Water Allocation Committee

Wednesday, May 10, 2006

- Overview of the Catawba and Yadkin Projects Low Inflow Protocols (LIP)
- Overview of Catawba Model and Catawba Basin Impacts of Interbasin Transfer
- Overview of the Yadkin-Pee Dee Model and Yadkin-Pee Dee Basin Impacts of the Interbasin Transfer

Overview of the Catawba and Yadkin Projects Low Inflow Protocols (LIP)

May 10, 2006

Background

- The Catawba-Wateree LIP was developed first.
- The Catawba-Wateree LIP is finalized and part of Duke Power's FERC application.
- The Yadkin-Pee Dee LIP used the Catawba-Wateree LIP as a template.
- The Yadkin-Pee Dee LIP is a working draft.

Purpose

- The purpose of these Low Inflow Protocols (LIP) is to establish procedures for reductions in water use during periods of low inflow to the Projects.

Overview

- These Low Inflow Protocols provide trigger points and procedures for how the Projects will be operated by the Licensees, as well as water withdrawal reduction measures and goals for other water users during periods of low inflow (i.e., drought periods).

Summary of LIP Trigger Points

- Catawba-Wateree Project

Stage	Storage Index			Drought Monitor (3-month average)		Monitored USGS Streamflow Gages 6-Month Average	
0	90% < SI < TSI	or		0 ≤ DM	or	AVG ≤ 85%	
1	75% < SI ≤ 90%TSI	and	(	1 ≤ DM	or	AVG ≤ 78%	)
2	57% < SI ≤ 75%TSI	and	(	2 ≤ DM	or	AVG ≤ 65%	)
3	42% < SI ≤ 57%TSI	and	(	3 ≤ DM	or	AVG ≤ 55%	)
4	SI ≤ 42%TSI	and	(	DM = 4	or	AVG ≤ 40%	)

Summary of LIP Trigger Points

- Yadkin-Pee Dee Projects

Summary of LIP Triggers (subject to change based on modeling results)					
Stage	Elevation		US Drought Monitor Three-Month Numeric Average		Stream Gage Three-Month Rolling Average
0	Elevation of High Rock or Narrows or Tillery <= NML	and either	>= 0	or	<= 85 % Historical Average
1	Elevation of High Rock and Narrows and Tillery <= LIP Stage 0 (Zero) Minimum Elevation	and either	>= 1	or	<= 78 % Historical Average
2	Elevation of High Rock and Narrows and Tillery <= LIP Stage 1 Minimum Elevation	and either	>= 2	or	<= 65 % Historical Average
3	Elevation of High Rock and Narrows and Tillery <= LIP Stage 2 Minimum Elevation	and either	>= 3	or	<= 55 % Historical Average
4	Elevation of High Rock and Narrows and Tillery <= Lip Stage 3 Minimum Elevation	and either	>= 4	or	<= 40 % Historical Average

Summary of PWS Actions

- Catawba-Wateree Project

Catawba-Wateree Project		
Stage	**Public Water Supply Actions**	**Water Use Reduction Goals**
0	Low Inflow Watch - DMAG meets	
1	Voluntary Water Use restrictions	3 - 5%
2	Mandatory Level 1	5 - 10%
3	Mandatory Level 2	10 - 20%
4	Emergency	20 - 30%

Model Input - Catawba-Wateree LIP Actions and Recovery

Actions to be performed

Licensee Actions	Licensee Delay in implementing Actions (days)	NLPF Reduction (%) Reduction to difference between NLPF and Critical Flow	Bypass Reduction (%) Reduction to difference between Bypass and Critical Flow	Recreation Flows Reduction (%)	Plant 1 Normal Minimum Pond Elevation Reduction (ft, absolute)	Plant 2 Normal Minimum Pond Elevation Reduction (ft, absolute)	Plant 3 Normal Minimum Pond Elevation Reduction (ft, absolute)	Plant 4 Normal Minimum Pond Elevation Reduction (ft, absolute)	Plant 5 Normal Minimum Pond Elevation Reduction (ft, absolute)	Plant 6 Normal Minimum Pond Elevation Reduction (ft, absolute)	Plant 7 Normal Minimum Pond Elevation Reduction (ft, absolute)	Plant 8 Normal Minimum Pond Elevation Reduction (ft, absolute)	Plant 9 Normal Minimum Pond Elevation Reduction (ft, absolute)	Plant 10 Normal Minimum Pond Elevation Reduction (ft, absolute)	Plant 11 Normal Minimum Pond Elevation Reduction (ft, absolute)
Stage 0	4	0%	0%	0%	0	0	0	0	0	0	0	0	0	0	0
Stage 1	4	60%	60%	60%	2	1	1	1	2	1	1	1	1	1	1
Stage 2	4	95%	95%	100%	3	2	2	2	4	2	2	2	2	2	2
Stage 3	4	100%	100%	100%	10	3	3	3	5	3	3	3	3	3	3
Stage 4	4	100%	100%	100%	critical	critical	critical	critical	critical	critical	critical	critical	critical	critical	critical

Consumptive Withdrawal Reduction (%)

Owners of public and large water supply intakes	Owner Delay in implementing Actions (days)	Plant 1	Plant 2	Plant 3	Plant 4	Plant 5	Plant 6	Plant 7	Plant 8	Plant 9	Plant 10	Plant 11
Stage 0	4	0%										
Stage 1	4	0.6%	3.0%	3.0%	3.0%	1.9%	3.0%	0.6%	3.0%	3.0%	3.0%	0.9%
Stage 2	4	1.3%	7.0%	7.0%	7.0%	4.5%	6.9%	1.4%	7.0%	7.0%	7.0%	2.0%
Stage 3	4	2.8%	15.0%	15.0%	15.0%	9.6%	14.8%	3.0%	15.0%	15.0%	15.0%	4.3%
Stage 4	4	4.6%	25.0%	25.0%	25.0%	16.1%	24.7%	4.9%	25.0%	25.0%	25.0%	7.2%

LIP Recovery

Days delayed after storage and hydrology condition recovery for groundwater wells to indicate groundwater levels have recovered

	From Stage 4 to Stage 3	From Stage 3 to Stage 2	From Stage 2 to Stage 1	From Stage 1 to Stage 0	Stage 0 to Normal
Groundwater Monitor	0	0	0	0	0

Summary of PWS Actions

- Yadkin-Pee Dee Projects

Stage	Public Water Supply Actions	Water Use Reduction Goals
0	Low Inflow Watch - DMAG meets	
1	Voluntary Water Use restrictions	5%
2	Mandatory Level 1	10%
3	Emergency	20%
4	Emergency	40%
Starting at stage 1 water withdrawal reporting to DMAG		

Recovery from the LIP

- Recovery is simply the reverse of the staged approach.
- Except all 3 triggers must be attained before returning to a lower stage.
- The Catawba-Wateree Project has 1 additional that also needed to be attained.
  - A ground water trigger.

