Water Supply Study

Final Report

Duke Energy®

Catawba-Wateree Hydroelectric Relicensing Project

April 2006

HDR

HDR Engineering, Inc.
of the Carolinas

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Prepared by:

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TABLE OF CONTENTS

GLOSSARY OF TERMS IV

1.0 EXECUTIVE SUMMARY 1

1.1 Introduction 1
1.2 Project Objectives 1
1.3 Water Withdrawal and Return Projections 2
1.4 Safe Yield Results 2
1.5 GIS Database 8
1.6 Water Withdrawal Management Survey Results 9
1.7 Low Inflow Protocol 9

2.0 PROJECT OVERVIEW 11

2.1 Catawba-Wateree Hydro Relicensing Project 11
2.2 Water Supply Study 11

3.0 WATER WITHDRAWAL AND RETURN PROJECTIONS 14

3.1 Objective 14
3.2 Water Withdrawal and Return Projection Methodology 15
3.2.1 Agricultural and Irrigation Projections 15
3.2.2 Duke Power Projections 16
3.2.3 Public Water Supplies and Wastewater Utilities Projections 18
3.2.4 Industrial User Projections 22
3.3 Application of Future Trends on Water Withdrawal and Return Projections 24
3.3.1 Water Reuse 24
3.3.2 Water Conservation 25
3.3.3 Regulatory and Economic Drivers 25
3.3.4 Industrial Shifts 26
3.4 Revised Withdrawal and Return Projections 26
3.5 Comparison of Baseline Projections to Past Projections 26
3.6 Future Inter-Basin Transfers of the Catawba-Wateree River Basin 27
3.7 Reservoir Watershed System Projections 27
3.8 Study Team Consensus 27
3.9 Water Withdrawal and Return Projections – Analysis Summary 27
3.10 Net Outflow Projection – Comparisons with Population History and Forecasts 39

3.11 Inter-Basin Transfers 39
3.12 Groundwater Impacts 41

4.0 SAFE YIELD ANALYSIS 42

4.1 Objective 42
4.2 Safe Yield Analysis – General Methodology 42
4.3 Application of Future Water Demands and Sedimentation to Determine Safe Yield 44
4.4 Critical Intake Levels 44
4.5 Low-Inflow Periods 45
4.5.1 Historical Hydrologic Records Analysis 45
4.5.2 Historical Energy Generation Data Analysis 46
4.5.3 Comparison of Results for Hydrologic Record and Energy Generation Analyses 48
4.6 Baseline Safe Yield Evaluation 49
4.6.1 Baseline – Safe Yield Operating Criteria 49
4.6.2 Baseline – Safe Yield Reservoir Constraint 50
4.6.3 Baseline – Safe Yield Results 51
4.6.4 Baseline – Safe Yield Conclusions 56
4.7 Mutual Gains Safe Yield – Evaluation 57
4.7.1 Mutual Gains – Safe Yield Operating Criteria 57
4.7.2 Mutual Gains – Safe Yield Reservoir Constraints 58
4.7.3 Mutual Gains – Safe Yield Results 59
4.7.4 Mutual Gains – Safe Yield Conclusions 67
4.8 Safe Yield Summary 67

5.0 GEOGRAPHICAL INFORMATION SYSTEM 70

5.1 Objective 70
5.2 GIS Development – Methodology 70
5.3 Coordinate System 72
5.4 GIS Data Dictionary 72
5.5 GIS Query Tool 72
5.6 GIS – Long-Term Maintenance 75

6.0 WATER WITHDRAWAL MANAGEMENT SURVEY 76

6.1 Objective 76
6.2 Water Withdrawal Management Survey 76
6.3 Water Withdrawal Management Survey Participants and Results 77
6.3.1 Survey Participants 77
6.3.2 Reservoir Use Permitting 78

6.3.3 Withdrawal Fees 79
6.3.4 Drought Management 79
6.3.5 Other Issues 82
6.4 Future Policy-Making Considerations 82

7.0 LOW INFLOW PROTOCOL 83

7.1 Objective 83
7.2 Low Inflow Protocol Summary 83

8.0 ACKNOWLEDGEMENTS 85

APPENDICES

A Study Plan
B Data Request Letter and Information Questionnaire
C Withdrawal and Return Summary Sheets
D Withdrawal and Return Detail Sheets
E Agricultural/Irrigational Water Withdrawal Detail Sheets
F Duke Power Water Consumption Projection Detail Sheets
G Raw Water Intake Summary Table
H Inflow data Series Analysis
I Hydroelectric Energy Generation Analysis
J Safe Yield Analyses
K Water Withdrawal Management Survey
L Low Inflow Protocol
M GIS – Database

Terms used in this Water Supply Study are defined as below:

Annual Average Flow – The mathematical average daily flow rate (either withdrawal or return flow) exerted by a water user over a calendar year, usually expressed in units of mgd or cfs.

Baseline Conditions – Duke Power's existing operating practices under the current FERC license requirements, and other honored agreements.

Catawba-Wateree Drought Management Advisory Group (CW-DMAG) – A group of committed water users and agencies who have a role or vested interest in the implementation response to the Low Inflow Protocol (see Appendix L for members).

CHEOPS™ – A proprietary computer model that is used to simulate the operations of Duke Power's Catawba-Wateree Hydroelectric Project, particularly accounting for water use related to the eleven reservoirs in the Project. Model version 8.5 was used for this Water Supply Study.

Current Flow – The annual average flow rate (in mgd or cfs) for a water user as determined by the most recent available years (at the time of this Study) for which withdrawals and returns were recorded. The most recent year for a given water user typically ranged between 1999 – 2003.

Inter-Basin Transfer (IBT) – The transfer of surface water that is withdrawn from anywhere within the Catawba-Wateree River Basin to a watershed outside of the Catawba-Wateree River Basin.

Low Inflow Period – A period of time during the 74-year hydrologic record when inflow, including stream flow, groundwater inflow or recharge, surface runoff, and precipitation into the Project's reservoirs, was abnormally low (i.e., drought type conditions) (Note: Varies from AIP definition).

Low Inflow Protocol – The written protocol that provides procedures for how the Project will be operated by the Licensee (Duke) and how other water users should respond during low inflow periods. The LIP will be developed on the basis that all parties with interests in water quantity will reduce their water consumption as needed and therefore share the responsibility of conserving the limited water supply. The LIP will also identify communication channels to help coordinate between water users.

Mutual Gains – The proposed operating practices negotiated (as of November 28, 2005) during the relicensing process. These conditions include new, proposed operating parameters compared to Baseline Conditions, including, but not limited to:

- Downstream flow requirements from each reservoir.
- Normal minimum elevations for each reservoir.
- Implementation of the Low Inflow Protocol.

Net Outflow – The difference between withdrawal and return flows, usually expressed in units of mgd or cfs.

Period of Record – The 74-year period from 1930 – 2003 for which hydrologic data was constructed for the Catawba River and the eleven lakes that comprise the Project.

Permitted Flow – The authorized flow rate (withdrawal or return flow) granted by a State or Federal regulatory authority to a water user.

Reservoir Constraint – The lowest water elevation in any given Project reservoir at which that reservoir must operate without being considered in violation, or "failing." If the reservoir's water surface elevation drops below its reservoir constraint, that reservoir has surpassed its safe yield value.

Return Flow – The amount of water returned (i.e. discharged) to a surface water, usually expressed in units of mgd or cfs.

Safe Yield – The amount of water that is theoretically available at a given location in a watershed. Safe yield is a commonly used measure of the dependability of a water supply source. The safe yield values in this Study are given as ranges; the lower end of the range was determined by extracting the withdrawal flow that was modeled in the time-step (10-year increment) just prior to a reservoir violation and the upper end of the range was determined by extracting the withdrawal flow that was modeled in the time-step (10-year increment) when a reservoir violation was deemed to have occurred.

Water Storage Inventory – The water volume in a reservoir available for use without causing a reservoir violation.

Watershed – An area within the Catawba-Wateree River Basin that supplies water to one Project reservoir through surface runoff and tributary streamflow. There are eleven watersheds within the Catawba-Wateree Project.

Water User – An entity that either withdraws water from or returns (i.e., discharges) water to a surface water body within the Catawba-Wateree River Basin.

