	SSI	Smith Mountain	SSI - Roanoke - Transmontaigne Montvale Atlantic Terminal		VA DEQ	-	0.78
VA	SSI	Smith Mountain	SSI - Roanoke - Western Energy Montvale Terminal		VA DEQ	-	0.14
VA	SSI	Kerr	VULCAN CONSTRUCTION MATERIALS		VA DEQ	0.16	1.49
VA	SSI	Kerr	Vulcan Construction Materials - Chatham		VA DEQ	-	0.39
VA	TP	Kerr	Dominion - Altavista Power Station		VA DEQ	0.43	0.22
VA	TP	Kerr	Dominion - Mecklenburg Power Station		VA DEQ	-	0.49
VA	TP	Kerr	Dominion - Pittsylvania Power Station		VA DEQ	-	0.11
VA	TP	Kerr	Old Dominion Demand (Clover Plant)		VA DEQ	9.18	1.05
VA	TP	Kerr	SSI - Bedford -AEP - Smith Mountain Hydro Plant		VA DEQ	-	2.37
VA	TP	Kerr	TP - Campbell - AEP - Leesville Hydro Plant		VA DEQ	-	0.66
VA	TP	Kerr	TP - Mecklenburg -John H Kerr Powerhouse		VA DEQ	-	0.55
VA	TP	Philpott	TP - Patrick - Philpott Dam Hydroelectric Plant		VA DEQ	-	0.31
VA	TP	Kerr	TP - Pittsylvania - Roxboro Steam Electric		2008 Reg Withdrawal Report	1 (net)	-

Appendix C
Virginia County Population Projections

ATTACHMENT II - APPENDIX C

VirginIa PWS Demand and Discharge Projections

Source	Name	Withdrawal	Dishcarge	Association	Projection (MGD)								
		(MGD)	(MGD)		2002	2007	2010	2020	2030	2034	2040	2050	2060
VA DEQ	ALTAVISTA SERVICE AREA	0.40	-	Altavista	0.40	0.40	0.41	0.42	0.44	0.45	0.46	0.48	0.49
VA DEQ	ALTAVISTA SERVICE AREA	1.22	-	Altavista	1.22	1.22	1.24	1.29	1.35	1.37	1.40	1.46	1.51
VA DEQ	ALTAVISTA WWTP	-	2.14	Altavista	2.14	2.14	2.17	2.26	2.36	2.40	2.45	2.55	2.65
VA DEQ	Appomattox Trickling Filter Plant	-	0.13	Appomattox	0.13	0.13	0.13	0.13	0.14	0.14	0.15	0.15	0.16
VA DEQ	BEDFORD (CITY) WTP	0.12	-	Bedford City	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
VA DEQ	BEDFORD (CITY) WTP / WWTP	-	0.99	Bedford City	0.99	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.95
VA DEQ	BEDFORD (CITY) WTP / WWTP	0.92		Bedford City	0.92	0.92	0.91	0.89	0.89	0.89	0.89	0.89	0.88
VA DEQ	Bedford County PSA - HIGH POINT SERVICE AREA	0.16	-	Bedford County	0.16	0.16	0.17	0.19	0.21	0.22	0.23	0.26	0.28
VA DEQ	Briarwood Village Mobile Home Park STP	-	0.11	Albemarle County	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
VA DEQ	Brookneal Town - Falling River Lagoon	-	0.11	Brookneal	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.13	0.13
VA DEQ	Brookneal Town - Staunton River Lagoon	-	0.10	Brookneal	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.12	0.13
VA DEQ	BROOKNEAL WTP	-	0.17	Brookneal	0.17	0.17	0.18	0.18	0.19	0.19	0.20	0.21	0.21
VA DEQ	BROOKNEAL WTP	0.14		Brookneal	0.14	0.14	0.14	0.15	0.16	0.16	0.16	0.17	0.18
VA DEQ	CAMPBELL COUNTY CWS - RUSTBURG SERVICE AREA	-	0.10	Campbell County	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.12
VA DEQ	CHATHAM WTP	-	0.31	Chatham	0.31	0.31	0.31	0.32	0.33	0.33	0.34	0.35	0.36
VA DEQ	CHATHAM WTP	0.42		Chatham	0.42	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.50
VA DEQ	CLARKSVILLE WTP	-	0.26	Clarksville	0.26	0.26	0.26	0.26	0.27	0.27	0.28	0.28	0.29
VA DEQ	CLARKSVILLE WTP	0.28		Clarksville	0.28	0.28	0.28	0.29	0.30	0.30	0.30	0.31	0.32
VA DEQ	Dan River - Schoolfield Complex	-	0.19	Danville City	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.17	0.16
VA DEQ	DANVILLE INDUSTRAL WTP	0.94	-	Danville City	0.94	0.94	0.92	0.93	0.94	0.92	0.90	0.86	0.83
VA DEQ	DANVILLE WTP	-	0.41	Danville City	0.41	0.41	0.40	0.40	0.41	0.40	0.39	0.38	0.36
VA DEQ	DANVILLE WTP	7.78		Danville City	7.78	7.78	7.64	7.67	7.72	7.61	7.43	7.13	6.84
VA DEQ	DANVILLE WWTP	-	5.49	Danville City	5.49	5.49	5.39	5.41	5.45	5.37	5.24	5.03	4.83
VA DEQ	Department of Correction - Baskerville	-	0.33	Mecklenburg County	0.33	0.33	0.33	0.33	0.33	0.34	0.34	0.35	0.36
VA DEQ	Ferrum Town - Sewage Treatment Plant	-	0.17	Franklin County	0.17	0.17	0.18	0.20	0.21	0.22	0.23	0.25	0.27
VA DEQ	GRETNA WTP	-	0.15	Gretna	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.17	0.17
VA DEQ	GRETNA WTP	0.20		Gretna	0.20	0.20	0.20	0.21	0.21	0.21	0.22	0.22	0.23
VA DEQ	HALIFAX (TOWN)	-	0.21	Halifax	0.21	0.21	0.21	0.22	0.23	0.23	0.23	0.24	0.24
VA DEQ	HALIFAX (TOWN)	0.17		Halifax	0.17	0.17	0.18	0.18	0.19	0.19	0.19	0.20	0.20
VA DEQ	Henry Co PSA	-	0.22	Henry County	0.22	0.22	0.21	0.21	0.21	0.21	0.20	0.20	0.20
VA DEQ	KEYSVILLE WTP	-	0.13	Charlotte County	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
VA DEQ	KEYSVILLE WTP	0.14		Charlotte County	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
VA DEQ	MARTINSVILLE WTP	4.13	-	Martinsville City	4.13	4.13	4.04	3.92	3.92	3.86	3.77	3.61	3.46