LIP - Questions

Summary of the Basin Models Features Common to Both Models

- Long term analysis
  - Catawba 75 years: 1929 – 2003
  - Yadkin-Pee Dee 74 years: 1930 – 2003
- Simulates current conditions
  - Current is the anticipated new FERC license conditions.
- Simulates future conditions
  - FERC license conditions
  - Water supply withdrawals

Summary of Common Model Inputs

- Temporal Data
  - 74 – 75 yrs of daily hydrology
- Engineering Data
  - Rating curves, generation conditions
- Hydrological Data
  - Evaporation
  - Inflow
- Variable Data
  - Water demand
  - Reservoir level conditions
  - Required flow conditions
  - Other operational conditions

Summary of Key Differences

- Time-Step
  - Catawba Model – 15 minute
  - Yadkin Model – Daily
- Model availability
  - Catawba Model – Duke Power has made CHEOPS available to anyone requesting a copy.
  - Yadkin Model – APGI limits availability of OASIS and requires a confidentiality agreement.
- LIP
  - Catawba Model includes the LIP
  - Yadkin Model does not include a LIP
- System
  - Catawba Model includes all 11 reservoirs in the Catawba-Wateree system.
  - Yadkin Model has all 6 reservoirs in the Yadkin-Pee Dee system but models the 2 Progress Energy reservoirs as run-of-the-river.

Overview of the Yadkin-Pee Dee Modeling and Impacts of the Interbasin Transfer

May 10, 2006

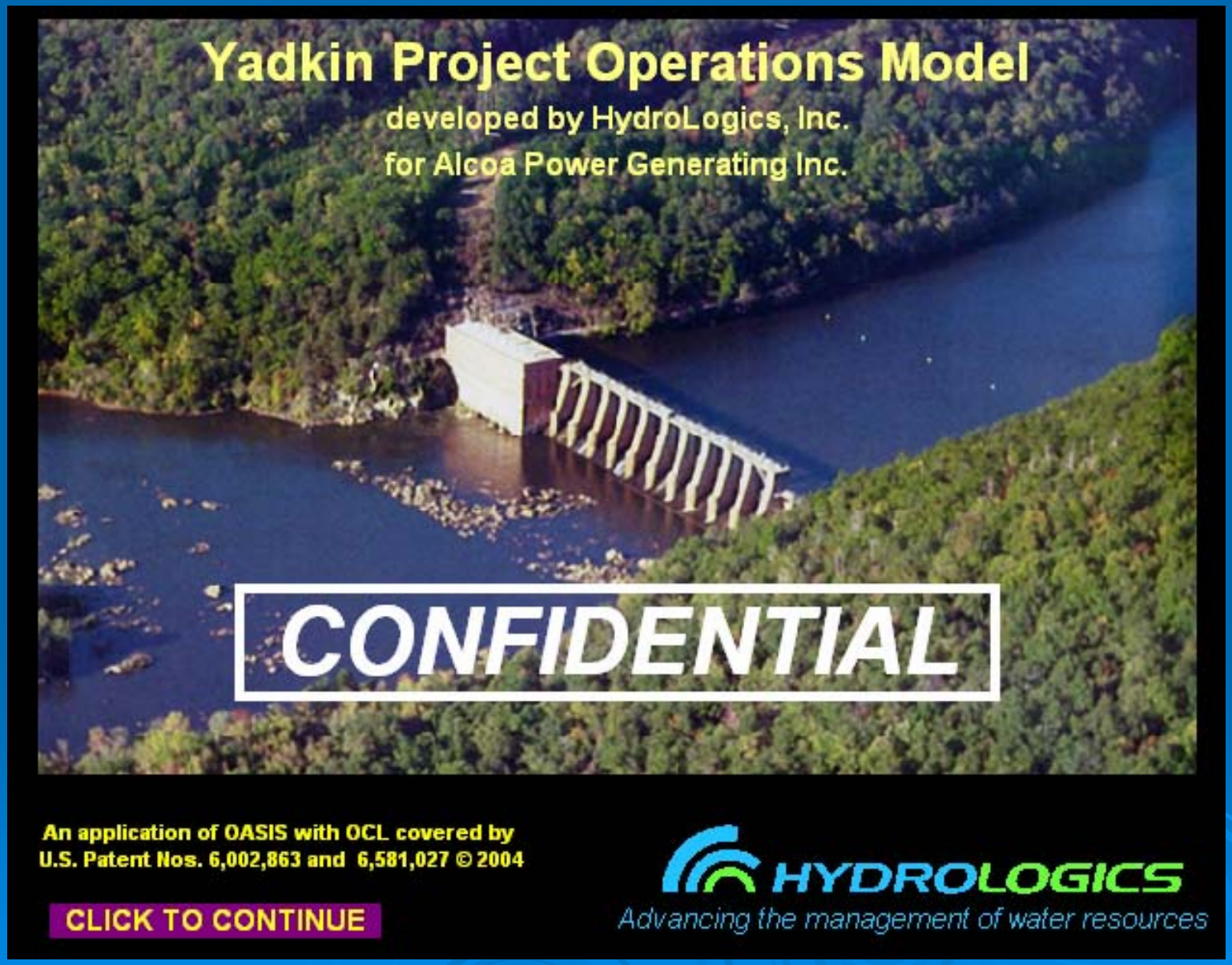
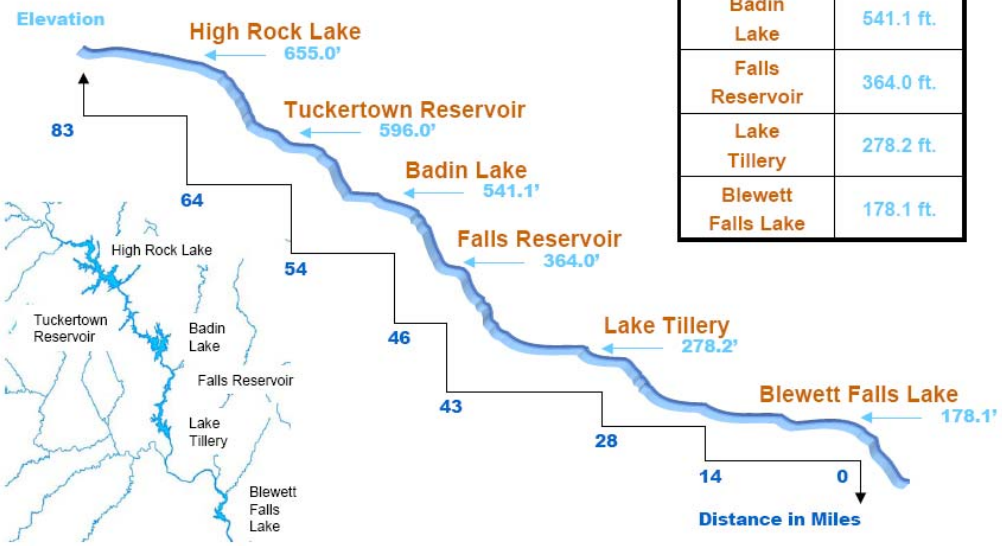
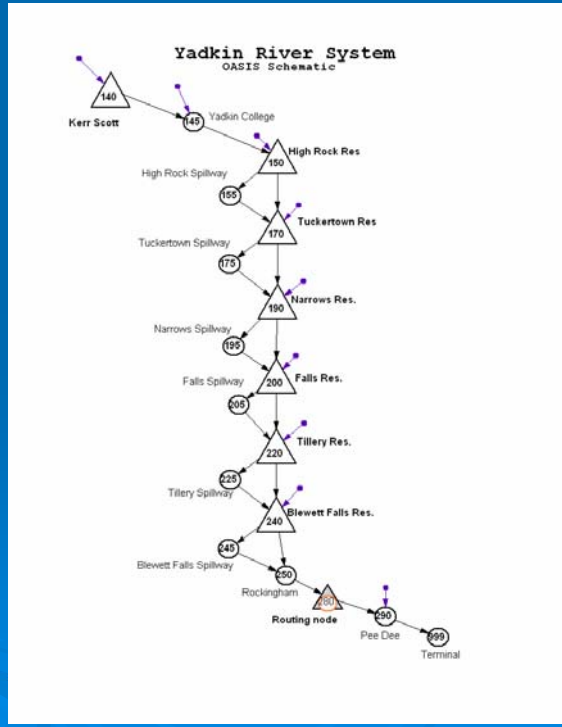
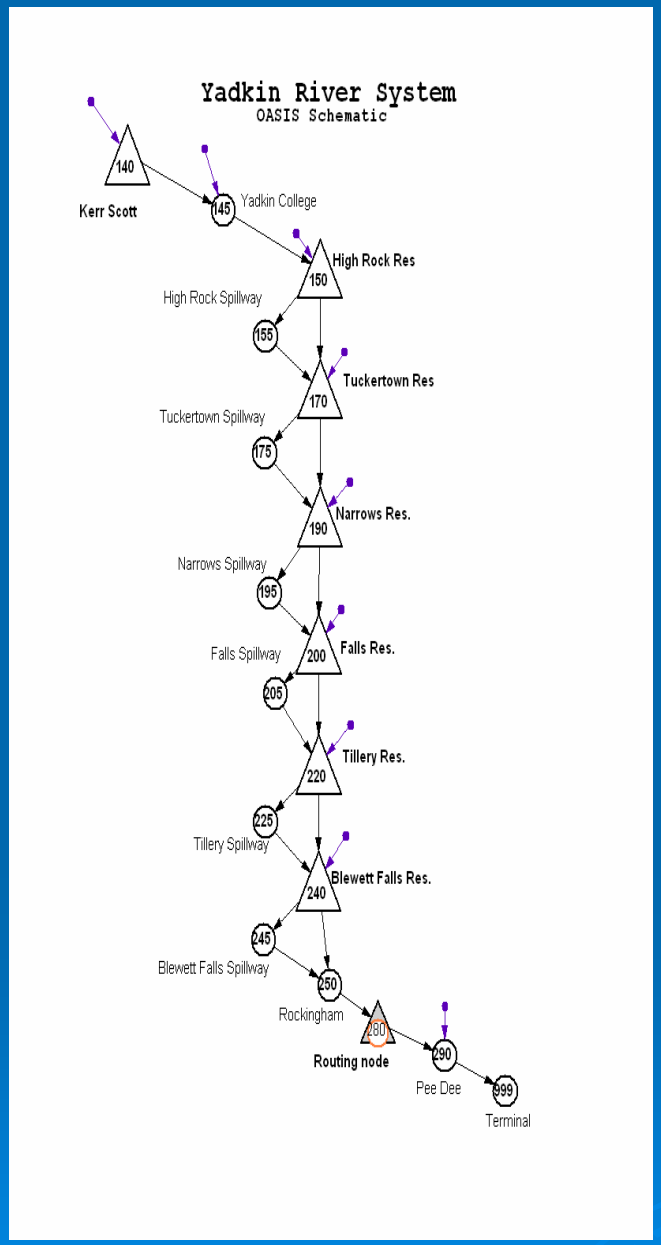