Withdrawal Flow – The amount of water withdrawn from a surface water source within the Catawba River Basin, usually expressed in terms of mgd or cfs.

1.1 INTRODUCTION

Duke Power's (Duke) current license to operate 13 hydroelectric stations and 11 reservoirs on the Catawba-Wateree River expires in 2008. The current license sets the conditions for operating this system or "Project" and ensures that equal consideration is given to power as well as non-power benefits. In 1958, Duke received a 50-year license from the Federal Energy Regulatory Commission (FERC) to operate and maintain the reservoirs of the Catawba-Wateree Hydro Project. With the intent of securing a new license, Duke has chosen a collaborative process, which includes a commitment to work with regional stakeholders in the development of new terms and conditions of the relicensing Agreement.

As part of this collaborative process, Duke solicited input from numerous regional stakeholders regarding key issues that should be studied and evaluated during relicensing. Several requests were made to evaluate the Catawba-Wateree Project's ability to reliably support future water supply needs for the region. As a result of these requests, and concerns over the impacts to water supply caused by the extended drought that occurred from 1998 to 2002, Duke elected to proceed with this Water Supply Study. A Study Team was formed to help guide this Study, including representatives from the North and South Carolina regulatory agencies, regional public water supply agencies, and Duke Power (see listing in Section 8.0 – Acknowledgements).

1.2 PROJECT OBJECTIVES

The Water Supply Study was divided into two phases and included the following general scope of work items (the detailed Study Plan is included in Appendix A):

- Compile a list of water withdrawals and returns within the Catawba-Wateree River Basin (the Basin) that are greater than or equal to 100,000 gallons per day.
- Develop future projections for water withdrawals and returns within the Basin to the year 2058.
- Evaluate groundwater impacts and recharge during drought conditions.
- Develop a GIS database of withdrawals and returns including ownership information, physical descriptions, historical water use, and future projections.
- Determine safe yields (SY) under current operating conditions for water supplies using the Project's reservoirs.
- Develop data and information for use in refining Duke's Low Inflow Protocol to be implemented by water users during drought conditions.
- Survey and review fee structures and other water management practices used by other reservoir owners for water withdrawals. (Note: Not all Study Team members supported this work element.)

- Develop a long-term management plan for the GIS database.
- Continue safe yield evaluation incorporating any changes in the operating conditions being proposed as part of relicensing.

The results of this Water Supply Study are included herein.

1.3 WATER WITHDRAWAL AND RETURN PROJECTIONS

The annual average water withdrawal and return projections and net system outflows are summarized in Table ES-1 and Figures ES-1 and ES-2 on the following pages. As presented, future water withdrawals and returns for each water user were generated for the years 2008, 2018, 2028, 2038, 2048, and 2058. Appendix C presents a summary breakdown of this analysis by user, while Appendix D provides detailed flow projection methodology for each user. Annual average flowrates for years that fall in between the projection years can be interpolated between the projected years.

As illustrated in Table ES-1 and Figures ES-1 and ES-2, the overall net outflow for the entire Basin is expected to increase from approximately 170 mgd (262 cfs) to 478 mgd (740 cfs) by the year 2058. This represents an increase of approximately 181 percent, or an annual growth rate of 1.9 percent.

Figures ES-3 and ES-4 present the percentage that each user type—public water supply, industrial, agricultural/irrigation, and power—contribute to the overall net outflow in the basin in the current year and the year 2058, respectively. As illustrated, all user types are expected to see an increase in total net outflow over the Study period, with public water supply projected to comprise a greater percentage of the total net outflow in 2058.

1.4 SAFE YIELD RESULTS

Safe yield is a term used in this Study to describe the amount of water theoretically available at a given location in a watershed. It is a commonly used measure of the dependability of a water supply source. To estimate safe yield, the basic analytical approach generally employed is the calculation of a water budget that allocates and accounts for the water, given the constraints imposed by the facilities and their operation, over the critical low-flow period of the available hydrologic record.

Safe yield analyses were completed for the two operating scenarios outlined below:

- ***Baseline Safe Yield*** – This analysis calculates safe yields for the Project's reservoirs using baseline, or current, operating conditions. These baseline conditions include Duke's current FERC license requirements, other agreements honored by Duke, and other current operating practices.

Table ES-1. Projected Annual Average Withdrawal, Return, and Net Outflow Rates by Watershed (in mgd)

Reservoir	Current[1]	2008	2018	2028	2038	2048	2058
				Year			
Withdrawals							
James	11	12	13	14	15	32	34
Rhodhiss	26	28	30	33	36	40	44
Hickory	18	17	21	25	30	37	44
Lookout Shoals	1	6	7	9	10	12	12
Norman	60	66	99	118	133	169	179
Mountain Island	101	131	153	172	192	207	224
Wylie	92	95	101	120	130	141	155
Fishing Creek	103	132	146	159	172	183	195
Great Falls-Dearborn	1	2	2	2	2	2	2
Cedar Creek	1	1	1	1	1	1	1
Wateree	6	8	9	11	26	27	56
Subtotal	*420*	*498*	*582*	*664*	*747*	*851*	*946*
Returns							
James	9	10	11	12	12	13	14
Rhodhiss	14	15	17	18	20	21	23
Hickory	6	7	8	9	11	14	16
Lookout Shoals	1	1	1	1	1	1	1
Norman	2	2	2	3	3	4	4
Mountain Island	6	8	12	14	16	18	18
Wylie	45	46	52	59	68	77	89
Fishing Creek	165	192	213	234	254	272	291
Great Falls-Dearborn	1	1	2	3	5	7	9
Cedar Creek	1	1	1	2	2	3	3
Wateree	0	0	0	0	0	0	0
Subtotal	*250*	*283*	*319*	*355*	*392*	*430*	*468*
Net Outflows							
James	2	2	2	2	3	19	20
Rhodhiss	12	13	13	15	16	19	21
Hickory	12	10	13	16	19	23	28
Lookout Shoals	0	5	6	8	9	11	11
Norman	58	64	97	115	130	165	175
Mountain Island	95	123	141	158	176	189	206
Wylie	47	49	49	61	62	64	66
Fishing Creek	-62	-60	-67	-75	-82	-89	-96
Great Falls-Dearborn	0	1	0	-1	-3	-5	-7
Cedar Creek	0	0	0	-1	-1	-2	-2
Wateree	6	8	9	11	26	27	56
Subtotal	*170*	*215*	*263*	*309*	*355*	*421*	*478*

1 – Current rates were based on the most recent available years for which withdrawals and returns were recorded. The most recent year for a given water user ranged between 1999 and 2003.

Figure ES-1. Current vs. 2058 Net Outflow Comparison (in units of mgd)