VA DEQ	Mecklenburg Co Schools Bluestone High School	-	1.16	Mecklenburg County	1.16	1.16	1.16	1.17	1.18	1.19	1.21	1.24	1.27
VA DEQ	Montgomery County PSA - Elliston-Lafayette WWTP	-	0.12	Montgomery County	0.12	0.12	0.12	0.12	0.13	0.14	0.14	0.15	0.16
1989 Model	Roanoke City -TINKER CR-CATAWBA CR DIVERSION	4.677	-	Roanoke City	4.68	4.518877574	4.45	4.36	4.36	4.32	4.26	4.17	4.07
VA DEQ	Rocky Mount	-	0.82	Rocky Mount	0.82	0.82	0.84	0.93	1.02	1.06	1.12	1.21	1.30
2003 CEDS	Rocky Mount - BLACKWATER RIVER WTP	1.02	-	Rocky Mount	1.02	1.106422599	1.14	1.27	1.39	1.44	1.51	1.64	1.76
VA DEQ	RRSA	1.41	-	Mecklenburg County	1.41	1.41	1.41	1.42	1.43	1.44	1.46	1.50	1.54
VA DEQ	RRSA - BOYDTON SERVICE AREA	-	0.15	Mecklenburg County	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16
PCS	RRSA - ROANOKE COUNTY SERVICE AREA	-	0.22	Roanoke County	0.22	0.228650424	0.23	0.25	0.27	0.27	0.28	0.30	0.32
VA DEQ	RRSA - South Hill WWTP	-	0.93	South Hill	0.93	0.93	0.94	0.96	0.99	1.00	1.01	1.03	1.06
VA DEQ	SALEM OLD WTP 1	4.20	-	Salem City	4.20	4.20	4.18	4.15	4.15	4.16	4.17	4.19	4.20
VA DEQ	Shawsville Sewage Treatment Plant	-	0.12	Montgomery County	0.12	0.12	0.12	0.13	0.13	0.14	0.14	0.15	0.16
VA DEQ	South Boston - Maple Ave WWTP	-	1.57	South Boston	1.57	1.57	1.59	1.64	1.68	1.70	1.73	1.78	1.83
1989 Model	SOUTH BOSTON WTP	1.842	-	South Boston	1.84	1.882806193	1.90	1.96	2.02	2.04	2.08	2.14	2.20
VA DEQ	STUART WTP	-	0.26	Patrick County	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.27	0.27
VA DEQ	STUART WTP	0.28		Patrick County	0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.29	0.30
VA DEQ	VA Beach	25.20	-	Virginia Beach	25.20	25.20	25.44	26.22	27.04	27.37	27.88	28.74	29.63
VA DEQ	WVWA -FALLING CR/BEAVERDAM CR WTP	0.70	-	Roanoke County	0.70	0.70	0.71	0.77	0.82	0.84	0.87	0.92	0.97
VA DEQ	WWVA - Carvin's Cove	-	0.44	Roanoke County	0.44	0.44	0.45	0.48	0.52	0.53	0.55	0.58	0.62
VA DEQ	WWVA - ROANOKE (CITY) SERVICE AREA	8.41	-	Roanoke City	8.41	8.41	8.28	8.11	8.11	8.04	7.93	7.75	7.57
VA DEQ	WWVA - SPRING HOLLOW RESERVOIR	10.07	-	Roanoke County	10.07	10.07	10.29	11.03	11.79	12.09	12.53	13.27	14.01
VA DEQ	WWVA - SPRING HOLLOW WTP	4.86	-	Roanoke County	4.86	4.86	4.96	5.32	5.69	5.83	6.05	6.40	6.76
VA DEQ	WWVA - WPCP	-	63.75	Roanoke County	63.75	63.75	65.15	69.87	74.69	76.56	79.37	84.06	88.74