Yadkin Project Operations Model
developed by HydroLogics, Inc.
for Alcoa Power Generating Inc.
CONFIDENTIAL
An application of OASIS with OCL covered by
U.S. Patent Nos. 6,002,863 and 6,581,027 © 2004
CLICK TO CONTINUE
HYDROLOGICS
Advancing the management of water resources

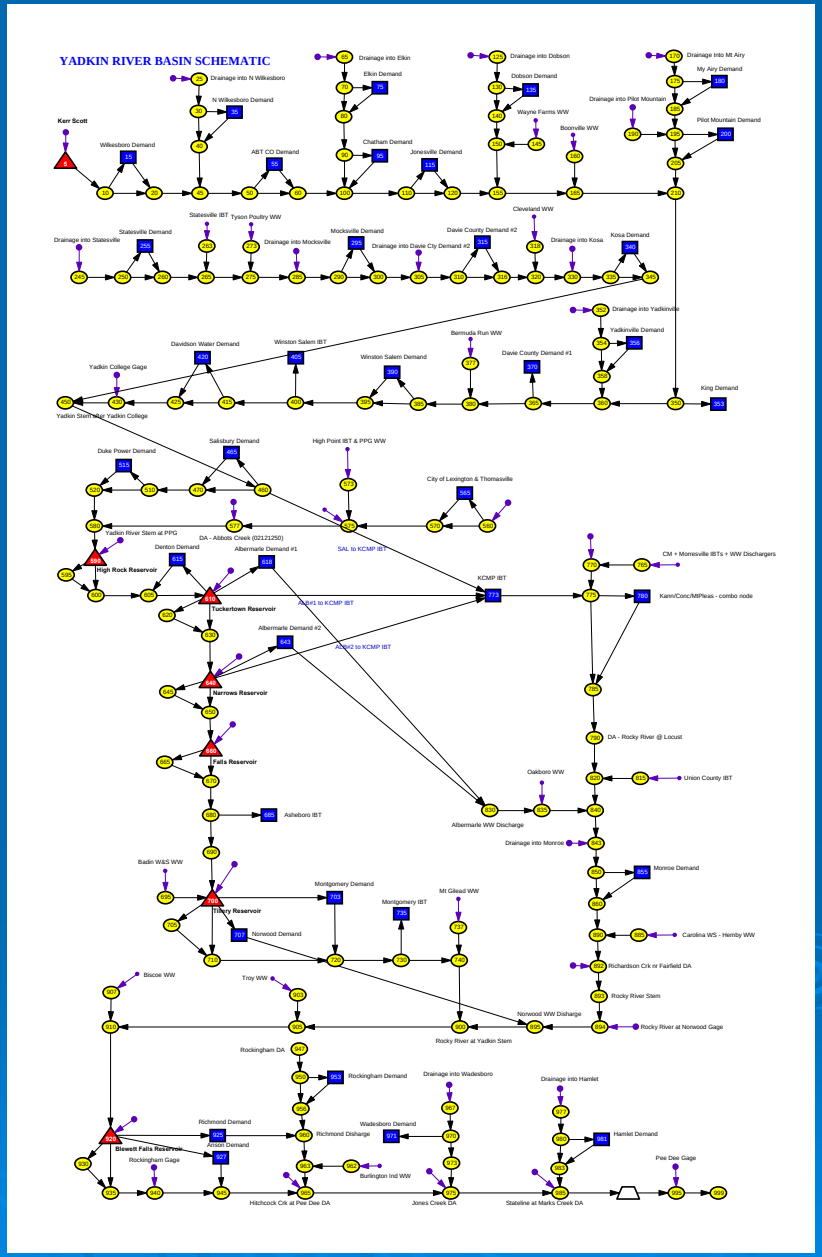
FIGURE 2-3
Yadkin River Reservoirs managed by Alcoa and Progress Energy
Concord/Kannapolis IBT Environmental Impact Statement