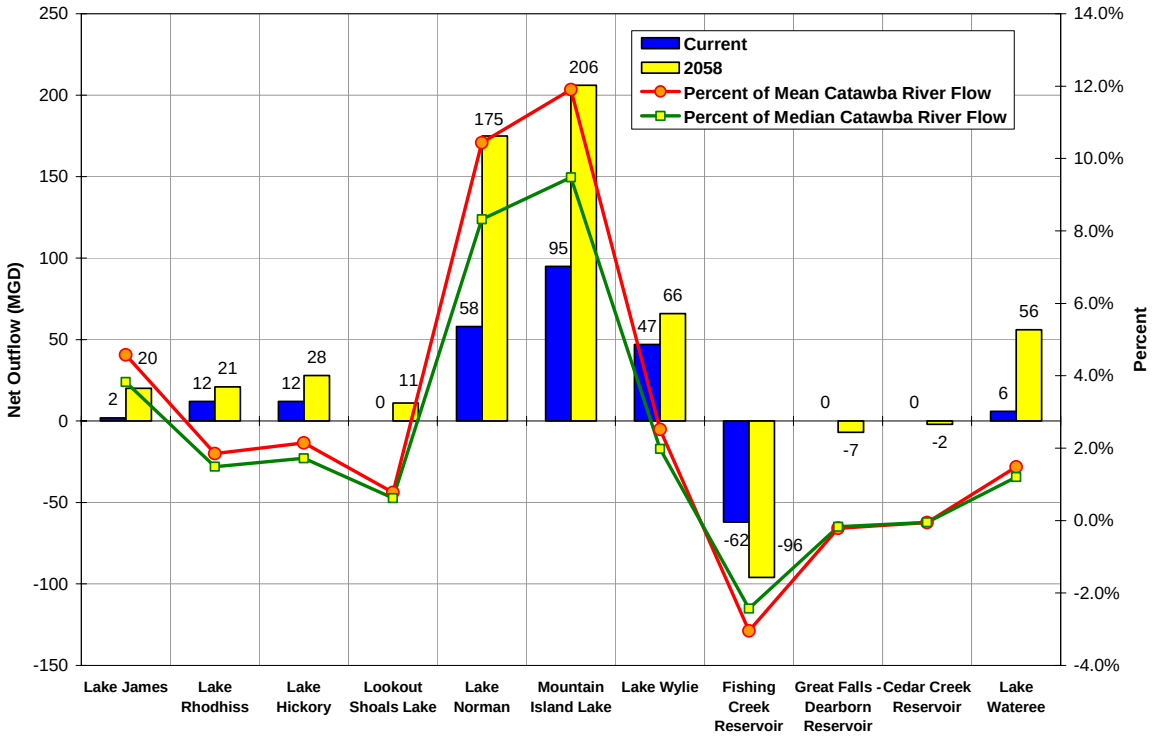


Figure ES.2 - Current vs. 2058 Net Outflow Comparison (in units of cfs)

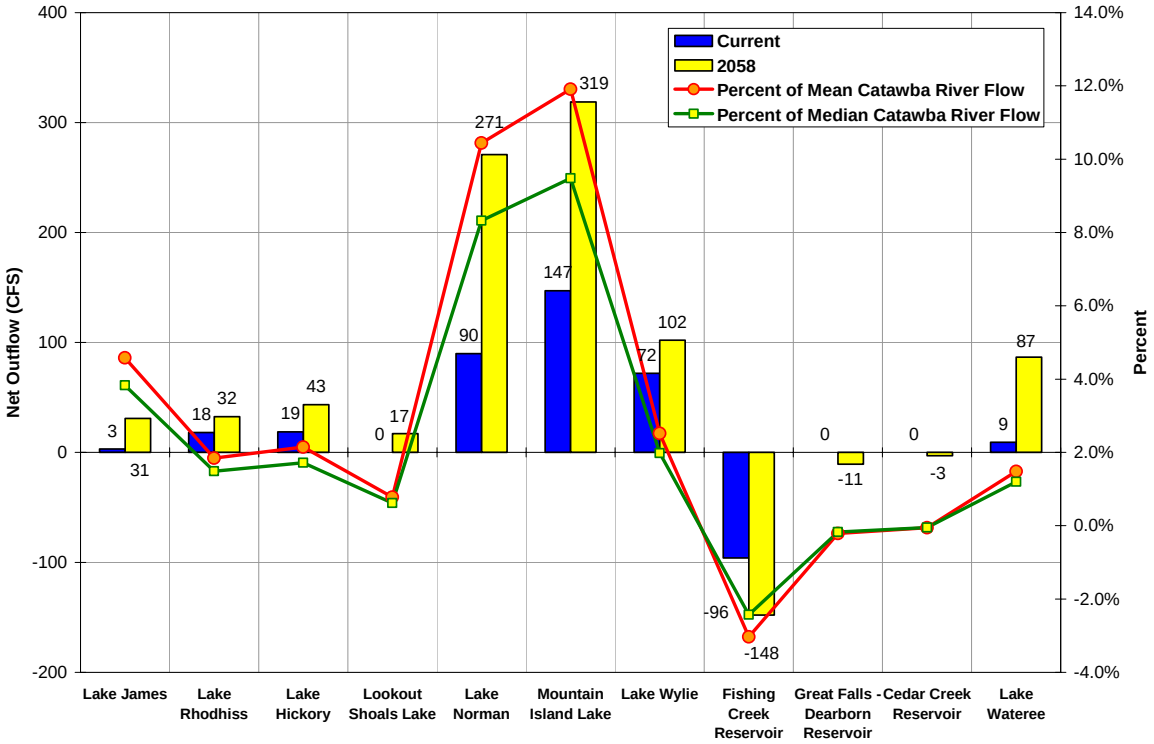


Figure ES.3 - Current Net Outflows for the Catawba-Wateree River Basin (in MGD) and % of Total

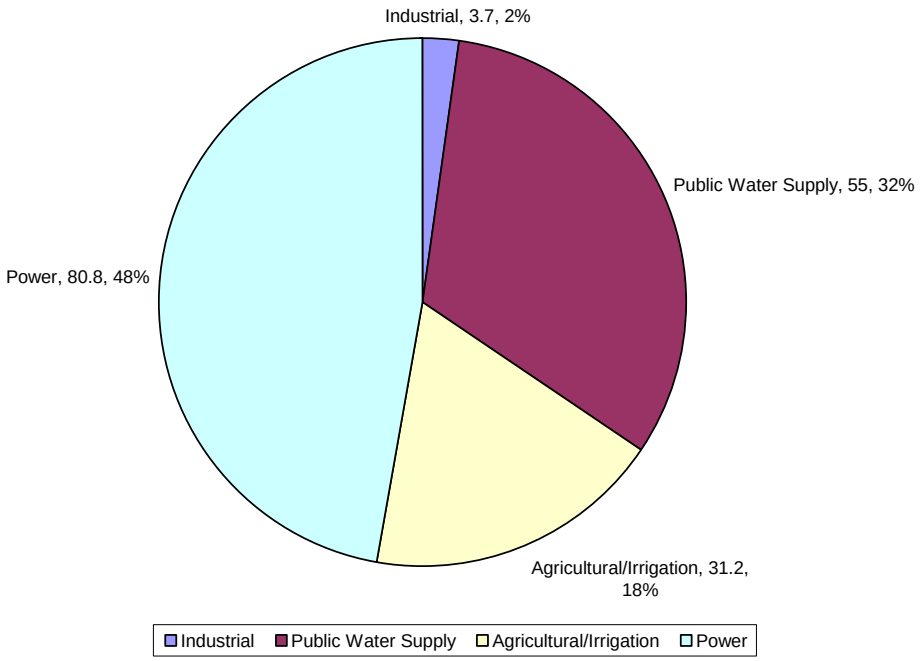
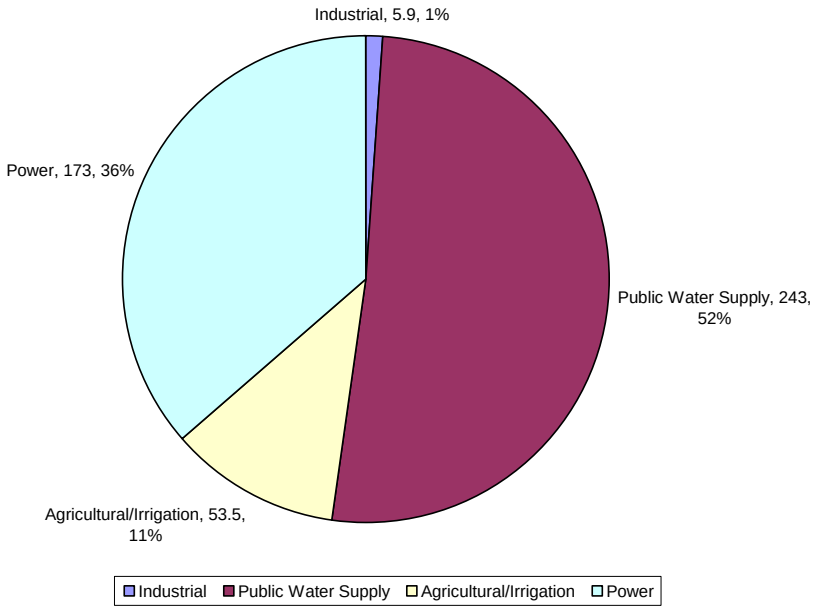


Figure ES.4 - Projected Net Outflows for the Catawba-Wateree River Basin in 2058 (in MGD) and % of Total



- ***Mutual Gains Safe Yield*** – This analysis calculates safe yields for the Project's reservoirs using the Mutual Gains operating conditions negotiated (as of November 28, 2005) during the relicensing process. The Mutual Gains operating conditions include many new, proposed, operating parameters and constraints, including, but not limited to:
  - Downstream flow requirements from each reservoir.
  - Normal minimum elevations for each reservoir.
  - Implementation of the Low Inflow Protocol.