ATTACHMENT II - APPENDIX B

Non-PWS Demands and Discharges in NC and VA

State	Type	Reservoir	Name	1989 Model	Source	Withdrawal	Discharge
NC	SSI	Kerr	ITG/Burlington Demand		NC DWQ	1.63	2.01
NC	SSI	Roanoke Rapids	RRapMill		2008 Reg Withdrawal Report	19.80	21.14
NC	SSI	Albermarle	SSI - Bertie County		1989 Model	0.36	-
NC	SSI	Hamilton	SSI - Halifax County		1989 Model	1.30	0.00
NC	SSI	Albermarle	SSI - Martin - Weyerhaeuser		1989 Model	11.58	-
NC	SSI	Kerr	SSI - Rockingham - MillerCoors WWTP		NC DWQ	-	1.79
NC	SSI	Albermarle	SSI - Washington -Domtar		CCPCUA and PCS DMR	64.43	34.30
NC	TP	Kerr	TP - Person - Mayo Steam Electric		2008 Reg Withdrawal Report	7.9 (net)	-
NC	TP	Kerr	TP - Rockingham -Dan River Steam Station		2008 Reg Withdrawal Report	1.9 (net)	-
NC	TP	Kerr	TP - Stokes -Belews Creek Steam Station		2008 Reg Withdrawal Report	12.7 (net)	-
NC	TP	Albermarle	TP -Washington County		1989 Model	11.6 (net)	-
VA	SSI	Smith Mountain	Adams Construction Co - Fowler Sand Plant		VA DEQ	-	1.08
VA	SSI	Smith Mountain	Boxley Materials Company - Blue Ridge		VA DEQ	-	0.67
VA	SSI	Kerr	Boxley Materials Company - Fieldale Plant		VA DEQ	-	1.25
VA	SSI	Kerr	DAN RIVER INC		VA DEQ	0.96	0.37
VA	SSI	Smith Mountain	Koppers Ind Demand		VA DEQ	1.00	-
VA	SSI	Smith Mountain	NORFOLK SOUTHERN CORP		VA DEQ	1.76	-
VA	SSI	Smith Mountain	SSI - Bedford - Blue Ridge Wood Preserving Inc		VA DEQ	-	0.18
VA	SSI	Kerr	SSI - Campbell - BOXLEY MATERIALS COMPANY - LAWYERS ROAD PLANT		VA DEQ	0.86	-
VA	SSI	Kerr	SSI - Campbell - BOXLEY MATERIALS COMPANY - LAWYERS ROAD PLANT		VA DEQ	0.18	-
VA	SSI	Smith Mountain	SSI - Franklin - Ronile Incorporated		VA DEQ	-	0.11
VA	SSI	Smith Mountain	SSI - Franklin - THE WATER FRONT - GOLF COURSE		VA DEQ	0.12	-
VA	SSI	Smith Mountain	SSI - Franklin - TSO of Virginia		VA DEQ	-	0.17
VA	SSI	Kerr	SSI - Henry - BASSETT FURNITURE INDUSTRIES		VA DEQ	0.16	-
VA	SSI	Kerr	SSI - Henry -BOXLEY MATERIALS COMPANY - MARTINSVILLE PLANT		VA DEQ	0.18	-
VA	SSI	Kerr	SSI - Henry -BOXLEY MATERIALS COMPANY - MARTINSVILLE PLANT		VA DEQ	0.26	-
VA	SSI	Kerr	SSI - Henry -CPFILMS INC - Fieldale Plant		VA DEQ	1.14	0.62
VA	SSI	Philpott	SSI - Patrick HANES BRANDS INC		VA DEQ	0.14	0.35
VA	SSI	Kerr	SSI - Pittsylvania - TUSCARORA COUNTRY CLUB		VA DEQ	0.11	-
VA	SSI	Kerr	SSI - Pittsylvania - VIRGINIA ELECTRIC		VA DEQ	0.61	-
VA	SSI	Kerr	SSI - Pittsylvania -Corning Inc - Danville		VA DEQ	-	0.14
VA	SSI	Smith Mountain	SSI - Roanoke - Kinder Morgan Southeast Terminals LLC - Roanoke		VA DEQ	-	0.13
VA	SSI	Smith Mountain	SSI - Roanoke - Marathon Petroleum Company LLC - Roanoke Terminal		VA DEQ	-	0.18