Lakes	Full Pool
High Rock Lake	655.0 ft.
Tuckertown Reservoir	596.0 ft.
Badin Lake	541.1 ft.
Falls Reservoir	364.0 ft.
Lake Tillery	278.2 ft.
Blewett Falls Lake	178.1 ft.






Yadkin River System
OASIS Schematic
140
Kerr Scott
145
Yadkin College
High Rock Res
150
High Rock Spillway
155
Tuckertown Res
170
Tuckertown Spillway
175
Narrows Res.
190
Narrows Spillway
195
Falls Res.
200
Falls Spillway
205
Tillery Res.
220
225
Tillery Spillway
Blewett Falls Res.
240
245
Blewett Falls Spillway
250
Rockingham
280
Routing node
290
Pee Dee
999
Terminal


YADKIN RIVER BASIN SCHEMATIC

Key Modeling Assumptions

- Simulates 74 years (1930 – 2003)
- No LIP modeled
  - LIP draft was no far enough long to model
- The 2 Progress Energy Reservoirs are modeled as run-of-river projects
  - Lake Tillery & Blewett Falls Lake
- All NC withdrawals and discharges of 100,000 gpd or greater are included. Most as an individual model node.

Modeling Scenarios

- BaseCase2008
  - Proposed new license conditions, 2008 water use estimates, and no Concord/Kannapolis IBT.
- BaseCase2038
  - Proposed new license conditions, 2038 water use estimates, and no Concord/Kannapolis IBT.
- Salisbury2038
  - Proposed new license conditions, 2038 water use estimates, Concord/Kannapolis IBT is 10 mgd MDD from Salisbury.

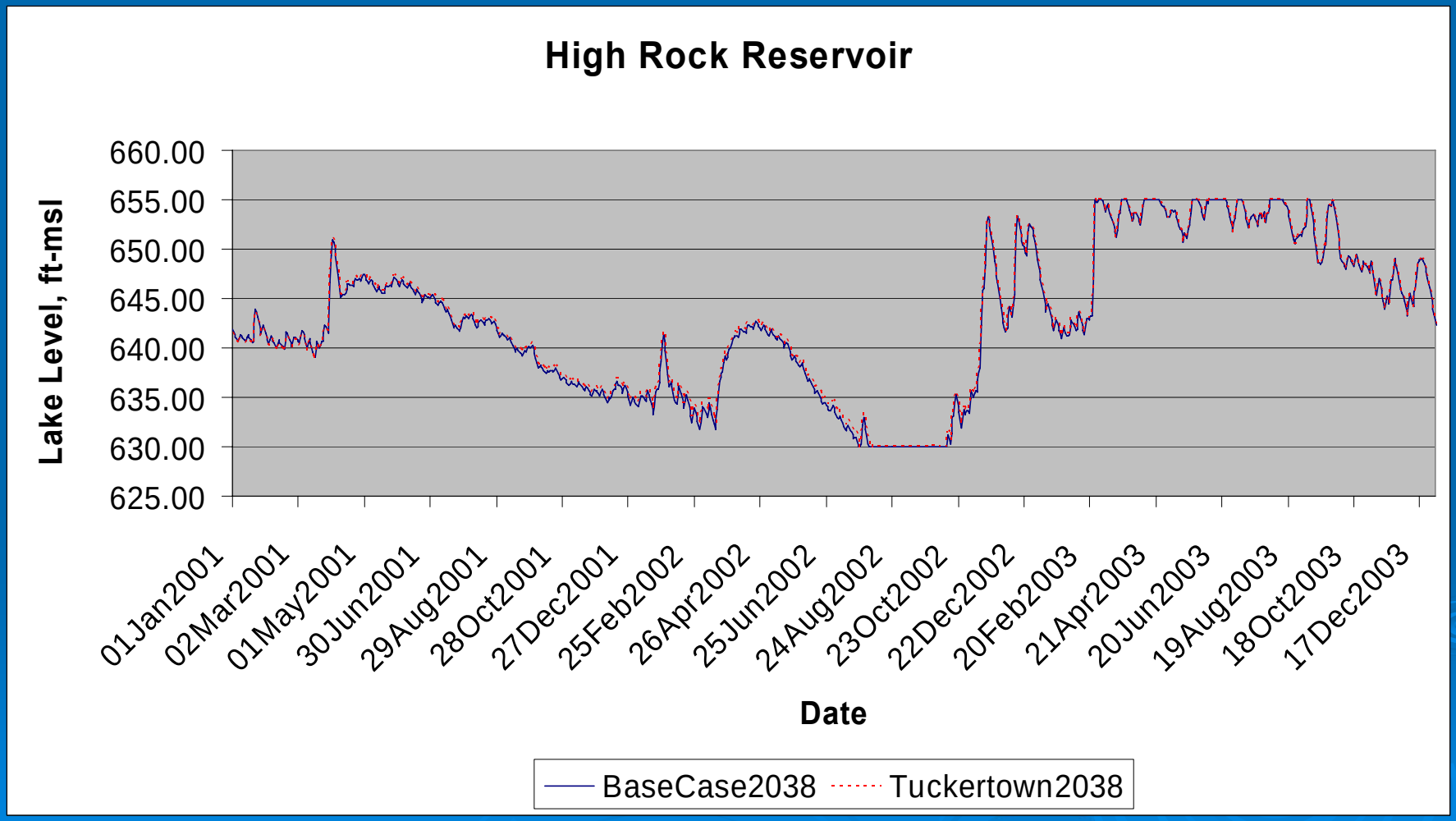
Modeling Scenarios - Continued

- Tuckertown2038
  - Proposed new license conditions, 2038 water use estimates, Concord/Kannapolis IBT is 10 mgd MDD from Albemarle's Tuckertown intake.
- TuckertownNarrows2038
  - Proposed new license conditions, 2038 water use estimates, Concord/Kannapolis IBT is 5 mgd MDD from Albemarle's Tuckertown intake and 5 mgd MDD from their Narrows' intake.
- TuckertownSalisbury2038
  - Proposed new license conditions, 2038 water use estimates, Concord/Kannapolis IBT is 5 mgd MDD from Salisbury and 5 mgd from Albemarle's Tuckertown intake.