Since safe yield is a measure of a water supply's reliability, it is important to evaluate low flow periods throughout the water supply's hydrologic record. After reviewing the available hydrologic data and energy generation history of the Project, the low inflow periods identified in Table ES-2 were selected to evaluate safe yield. In order to ensure that the full drought period was captured, the inflow periods chosen for safe yield modeling began and ended with a 'wet' year (i.e., years not considered part of the drought).

Table ES-2. Low-Inflow Periods Utilized for Safe Yield Evaluation

Low-Inflow Period	Dates
1	January 1937 – December 1948
2	January 1949 – December 1959
3	January 1964 – December 1971
4	January 1984 – December 1989
5	January 1998 – December 2003

For the Baseline safe yield evaluation, the critical intake reservoir elevation constraint was utilized. For the Mutual Gains safe yield evaluation, the following three reservoir constraint elevations were considered: critical intake reservoir elevation constraint, critical boat access reservoir elevation constraint, and full reservoir usage.

The relationship and operation of the Project's reservoirs, the physical limitations of the existing water supply infrastructure, and the various operating constraints that can be evaluated make the determination of safe yield for the Project's reservoirs a complex and challenging task. The CHEOPS™ (Version 8.5) model has been a valuable tool to simulate the operation of the Project under various operating conditions. Some of the variables that have been considered to arrive at safe yield results include, but are not limited to:

- Operating conditions: Baseline (current), Mutual Gains.
- Low inflow periods evaluated.
- Projected future water withdrawals and returns; and the locations of these withdrawals and returns.

- Low inflow protocol triggers and actions.
- Locations of reservoir level constraints and/or physical infrastructure locations.

For this Study, both a Baseline safe yield and a Mutual Gains safe yield have been calculated. Table ES-3 provides a quick summary of the results for each of these safe yield evaluations.

Table ES-3. Safe Yield Evaluation - Summary

Reservoir	Projected Range of Safe Yield Values (mgd) [Associated Year Withdrawal is Projected to be Reached]	
	Baseline Critical Intake [1]	Mutual Gains Critical Intake
James	32-34 (2048-2058)	32-34 (2048-2058)
Rhodhiss	40-44 (2048-2058)	40-44 (2048-2058)
Hickory	37-44 (2048-2058)	37-44 (2048-2058)
Lookout Shoals	12 (2048-2058)	12 (2048-2058)
Norman	133-169 (2038-2048)	169-279 (2048-2058)
Mountain Island	192-207 (2038-2048)	207-224 (2048-2058)
Wylie	171-189 (2068-2078)	141-155 (2048-2058)
Fishing Creek	> 238 (> 2078)	> 238 (> 2078)
Great Falls-Dearborn	2-3 (2058-2068)	> 3 (> 2078)
Cedar Creek	1 (2058-2068)	> 1 (> 2078)
Wateree	> 74 (> 2078)	> 74 (> 2078)

Notes: 1. Withdrawal flows associated with years given may not match exactly with flows outlined in Section 3 and Appendix C. Baseline safe yield analysis was completed in January 2005, prior to minor updates of the withdrawal/return projections.

Based on the results presented in this section, the following key conclusions can be made regarding safe yield:

- Low inflow periods 2 (1950s drought) and 5 (the 1998-2002 drought) are the key drought periods in the hydrologic period of record to consider for determining safe yield.

- Upstream reservoirs in the Catawba-Wateree Project are integrally linked to supplying downstream reservoirs during periods of low inflow, given the relative size of the reservoirs and their location to water withdrawals and net outflows.

- The development of the Mutual Gains operating conditions was completed through negotiation with the Project's stakeholders, and through a series of CHEOPS™ modeling runs. One objective of this operating condition was to promote a reliable water supply during periods of low inflow. The Baseline safe yield values resulted in projected net outflows to be limited in some reservoirs by the year 2038. The Mutual Gains safe yield modeling runs have indicated safe yield of the first seven reservoirs being reached by the year 2048 (actually between years 2048 and 2058).

- The implementation of the Low Inflow Protocol makes a substantial impact on the Project's ability to maintain critical water storage inventory during periods of low inflow; and to access needed storage if hydrologic conditions continue to worsen.

- The safe yield values associated with the critical boat access constraint elevations fall into one of two categories. For those reservoirs where this constraint elevation is relatively high, the Mutual Gains operating condition indicates failure at or before the year 2008 projected net outflows. For those reservoirs where the constraint elevation is not as high, then the projected net outflows are able to reach beyond 2078 projections, due in part to the projected net outflows of the other reservoirs being limited to 2008 conditions after failure.

- Changes in any of the variables discussed above, or throughout this document, that may impact safe yield results will require an update to the modeling runs to determine revised safe yield values.

- To ensure a reliable safe yield from the Project's reservoirs throughout the next 50 years, Duke Power and the other water users must adhere closely to the Mutual Gains operating conditions, including implementation of the Low Inflow Protocol.

1.5 GIS DATABASE

A Geographic Information System (GIS) database was created during this Study to document water withdrawals and returns in the Catawba-Wateree River Basin. This database is a useful tool in reporting and documenting the findings of this Study. Furthermore, the GIS database is available for future use by the Study Team members (and others), and it may be enhanced to support long-term water and wastewater planning for the region.

The GIS database includes background topographical and physical feature information that was obtained from GIS data clearinghouses and public domain datasets. In addition to these layers, two additional layers were added as part of this Study:

- ***Flow Modification Points (FMPs) Layer*** – Each defined feature in this layer is a single point that represents a location where water is either withdrawn from or returned to a reservoir or free-flowing water body. Points are defined in the database for those locations where average daily withdrawals or returns are greater than 100,000 gallons per day (gpd), for withdrawals where an assigned value has been made (e.g., an agricultural demand per reservoir), or as a placeholder for known, potential, future withdrawals.

- ***Basin Layer*** – The watershed for each of the 11 Project reservoirs is delineated to help users identify FMP locations and their relationship to the Project reservoirs.

The GIS database is included in electronic format in Appendix M.

1.6 WATER WITHDRAWAL MANAGEMENT SURVEY RESULTS

Duke and its electric customers absorb the cost of maintaining the Project's eleven reservoirs. Continued regional growth, as well as the operational changes resulting from the ongoing hydro-relicensing process, will increase the demand for the limited water supply and will result in a long-term, gradual reduction in the amount of water available to produce hydroelectricity. This reduction in hydropower, which is Duke's lowest costing, most efficient, most flexible, and cleanest generation source, will result in higher costs for electric customers. Duke will have to burn more fuel at its fossil-fueled stations or purchase higher-cost power elsewhere to make up for the lost hydroelectricity. Duke is concerned about the potential impacts to its electric customers as well as the long-term economic viability of its hydro stations. As a result, Duke used this Water Supply Study as a vehicle to evaluate cost and water management options used by other reservoir owners.

Since the Water Supply Study was directed by a Study Team comprised of industry professionals who represent water users that may be affected by future policy changes, it was determined to be the best venue for completing a survey of other reservoir owners (e.g., other utilities, US Army Corps of Engineers, Tennessee Valley Authority, etc.) to gather information on their water withdrawal permitting practices, drought response measures, and policies for charging water withdrawal fees.

A water withdrawal management survey form (Survey) was developed with input from the Water Supply Study Team. The Survey covered a wide variety of informational topics that are categorized as follows:

- Background Information on the institution or organization completing the Survey.
- Reservoir use permitting.
- Withdrawal fees.
- Drought management.
- Other issues.

The findings from this survey are included in Section 6.0.

1.7 LOW INFLOW PROTOCOL

As part of the relicensing effort, Duke Power has led the development of a Low Inflow Protocol (LIP) for the Catawba-Wateree Project. The purpose of the LIP is to establish procedures for reductions in water use during periods of low inflow to the Catawba-Wateree Project. The LIP was developed on the basis that all parties with interests in water quantity will share the responsibility to establish priorities and to conserve the limited water supply. The Water Supply Study Team members, as well as other stakeholders in the Project, have provided input into the development of the LIP.