State	Type	Reservoir	Name	1989 Model	Source	Withdrawal	Discharge
VA	SSI	Smith Mountain	SSI - Roanoke - Transmontaigne Montvale Atlantic Terminal		VA DEQ	-	0.78
VA	SSI	Smith Mountain	SSI - Roanoke - Western Energy Montvale Terminal		VA DEQ	-	0.14
VA	SSI	Kerr	VULCAN CONSTRUCTION MATERIALS		VA DEQ	0.16	1.49
VA	SSI	Kerr	Vulcan Construction Materials - Chatham		VA DEQ	-	0.39
VA	TP	Kerr	Dominion - Altavista Power Station		VA DEQ	0.43	0.22
VA	TP	Kerr	Dominion - Mecklenburg Power Station		VA DEQ	-	0.49
VA	TP	Kerr	Dominion - Pittsylvania Power Station		VA DEQ	-	0.11
VA	TP	Kerr	Old Dominion Demand (Clover Plant)		VA DEQ	9.18	1.05
VA	TP	Kerr	SSI - Bedford -AEP - Smith Mountain Hydro Plant		VA DEQ	-	2.37
VA	TP	Kerr	TP - Campbell - AEP - Leesville Hydro Plant		VA DEQ	-	0.66
VA	TP	Kerr	TP - Mecklenburg -John H Kerr Powerhouse		VA DEQ	-	0.55
VA	TP	Philpott	TP - Patrick - Philpott Dam Hydroelectric Plant		VA DEQ	-	0.31
VA	TP	Kerr	TP - Pittsylvania - Roxboro Steam Electric		2008 Reg Withdrawal Report	1 (net)	-