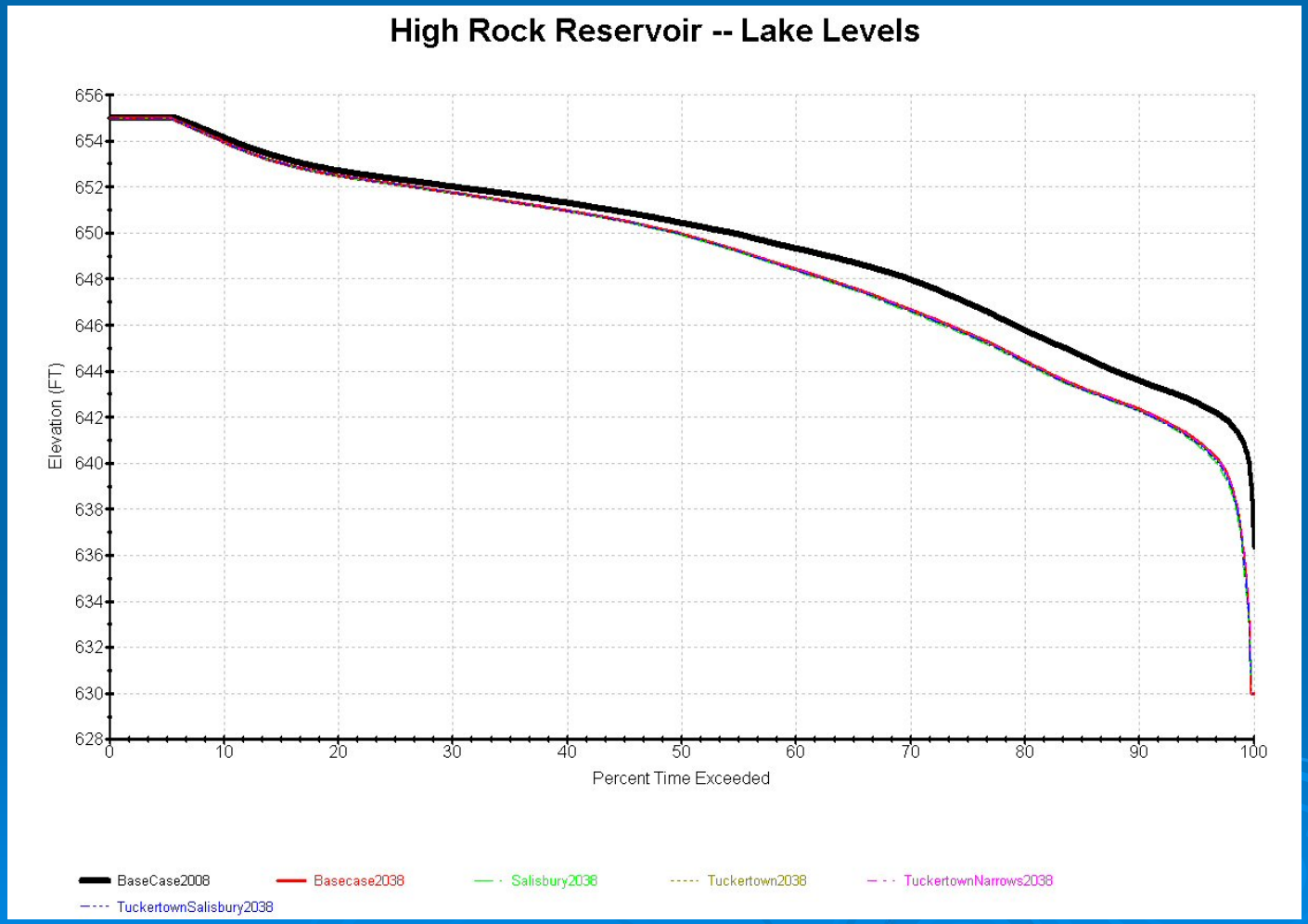
Key Impact Points

- Lake Levels for High Rock and Narrows.
  - The other lakes are modeled run-of-river projects.
- Rockingham gage flows.
  - Key instreamflow target flow point.
- Mainstem/Reservoir Public Water Systems