The LIP provides trigger points and procedures for how the Catawba-Wateree Project will be operated by Duke Power, as well as water withdrawal reduction measures and goals for other water users during periods of low inflow (i.e., periods when there is not enough water flowing into the Project reservoirs to meet the normal water demands while maintaining reservoir levels within normal ranges).

The LIP includes five stages (Stages 0 thru 4) with progressively greater water reduction measures for all water users imposed as various trigger points are reached. The goal of the staged LIP is to take the actions needed in the Catawba-Wateree River Basin to delay the point at which the Project's available water storage inventory is fully depleted.

2.1 CATAWBA-WATEREE HYDRO RELICENSING PROJECT

Duke Power's (Duke) current license governing operation of its Catawba-Wateree Project (the Project), which includes 13 hydroelectric power stations and 11 reservoirs spanning from the foothills of North Carolina to the central Piedmont of South Carolina, expires in 2008. Given the need to continue operation of this system, Duke is in the process of relicensing this Project. It is one of the largest relicensing projects currently underway in the United States. In addition to supplying hydroelectric power, the Project also supports water supply for public health, agriculture, irrigation, thermal power plants, industries, and recreational uses. The Project helps fuel economic development and growth to a region that currently has a population of over 1.5 million people. An outline of the Catawba-Wateree River Basin is included in Figure 2.1. The Federal Energy Regulatory Commission's (FERC) possible relicensing period is from 30 to 50 years, and the terms and conditions of the new license will help shape the future of the Catawba-Wateree River Basin. Duke Power has elected to pursue relicensing under an approach that provides collaboration between many stakeholders of the Catawba-Wateree system, and those stakeholders are currently negotiating a stakeholder agreement that will hopefully resolve many of the relicensing issues.

2.2 WATER SUPPLY STUDY

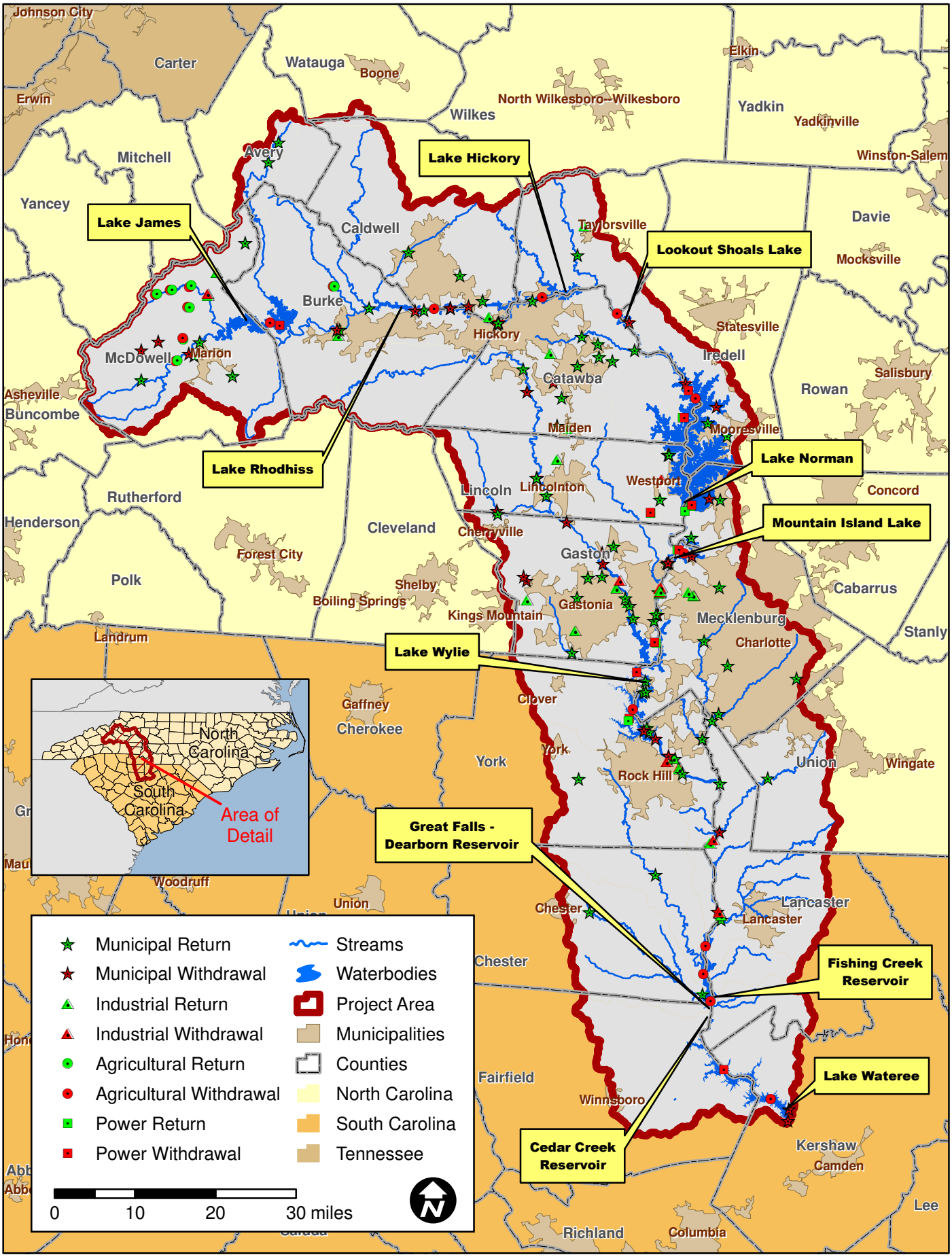
Early in the relicensing process, the Project's stakeholders had an opportunity to provide comments, recommendations, and requests for studies that they deemed important to the relicensing effort. Several stakeholders requested that long-term regional water supply issues be evaluated. Duke envisioned a similar evaluation after struggling through the recent drought that occurred in the region from 1998 to 2002. Fortunately, the drought ended in late 2002 and water supply has been adequate in the region since that time. However, the need to consider long-term water demand and its relationship to Duke's operation of the 11 reservoirs was still deemed important. Thus, Duke initiated a Water Supply Study (Study) as part of the relicensing effort.

Since the Water Supply Study has benefits to others in the region, including water supply interests and state regulatory agencies, Duke elected to develop a technical team of water supply professionals that would serve to guide the Study. The Study Team is comprised of 14 water supply agencies, regulatory agencies of both Carolinas, and Duke Power (see Acknowledgements in Section 9.0). The input provided by this group led to the development of a scope of work as well as parameters for selection of an engineering consultant to complete the Study. The Study was divided into two phases and included the following general scope of work items (the detailed Study Plan is included in Appendix A):

- Compile a list of water withdrawals and returns within the Basin that are greater than or equal to 100,000 gallons per day.
- Develop future projections for water withdrawals and returns within the Basin to the year 2058.

- Evaluate groundwater impacts and recharge during drought conditions.
- Develop a GIS database of withdrawals and returns including ownership information, physical descriptions, historical water use, and future projections.
- Determine safe yields (SY) under current operating conditions for water supplies using the Project's reservoirs.
- Develop data and information for use in refining Duke's Low Inflow Protocol to be implemented by water users during drought conditions.
- Survey and review fee structures and other water management practices used by other reservoir owners for water withdrawals. (Note: Not all Study Team members supported this work element.)
- Develop a long-term management plan for the GIS database.
- Continue SY evaluation incorporating any changes in the operating conditions being proposed as part of relicensing.

Once the scope of work was defined and a consultant selected, the Study Team switched its focus to Project execution. The results of this Study are included herein.



Catawba-Wateree River Basin

Figure 2-1

3.1 OBJECTIVE

The initial step in this Study called for developing reliable water withdrawal and return projections for the entire Catawba-Wateree Basin to the year 2058 (the possible period of relicensing). In compiling the list of current users, the Water Supply Study Team elected to focus on those users that currently withdraw or return from a surface water source an average daily rate of 100,000 gallons per day (gpd - or 0.1 mgd) or more from the Basin. While there may be numerous users that withdraw or return water at rates less than 100,000 gpd, their impact on net outflow from the watersheds of each reservoir was considered insignificant for long-term safe-yield analyses. This determination was made since many of these small users would likely be withdrawing and returning at similar rates and within the same watershed. Also, the net outflow produced by these users would be very small relative to the overall net outflow resulting from the users that are documented in this Study.