ATTACHMENT II - APPENDIX C

VirginIa PWS Demand and Discharge Projections

Source	Name	Withdrawal	Dishcarge	Association	Projection (MGD)								
		(MGD)	(MGD)		2002	2007	2010	2020	2030	2034	2040	2050	2060
VA DEQ	ALTAVISTA SERVICE AREA	0.40	-	Altavista	0.40	0.40	0.41	0.42	0.44	0.45	0.46	0.48	0.49
VA DEQ	ALTAVISTA SERVICE AREA	1.22	-	Altavista	1.22	1.22	1.24	1.29	1.35	1.37	1.40	1.46	1.51
VA DEQ	ALTAVISTA WWTP	-	2.14	Altavista	2.14	2.14	2.17	2.26	2.36	2.40	2.45	2.55	2.65
VA DEQ	Appomattox Trickling Filter Plant	-	0.13	Appomattox	0.13	0.13	0.13	0.13	0.14	0.14	0.15	0.15	0.16
VA DEQ	BEDFORD (CITY) WTP	0.12	-	Bedford City	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12	0.12
VA DEQ	BEDFORD (CITY) WTP / WWTP	-	0.99	Bedford City	0.99	0.99	0.98	0.97	0.97	0.96	0.96	0.96	0.95
VA DEQ	BEDFORD (CITY) WTP / WWTP	0.92		Bedford City	0.92	0.92	0.91	0.89	0.89	0.89	0.89	0.89	0.88
VA DEQ	Bedford County PSA - HIGH POINT SERVICE AREA	0.16	-	Bedford County	0.16	0.16	0.17	0.19	0.21	0.22	0.23	0.26	0.28
VA DEQ	Briarwood Village Mobile Home Park STP	-	0.11	Albemarle County	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11	0.11
VA DEQ	Brookneal Town - Falling River Lagoon	-	0.11	Brookneal	0.11	0.11	0.11	0.11	0.12	0.12	0.12	0.13	0.13
VA DEQ	Brookneal Town - Staunton River Lagoon	-	0.10	Brookneal	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.12	0.13
VA DEQ	BROOKNEAL WTP	-	0.17	Brookneal	0.17	0.17	0.18	0.18	0.19	0.19	0.20	0.21	0.21
VA DEQ	BROOKNEAL WTP	0.14		Brookneal	0.14	0.14	0.14	0.15	0.16	0.16	0.16	0.17	0.18
VA DEQ	CAMPBELL COUNTY CWS - RUSTBURG SERVICE AREA	-	0.10	Campbell County	0.10	0.10	0.10	0.10	0.11	0.11	0.11	0.12	0.12
VA DEQ	CHATHAM WTP	-	0.31	Chatham	0.31	0.31	0.31	0.32	0.33	0.33	0.34	0.35	0.36
VA DEQ	CHATHAM WTP	0.42		Chatham	0.42	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.50
VA DEQ	CLARKSVILLE WTP	-	0.26	Clarksville	0.26	0.26	0.26	0.26	0.27	0.27	0.28	0.28	0.29
VA DEQ	CLARKSVILLE WTP	0.28		Clarksville	0.28	0.28	0.28	0.29	0.30	0.30	0.30	0.31	0.32
VA DEQ	Dan River - Schoolfield Complex	-	0.19	Danville City	0.19	0.19	0.18	0.18	0.18	0.18	0.18	0.17	0.16
VA DEQ	DANVILLE INDUSTRAL WTP	0.94	-	Danville City	0.94	0.94	0.92	0.93	0.94	0.92	0.90	0.86	0.83
VA DEQ	DANVILLE WTP	-	0.41	Danville City	0.41	0.41	0.40	0.40	0.41	0.40	0.39	0.38	0.36
VA DEQ	DANVILLE WTP	7.78		Danville City	7.78	7.78	7.64	7.67	7.72	7.61	7.43	7.13	6.84
VA DEQ	DANVILLE WWTP	-	5.49	Danville City	5.49	5.49	5.39	5.41	5.45	5.37	5.24	5.03	4.83
VA DEQ	Department of Correction - Baskerville	-	0.33	Mecklenburg County	0.33	0.33	0.33	0.33	0.33	0.34	0.34	0.35	0.36
VA DEQ	Ferrum Town - Sewage Treatment Plant	-	0.17	Franklin County	0.17	0.17	0.18	0.20	0.21	0.22	0.23	0.25	0.27
VA DEQ	GRETNA WTP	-	0.15	Gretna	0.15	0.15	0.15	0.15	0.16	0.16	0.16	0.17	0.17
VA DEQ	GRETNA WTP	0.20		Gretna	0.20	0.20	0.20	0.21	0.21	0.21	0.22	0.22	0.23
VA DEQ	HALIFAX (TOWN)	-	0.21	Halifax	0.21	0.21	0.21	0.22	0.23	0.23	0.23	0.24	0.24
VA DEQ	HALIFAX (TOWN)	0.17		Halifax	0.17	0.17	0.18	0.18	0.19	0.19	0.19	0.20	0.20
VA DEQ	Henry Co PSA	-	0.22	Henry County	0.22	0.22	0.21	0.21	0.21	0.21	0.20	0.20	0.20
VA DEQ	KEYSVILLE WTP	-	0.13	Charlotte County	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13	0.13
VA DEQ	KEYSVILLE WTP	0.14		Charlotte County	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14	0.14
VA DEQ	MARTINSVILLE WTP	4.13	-	Martinsville City	4.13	4.13	4.04	3.92	3.92	3.86	3.77	3.61	3.46