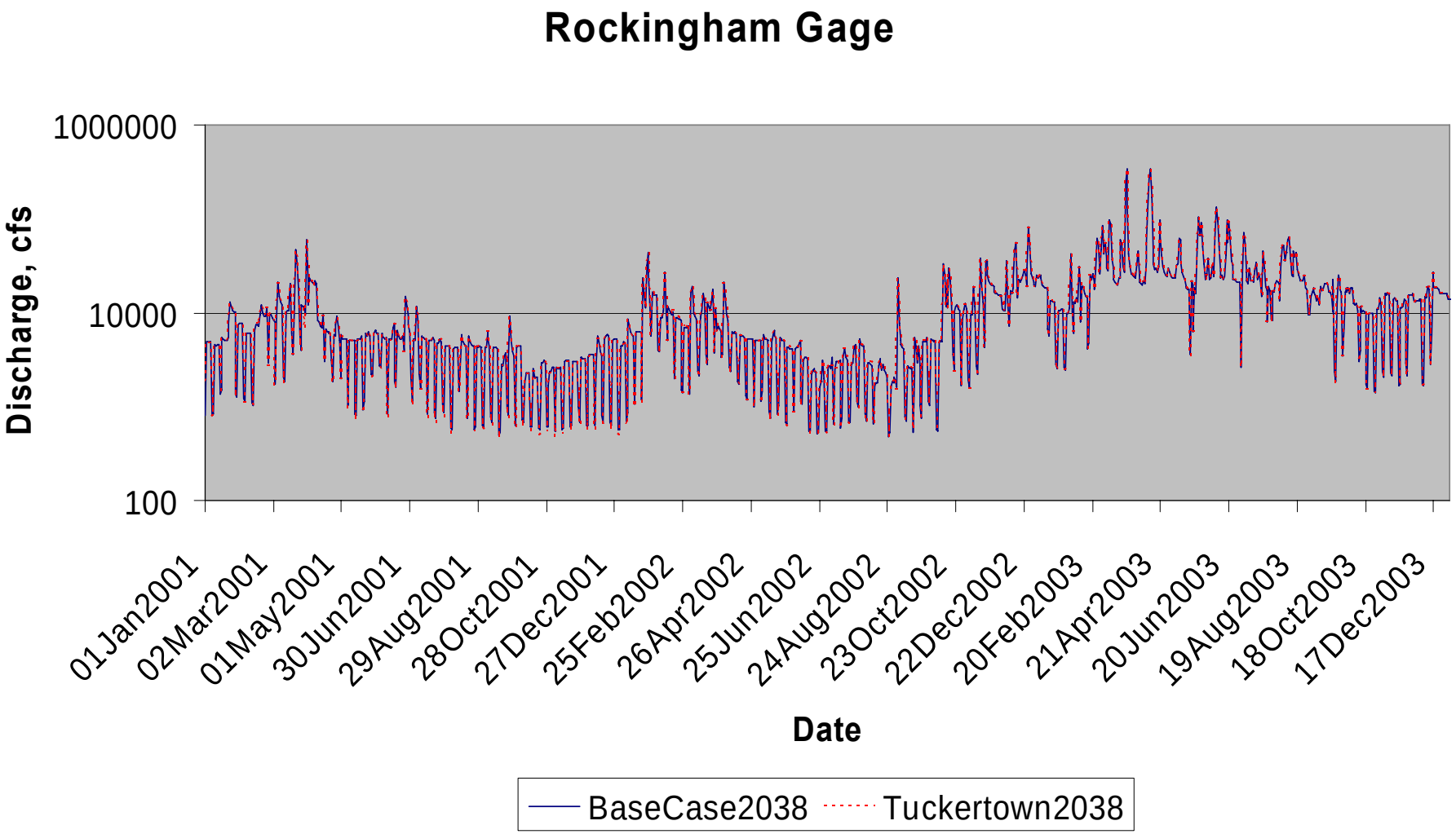
High Rock Lake



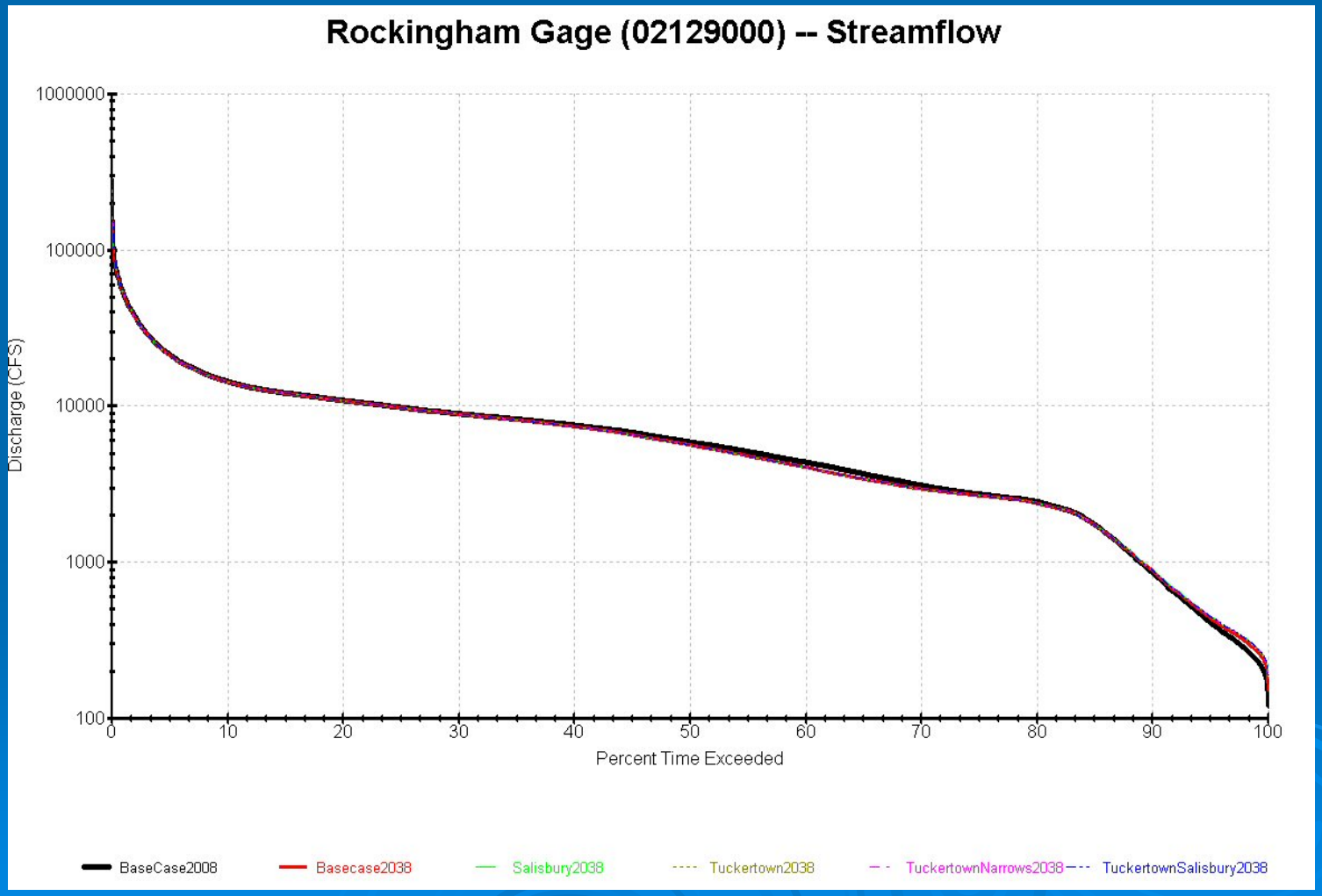
High Rock Lake



Rockingham Gage



Rockingham Gage



Yadkin-Pee Dee Model Questions?