There are 11 dams and reservoirs in the Catawba-Wateree Basin that are operated by Duke Power. For the purpose of this Study, the Catawba-Wateree Project was delineated into 11 incremental watersheds, one for each reservoir in the Project. These watersheds are listed below from the most upstream reservoir to the most downstream reservoir in the Project:

- Lake James
- Lake Rhodhiss
- Lake Hickory
- Lookout Shoals Lake
- Lake Norman
- Mountain Island Lake
- Lake Wylie
- Fishing Creek Reservoir
- Great Falls-Dearborn Reservoir
- Cedar Creek Reservoir
- Lake Wateree

While it was important to perform a detailed evaluation of each water withdrawal and return, the focus was on a watershed system analysis of total net water usage. By evaluating the total water demand using this watershed system, more accurate projections were computed as individual system forecasts were measured against other regional projections for population growth and economic factors. For example, if all the water users within a particular watershed were forecasted with aggressive growth in demand, it is possible that an overestimate of actual water usage for the Study period would have resulted from that particular area. The watershed-based system evaluation facilitated keeping the projections within the bounds of more reasonable regional projections.

Furthermore, the net water usage (or outflow) for each watershed system was determined to be the critical value for this Study, since it impacts available water supply for the users.

3.2 WATER WITHDRAWAL AND RETURN PROJECTION METHODOLOGY

A detailed approach was used to forecast future (50+ years) water withdrawal and water return projections within the Catawba-Wateree River Basin. The following subsections outline the considerations and approach to forecasting water withdrawal and return projections for the Study period.

Those using the Catawba-Wateree River Basin for water supply or returns can generally be grouped into one of the following major categories:

- ***Agricultural and Irrigation*** – These users include farms, golf courses, and other facilities that utilize water for livestock production, irrigation, and other uses.
- ***Power*** – Duke (non-hydro) facilities within the Project that utilize water for cooling and other energy production needs.
- ***Public Water Supplies and Wastewater Utilities*** – These systems include municipal and other utility agencies that withdraw and treat water for public consumption; residential, commercial, and industrial use; and systems that treat wastewater and return it to a surface water source.
- ***Direct Industrial*** – These industrial users have direct withdrawals and/or returns from surface water sources and utilize water in their manufacturing processes.

As noted above, this Study was limited to withdrawals and returns that are greater than 100,000 gpd. This approach was selected to allow greater focus and more detailed projections for those significant users of the Catawba-Wateree system.

3.2.1 Agricultural and Irrigation Projections

Agricultural and irrigation (A&I) users required a multi-step process to forecast usage within the Basin. Data on specific agricultural and irrigation withdrawals is limited. The minimum registration required for agricultural withdrawals by North Carolina statute is 1 mgd; no registrations are required in South Carolina. Therefore, the following approach was utilized to forecast A&I usage.

Data was obtained from the United States Geological Survey (USGS) in five-year increments and from the South Carolina 2004 Water Plan on a per-County basis. The North Carolina USGS section provided crop and livestock withdrawals between 1985 and 2000. In 2000, they further disaggregated usage into crop, livestock, and golf courses and distinguished between ground and surface water withdrawals. The South Carolina USGS section provided crop and livestock information between 1985 and 1995. Data for 2000 was obtained from the South Carolina 2004 Water Plan, which also indicated water usage for golf courses by county. It should be noted that the A&I forecasts incorporated four main assumptions:

- A&I water withdrawals are completely consumptive (i.e., no surface returns).
- A&I water withdrawals for a given county are consumed uniformly over that county's land area.

- The percentage of a county's land area within a particular reservoir's watershed is commensurate with the percentage of that county's total A&I water withdrawal that is taken from that watershed. For example, if 25 percent of a county's land area resides within a particular watershed, it was assumed that 25 percent of that county's A&I water demand is satisfied by the reservoir associated with that watershed.

- Private irrigation by individual residential properties directly from the Project's reservoirs presents a negligible impact on the net outflow from the Project reservoirs. While there may be numerous residential irrigation users, their average daily withdrawals are extremely small relative to other user types in this Study. Additionally, since these properties are adjacent, or nearly adjacent to the reservoirs, much of the water withdrawn is likely transferred into the groundwater and feeds back into the reservoirs.

Projections were completed on a per-watershed level. For example, A&I usage was calculated for Lake Rhodhiss separately from Lake Norman, and so forth. The GIS database developed for this Study was utilized to determine the percentage of each county that lies in each reservoir's watershed within the Catawba-Wateree Basin.

The water withdrawal trends for A&I were evaluated from 1985 through 2000. An annual growth rate (AGR) for each county was determined for each usage category (crop, livestock, and golf courses). For crop and livestock projections, the AGR for each county was utilized to forecast withdrawals through 2058. Subjective consideration was also given to counties likely to experience rapid urban development, and the impacts of this development on land available for A&I uses. These numbers were then multiplied by the percentage of each county that lies within each reservoir's watershed.

The 2000 data provided by the North Carolina USGS office broke down the withdrawals between surface and groundwater. This percentage of surface water withdrawals for North Carolina was applied to the South Carolina golf course data. Then the percentage that each county overlaps the watersheds was applied to forecast usage through 2058.

The golf course projections made were also compared with a typical golf course that utilizes approximately 0.25 mgd per 18 holes. The projected increase in number of golf courses per county, and subsequently in each watershed, was determined. The irrigation rate per 18 holes was applied to determine the number of courses in each watershed and then compared to the 2004 projections. Based on these results, subjective consideration was also given to the number of golf courses per county and counties likely to experience rapid urban development and the impacts of these results on water demand.

A&I water withdrawal projection analyses are included in Appendix E.

3.2.2 Duke Power Projections

Duke Power maintains a database of energy demand, water use, and population. For the purposes of this Study, Duke completed an internal evaluation of future energy needs during the expected period of relicensing and then equated this future energy need with a water use forecast. As it relates to the net

outflow of water from the system, accurate accounting for Duke's current and future demand was critical to this Study's success.

The process used to project future water use for Duke's facilities is outlined as follows:

- Project future population growth within the current and potential future service areas to be supplied by Duke facilities that are located in the Catawba-Wateree River Basin.
- Determine additional power production requirements to meet the needs of this population growth and service area expansion.
- Determine the type of power production facilities that could be utilized to meet this future demand. It was assumed that 50 percent of future generation capacity would be comprised of baseload power and 50 percent would be combined cycle. Baseload power represents conventional facilities such as fossil fuel, nuclear, gas, or steam power generating stations. Combined cycle facilities generate power by combining gas and steam generators to produce energy more efficiently. Cooling water is required for both types of power generation, but combined cycle is more economical in its water use.
- Assign new power plant requirements to locations within the 11 reservoirs of the Catawba-Wateree River Basin.
- Determine when the new projects must be completed to meet the demands within the planning period.
- Equate water demand to the assignment of new power production facilities.
- Assume that the existing power production facilities in the Catawba-Wateree Basin will remain or be replaced by similar facilities.

It should be noted that the above analysis was not completed for the purpose of siting future power facility projects, nor do the assigned locations for new facilities indicate actual plans or targeted sites. The analysis was completed to ensure that these critical future water uses were considered as part of this Water Supply Study.

Duke currently operates two nuclear and three coal-fired power plants on three of the reservoirs in the Catawba-Wateree River Basin. The water needs for the new power plant production requirements determined as outlined above were, for the purposes of this Study, assigned to Lake James, Lake Norman, Lake Wylie, and Lake Wateree. This assignment of water demand was based on two primary considerations. First, this assignment conservatively spreads future water demand throughout the system. Second, these reservoirs represent the larger storage reservoirs within the Project. Table 3-1 summarizes the current and future power production assignments made by Duke for this Water Supply Study.

The total water use projections for these new and expanded facilities are included in Appendix C – Water Withdrawal and Return Projection Summary, and Appendix F – Duke Power Water Withdrawal Projections.