VA DEQ	Mecklenburg Co Schools Bluestone High School	-	1.16	Mecklenburg County	1.16	1.16	1.16	1.17	1.18	1.19	1.21	1.24	1.27
VA DEQ	Montgomery County PSA - Elliston-Lafayette WWTP	-	0.12	Montgomery County	0.12	0.12	0.12	0.12	0.13	0.14	0.14	0.15	0.16
1989 Model	Roanoke City -TINKER CR-CATAWBA CR DIVERSION	4.677	-	Roanoke City	4.68	4.518877574	4.45	4.36	4.36	4.32	4.26	4.17	4.07
VA DEQ	Rocky Mount	-	0.82	Rocky Mount	0.82	0.82	0.84	0.93	1.02	1.06	1.12	1.21	1.30
2003 CEDS	Rocky Mount - BLACKWATER RIVER WTP	1.02	-	Rocky Mount	1.02	1.106422599	1.14	1.27	1.39	1.44	1.51	1.64	1.76
VA DEQ	RRSA	1.41	-	Mecklenburg County	1.41	1.41	1.41	1.42	1.43	1.44	1.46	1.50	1.54
VA DEQ	RRSA - BOYDTON SERVICE AREA	-	0.15	Mecklenburg County	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.16	0.16
PCS	RRSA - ROANOKE COUNTY SERVICE AREA	-	0.22	Roanoke County	0.22	0.228650424	0.23	0.25	0.27	0.27	0.28	0.30	0.32
VA DEQ	RRSA - South Hill WWTP	-	0.93	South Hill	0.93	0.93	0.94	0.96	0.99	1.00	1.01	1.03	1.06
VA DEQ	SALEM OLD WTP 1	4.20	-	Salem City	4.20	4.20	4.18	4.15	4.15	4.16	4.17	4.19	4.20
VA DEQ	Shawsville Sewage Treatment Plant	-	0.12	Montgomery County	0.12	0.12	0.12	0.13	0.13	0.14	0.14	0.15	0.16
VA DEQ	South Boston - Maple Ave WWTP	-	1.57	South Boston	1.57	1.57	1.59	1.64	1.68	1.70	1.73	1.78	1.83
1989 Model	SOUTH BOSTON WTP	1.842	-	South Boston	1.84	1.882806193	1.90	1.96	2.02	2.04	2.08	2.14	2.20
VA DEQ	STUART WTP	-	0.26	Patrick County	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.27	0.27
VA DEQ	STUART WTP	0.28		Patrick County	0.28	0.28	0.28	0.28	0.28	0.28	0.29	0.29	0.30
VA DEQ	VA Beach	25.20	-	Virginia Beach	25.20	25.20	25.44	26.22	27.04	27.37	27.88	28.74	29.63
VA DEQ	WVWA -FALLING CR/BEAVERDAM CR WTP	0.70	-	Roanoke County	0.70	0.70	0.71	0.77	0.82	0.84	0.87	0.92	0.97
VA DEQ	WWVA - Carvin's Cove	-	0.44	Roanoke County	0.44	0.44	0.45	0.48	0.52	0.53	0.55	0.58	0.62
VA DEQ	WWVA - ROANOKE (CITY) SERVICE AREA	8.41	-	Roanoke City	8.41	8.41	8.28	8.11	8.11	8.04	7.93	7.75	7.57
VA DEQ	WWVA - SPRING HOLLOW RESERVOIR	10.07	-	Roanoke County	10.07	10.07	10.29	11.03	11.79	12.09	12.53	13.27	14.01
VA DEQ	WWVA - SPRING HOLLOW WTP	4.86	-	Roanoke County	4.86	4.86	4.96	5.32	5.69	5.83	6.05	6.40	6.76
VA DEQ	WWVA - WPCP	-	63.75	Roanoke County	63.75	63.75	65.15	69.87	74.69	76.56	79.37	84.06	88.74