Overview of Catawba Model and Impacts of Interbasin Transfer

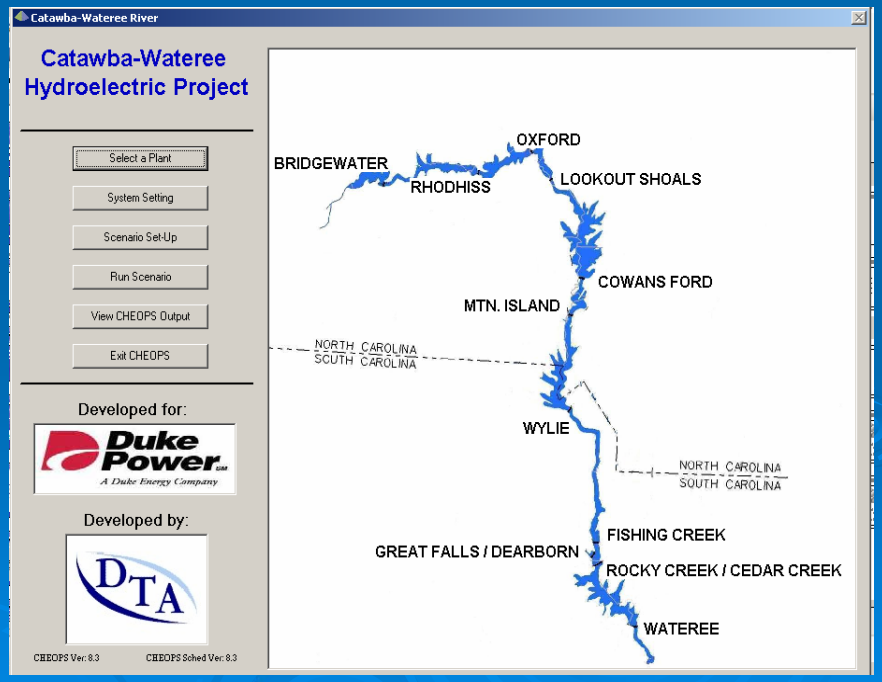
5/10/2006

Catawba Model Cheops -

Computer Hydro Electric Operations and Planning Software

Version 8.3

Released in October, 2005



Catawba-Wateree Project Reservoirs

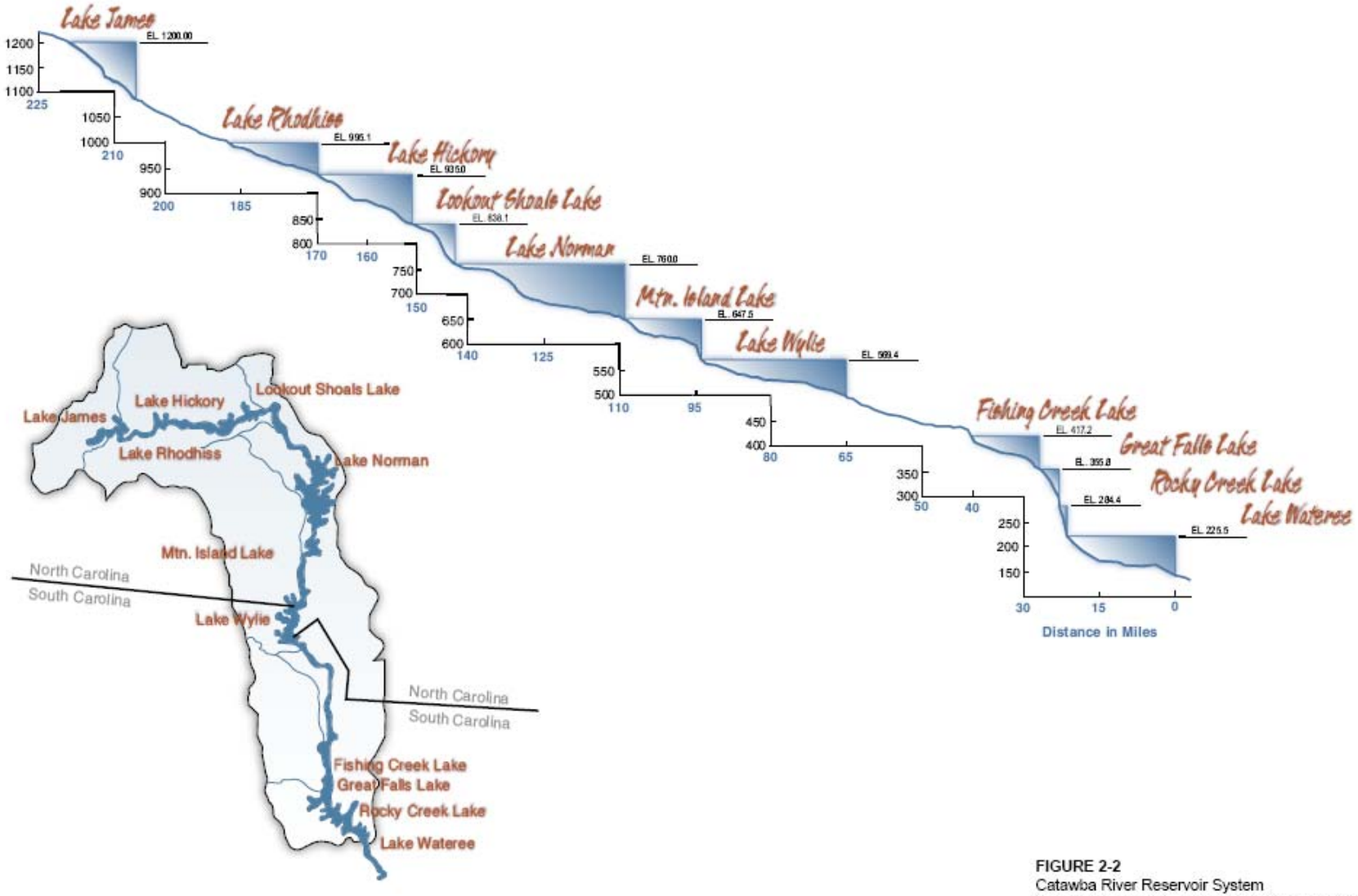


FIGURE 2-2
Catawba River Reservoir System
Concord/Kannapolis IBT Environmental Impact Statement

Modeling Assumptions

- LIP
  - July 2005 version for all scenario [Old]
  - November 2005 version for one scenario [New]
- Mutual Gain (**MG**) Operational Requirements – Flow schedules recommended for mutual gain of the water users, ecosystems & recreational activities
  - Included the requirements proposed in September 2005
- **NGO** Flow – increased instream flow requirements proposed by NGOS

Modeling Assumptions – contd…

- Water withdrawals for scenarios with constraints:
  1. MG, 2008 demand - *MG 08*
  2. MG, 2008 demand + IBT from Lake Norman - *MG 08 CF*
  3. MG, 2035 demand – *MG 35*
  4. MG, 2035 demand + IBT from Lake Norman – *MG 35 CF*
  5. MG, 2035 demand + IBT from Mountain Island – *MG 35 MI*
  6. MG, 2035 demand & NGO flow – *MG 35 NGO*
  7. MG, 2035 demand & NGO flow + IBT from Lake Norman – *MG 35 CF NGO*
  8. MG, 2035 demand & New LIP – *MG 35 LIP*

Output data was analyzed to find the impacts of

- IBT quantities
- IBT locations
- IBT with increased instream flow requirements by NGOs
- New modified LIP