Table 3-1. Duke Power Existing and Future Power Plant Requirements Determined for the Study

Power Plant Description	Reservoir	Existing (E)/ New (N)	Year(s) New Facilities Completed
Lake James – New	James	N	2048
Lake Norman – New	Norman	N	2018, 2048, 2058
Marshall	Norman	E	-
McGuire	Norman	E	-
Riverbend	Mt. Island	E	-
Catawba	Wylie	E	-
Allen	Wylie	E	-
Lake Wylie – New	Wylie	N	2028
Lake Wateree - New	Wateree	N	2038

3.2.3 Public Water Supplies and Wastewater Utilities Projections

Forecasting water withdrawal and return projections on a regional basis for public water supplies required a multi-step approach. The approach used in this Study is summarized as follows:

1. Collected available data to determine historical results for withdrawals and returns, and gathered previously developed future projections. This data included:
    a. Local Water Supply Plans (LWSPs) (for water systems in North Carolina); and other water use data for water supplies for the years 1992, 1997, 2002, and 2003.
    b. Discharge Monitoring Reports (DMRs) or wastewater discharge/return data for wastewater facilities – 1992, 1997, 2002, and 2003.
    c. Recent studies and reports (e.g., 201 Facility Plans, water master plans) from specific users.
    d. Historical population figures and population projections.
    e. Significant industrial users for large public water supply systems (e.g., those using 50,000 gpd or more).
2. Disaggregated industrial and other types of usage from historical water withdrawal and return results provided by the public water systems and evaluated usage per customer type for each system.
3. Evaluated future increases in water demand by evaluating growth within existing service areas, and through evaluation of service area expansion for each system or industry.

4. Considered impacts of future trends on water withdrawal and return projections, including:
    a. Water reuse.
    b. Water conservation.
    c. Regulatory and economic drivers.
    d. Industrial/economic shifts.
5. Generated revised withdrawal and return projections for each existing user. These projections were based on annual average withdrawal and return rates for the Study period, with a monthly variation trend developed for each watershed to be applied to each year of the Study period.
6. Compared any previous projections with the revised projections and analyzed any differences.
7. Evaluated water supply sources and growth adjacent to the Catawba-Wateree River Basin and estimated future increases in inter-basin transfers either into or out of the Basin.
8. Summed individual results into total projections for each reservoir watershed system.

The goal for this forecasting effort was to minimize assumptions required and be equitable in the treatment of each system. The methodology used is outlined in further detail in the subsections to follow.

3.2.3.1 Data Gathering Process

Duke's Catawba-Wateree Project lies within both North and South Carolina. Therefore, data was obtained from the North Carolina Department of Environment and Natural Resources (NC-DENR) and other North Carolina agencies in addition to the South Carolina Department of Health and Environmental Control (SC-DHEC) and the South Carolina Department of Natural Resources (SC-DNR).

Most data on withdrawals and returns in North Carolina is publicly available on NC-DENR's website. Therefore, historical water demand data was gathered from information presented in the 1991 and 1997 LWSPs submitted to the NC-DENR Division of Water Resources (DWR) by each utility. The 2002 LWSPs were also obtained for use in this Study.

Discharge monitoring reports (DMRs) for all National Pollutant Discharge Elimination System (NPDES) permitted facilities that are registered to return more than 0.1 mgd were obtained from the NC-DENR Division of Water Quality (DWQ) for years 1997 and 2002. Analysis of the DMRs was used to develop a correlation between the historical water demand data and wastewater discharges.

Water supply and demand data for South Carolina is not readily available in the same format as the LWSPs in North Carolina. A request letter was submitted to SC-DHEC's Freedom of

Information (FOI) office to obtain updated information. An updated list of NPDES permitted facilities, along with DMRs for years 1997 and 2002, was also obtained from SC-DHEC.

While data available in the public domain was useful to evaluate historical results and determine baseline projections, it was recognized that greater and more specific information could be obtained directly from individual permitted users. As such, HDR submitted a data request letter and questionnaire to the utilities and industries within the Basin. A copy of that letter and questionnaire is included in Appendix B. Responses to this information request were sporadic. Thus, HDR continued with follow-up phone calls and emails to many of the users. Furthermore, since a high percentage of the total water use in the Basin was comprised of organizations with representatives on the Water Supply Study Team, individual meetings were held with each of these Team members to ensure more accurate withdrawal and return projections.

Historical population data and projections were also obtained through contact with regional Councils of Government (COGs), the Office of State Planning, and regional planning agencies. Historical population figures and system data were used to help determine historical per capita use rates for the different systems. Population projections were used to generate future water demand and provide a check on regional water demand projections.

In addition to personal communications, the following list summarizes sources of data used in the development of withdrawal and return projections:

- North Carolina Department of Environment and Natural Resources
- South Carolina Department of Natural Resources
- South Carolina Department of Health and Environmental Control
- US Census Bureau
- North Carolina Office of State Planning
- South Carolina Office of State Planning
- North Carolina State Demographer
- Mecklenburg County Planning Commission
- Catawba Regional Council of Government
- Western Piedmont Council of Government
- Charlotte Chamber of Commerce

3.2.3.2 Disaggregation of User Types

Using the historical information available, the major industrial, commercial, and other user categories supplied by each public water system were disaggregated, as appropriate, and a per-customer usage factor was developed. Future industrial withdrawal and return rate projections were considered as part of the external impact evaluations as outlined in Section 3.3.4. Current water use factors for residential and other non-industrial demand were calculated for major water purveyors on a gallon per customer per day (gpcd) basis. Historical trends were

considered for water use factors for each system. For instance, the change in per customer usage over time was evaluated to determine the most appropriate forecasting unit factor.

3.2.3.3 Increased Withdrawals and Returns Within the Existing Service Areas

The water use factors and other information obtained were used to project future water demand due to residential population and other non-industrial growth. A similar approach was used to calculate water returns. If a wastewater drainage basin is expected to see population growth, unit factors for wastewater discharges or historical relationships established with water use were determined and appropriate projections made. Consideration was also given to the overall population density of service areas. For example, population growth rates throughout the Study period (to 2058) were used to project future population for defined service areas. In the more urbanized areas, an evaluation of population density was completed and a determination made on its impact to continued population growth. For example, while Mecklenburg County was projected for continued strong growth early in the Study period, this rate was much reduced near the end of the Study period (see detailed projections in Appendix D).

3.2.3.4 Increased Withdrawals and Returns Resulting from Service Area Expansion

One of the most challenging tasks of the water withdrawal and return projections was assessing the realistic potential for service area expansion of existing systems. Some of the water users had facility plans or master plans that outlined service area expansions and provided a detailed analysis in the projection of future water demand or wastewater generated. However, only a few of these planning documents extended beyond a 20-year planning period.

Some considerations that were factored into projecting future service area expansion included:

- A review of previous projections made by the individual systems.
- An evaluation of population density growth adjacent to the existing systems.
- Historical growth by the individual systems.
- Economic data and forecasts.
- Transportation corridors currently in the development stage and the potential impacts on water demand.

While this approach may seem tedious, it is important to remember that the focus of this Study is on individual watersheds. The actual service area expansion forecasts are more important on a regional basis, rather than an individual water system basis.

To illustrate, withdrawal and return projections were determined for the existing systems. Service area expansion was then assigned to one or more of the users within each reservoir's watershed. In making these assignments, the focus was on determining reasonable regional projections for future water withdrawals and returns, not on which entity would, or should, be designated to meet these future needs. The critical value in this Study is the total water withdrawals and returns within each reservoir's watershed.

3.2.3.5 Relationship of Future Projections to Permitted Flow

The projections used in this Study focus on annual average flows; that is, the average withdrawal or return flow through the course of a 365-day calendar year.

Many users of the Catawba River Basin have a permitted withdrawal or return flow for their facilities that is granted by state or federal regulatory agencies. These permitted flows were determined at different points in time and based on many environmental and other issues. This Study does not consider permitted flows for water users but makes projections based on expected future demand.