Elevation During Dry Years @ Lake James

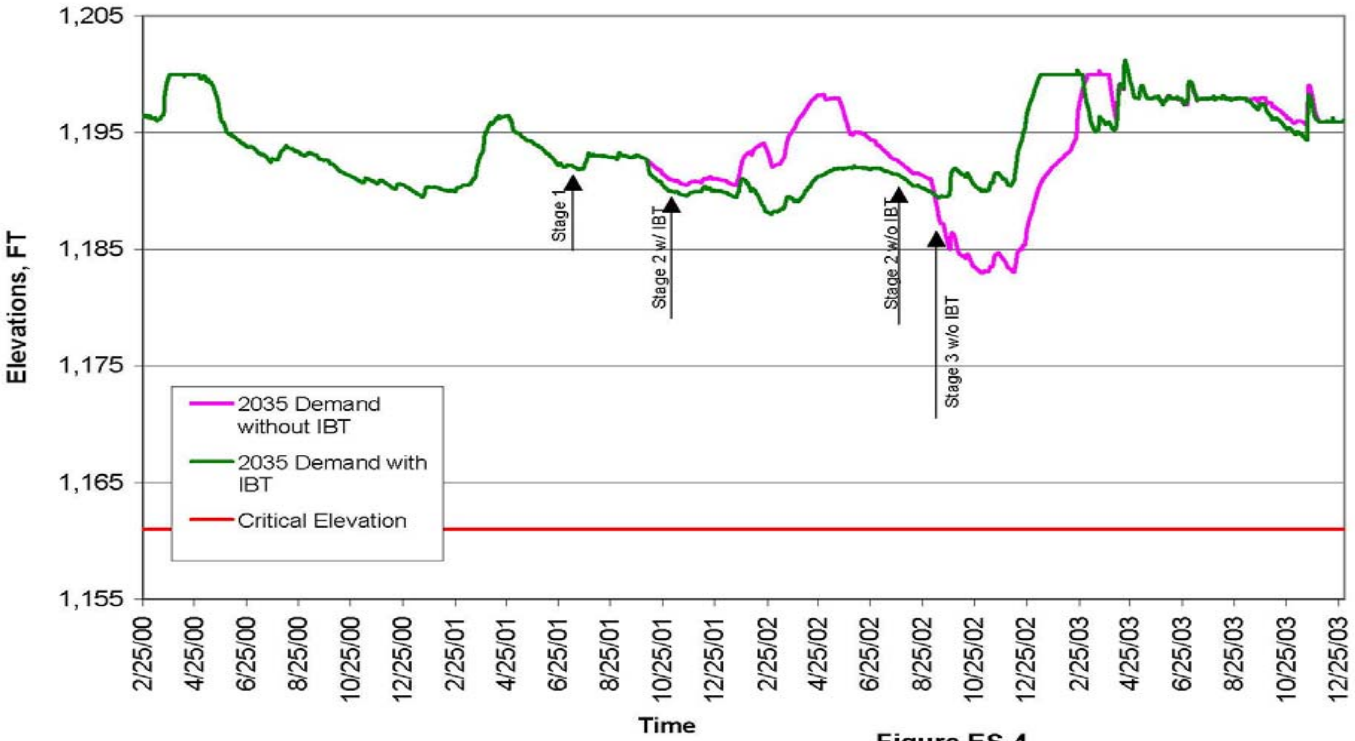


Figure ES-4
Comparison of Bridgewater (Lake James) Elevations Showing the Impacts of LIP

Concord/Kannapolis IBT Environmental Impact Statement

Elevation During Dry Years @ Lake Norman

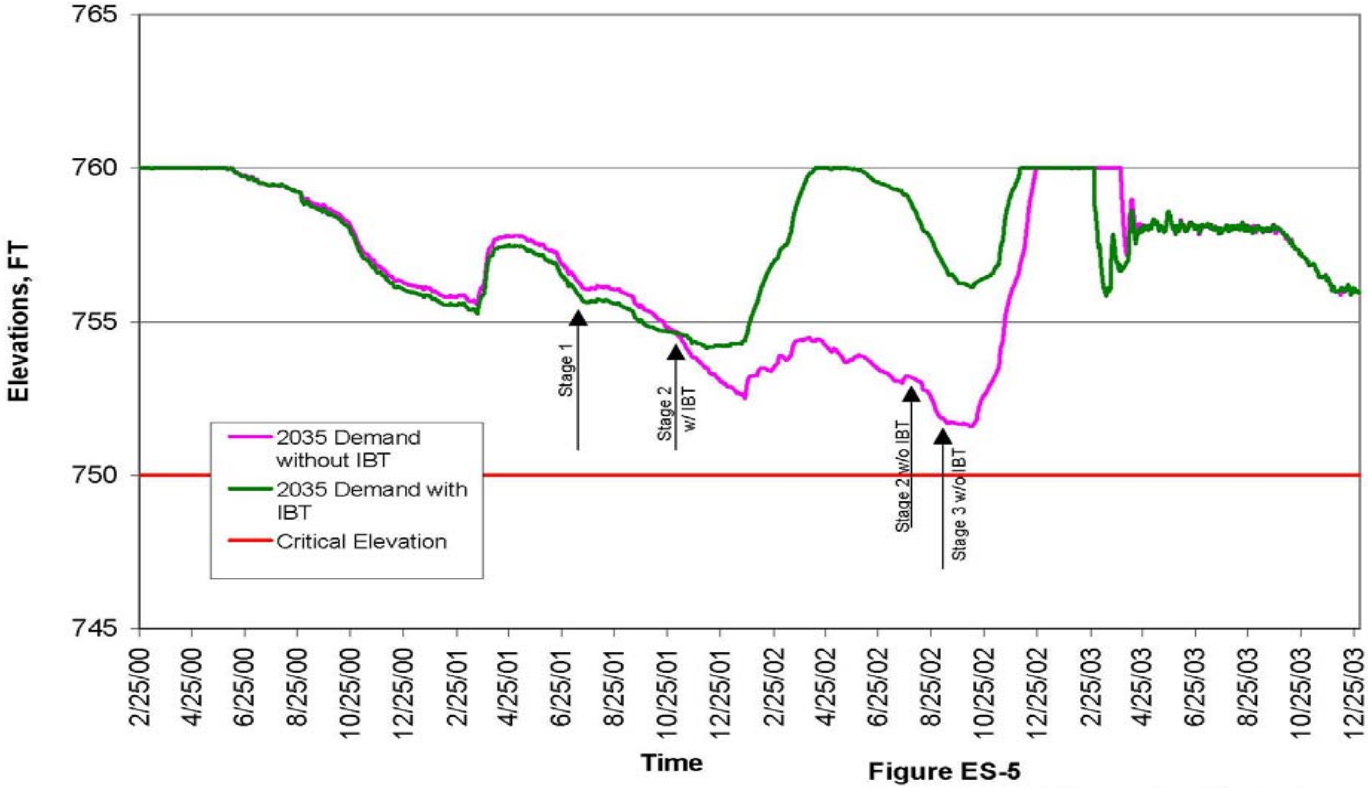


Figure ES-5
Comparison of Cowan Ford (Lake Norman) Elevations Showing the Impacts of LIP

Concord/Kannapolis IBT Environmental Impact Statement

Catawba Model - Questions?