3.2.4 Industrial User Projections

Industries that utilize waters of the Catawba-Wateree River Basin typically do so in one of two ways. First, an industry may have a direct withdrawal (or return) into one of the surface water sources (lake, river segment, tributary). Alternatively, an industry may be connected to a public water supply system or wastewater utility. Projections for both types of uses were made as part of this Study. Industries with direct withdrawal or return flows of greater than 100,000 gpd are presented and summarized in Appendices C and D. For industrial users connected to public water supplies or wastewater utilities, details are provided in Appendix D on how flow amounts were assigned to industrial categories and how the projections were made.

As data was gathered on historical flows (see previous section) from industrial users, the Water Supply Study Team quickly recognized the tremendous impact that the loss of industrial manufacturing has made on the water withdrawals and usage in the Basin. Some public water supplies in the Basin have seen flat or negative growth over the past decade in their overall water withdrawals, even as population in their service area grew. The challenge for this Study was to make the most accurate projections for industrial water demand without underestimating or overestimating the impact of future industrial needs in the Basin. To make these projections, a 'one size fits all' methodology was not used. Instead, data was gathered from a variety of sources and projections made based on the best information available. A few of the approaches taken to make these projections are outlined below.

For the 14 water supply agencies on the Water Supply Study Team (who comprise the vast majority of public water system withdrawals and returns in the Basin), a breakdown of their large industrial users (defined as those industries with flows greater than 50,000 gpd) was requested. A meeting was held with each of these agencies where industrial customer use was discussed to assist in making a best determination of how to project future flows.

- ***Example*** – The Town of Valdese has a high percentage of its customer base that is comprised of the textile industry. After meeting with the Town's staff and reviewing their large industrial customers, industrial flow projections were made based on a modest annual growth rate (AGR) of 0.25. In comparison, the residential and commercial projections for the Town of Valdese were made on an AGR of 1.25.

Attempts were also made for direct industrial users with large withdrawals to discuss their short-term and long-term plans for future water needs. No industry was able to project needs for the 50-year Study period, but many offered insight into shorter-range plans that promoted more accurate projections.

- ***Example*** – Bowater (located in SC) has a water withdrawal that has varied from 25 to 39 mgd between the years 1992 and 2002. Conversations with their staff indicated water optimization initiatives and future water demands that would be modest over approximately the next 20 years. Thus, the Study assigned an 0.5 percent AGR for the Study period.

In many cases, industrial withdrawal and return flow projections were evaluated based on the historical Gross State Product (GSP) trend for a particular industry type. These values were typically applied to increases or decreases in industrial production throughout the Basin during the Study period. By evaluating historical trends in water demand, and the GSP by industry type, the Study attempted to account for shifts in the regional economy from manufacturing to a more service-based economy. For example, a food processing company in North Carolina may currently withdraw from and/or return flow into the Basin. According to the North Carolina GSP, food product manufacturing statewide increased in production at an annual rate of 4.22 percent between the years 1990-2000. Assuming an annual inflation rate of 3 percent, which was experienced nationally during the decade of the 1990s, it was expected that this manufacturer would experience a 1.22 percent (4.22 to 3.00 percent) annual growth rate (AGR) in actual production. Water withdrawals would therefore be projected to increase from their current levels according to the same AGR.

- ***Example*** – For Huffman Finishing, furniture finishing; NC GSP of 4.68 percent from 1990 to 2000 for this industry sector, an AGR of 1.68 (4.68 to 3.00) was assumed.

It should also be noted that the AGRs produced from the GSP were used only as a foundation to arrive at realistic projections. For instance, the North Carolina GSP indicated an 0.17 percent annual <u>decline</u> in production for the textile industry statewide in the 1990s, which suggests a post inflation AGR of -3.17 percent. However, application of a negative AGR would result in negative or zero withdrawal flows for some textile manufacturers. Therefore, an AGR of 0.00 percent was assigned to simulate no change in water withdrawals.

Making flow projections for the 50-year Study period is a challenging task. Given the scope and schedule for the Water Supply Study, we believe the documentation of current industrial flows and the projections are among the most accurate completed for the Basin. In reviewing this information, it should be noted that many industrial users return much of the water back into a surface water source within the Basin. Further, the Study indicates that direct industrial users (not including industries who purchase from public water supply systems) account for only approximately 2 percent of the current net outflows (withdrawals – returns) in the Basin; and the Study projects the industrial net outflows to account for only approximately 1 percent in 2058.

3.3 APPLICATION OF FUTURE TRENDS ON WATER WITHDRAWAL AND RETURN PROJECTIONS

To accurately project water withdrawal requirements and return projections through 2058, consideration was given to how potential changes in the water industry will impact future water demands and on how customer use may vary. An historical look back through the same number of years as the expected period of relicensing shows a 1950s landscape of public water supply systems and municipal wastewater collection systems that looked vastly different than they do today. Indeed, it would be another 20 years or more before the Clean Water Act and the Safe Drinking Water Act were enacted, changing the landscape of the water industry forever. Regulatory changes, technological advancement, increased population and growth within the Catawba-Wateree Basin, shifts from a manufacturing to a service-based economy, and other changes have helped redefine the economics of water supply and wastewater treatment.

Through the next 50 years, these continued changes, coupled with the impacts of aging infrastructure, may again redefine the economics and landscape of the water industry in this region. As a result, the way water is utilized as a resource may change. Several factors that may affect future water use include:

- The increase in water reuse initiatives.
- The impacts of water conservation efforts.
- Regulatory changes.
- Industrial and economic shifts.

A brief statement on how each of these trends are incorporated into this Study is outlined below. It should be noted that this discussion is focused on how these trends may specifically impact this Study and the Catawba-Wateree River Basin, not on their impacts on a national or global scale.

3.3.1 Water Reuse

Water reuse is beginning to receive increased attention in the Catawba River Basin. The future implementation of centralized and distributed reuse systems is likely to be driven by changing economics for water purveyors and wastewater utilities, <u>and</u> on water supply availability.

While water reuse systems may reduce the water withdrawals from the Catawba-Wateree Basin, they, in turn, may reduce direct water returns as well. The impacts of reuse were evaluated in this Study as to its overall impact on the withdrawal and return projections. However, after reviewing data from the utilities within the Basin, it was determined that projecting water reuse impacts should not be considered at this stage. This decision was made, in part, since none of the 14 Study Team Members are currently implementing water reuse within the Catawba-Wateree Basin. Charlotte-Mecklenburg Utilities has completed a small-scale reuse project, but it is located at one of their wastewater treatment facilities that currently discharges into the Yadkin River Basin. In addition to the lack of current water reuse activities in the Basin, meetings and discussions held with various public water supply agencies did not indicate a deliberate, rapid, or widespread move toward reuse implementation. However, several agencies indicated that reuse would likely be evaluated in the future. By not applying reductions to the water

demand during the planning period, the projections used for the safe yield analysis were more conservative. That is, the projections reflect future conditions without reductions that *may* occur as a result of more widespread implementation of water reuse. Based on the results of the safe yield analysis and other Study work elements, the application of water reuse to show potential impacts to overall demand may subsequently be considered. The impact of water reuse will likely vary by system due to the likelihood that the economic drivers, and the densification of reuse customers, will be different for many of the public water and wastewater systems within the Basin.

3.3.2 Water Conservation

The impact of water conservation initiatives in the Catawba-Wateree River Basin is similar to water reuse. That is, water supply availability, economic considerations, and system capacity limitations will help drive conservation – both on the purveyor side and the customer side. Water 'saved' through conservation will reduce both withdrawals and returns, but likely in different proportions. A review of selected water conservation programs was completed, including an analysis of their impact on water demand. Having reviewed several of the conservation programs for utility systems within the Basin, it was determined that projecting water conservation impacts should not be considered at this stage for several reasons. First, the relationship between conservation programs and withdrawals is difficult to quantify. Secondly, not assuming great reductions in withdrawals due to conservation programs would result in a safe yield analysis that is more representative of true current demand. Also, many of the public water supply agencies have already implemented water conservation initiatives, and the impacts of these initiatives are reflected in the baseline flows. By not applying reductions to the water demand during the planning period, the projections for the safe yield analysis are more conservative. Again, this approach reflects future conditions without reductions that *may* occur as a result of more widespread or more deliberate conservation programs. Based on the results of the safe yield analysis and other Study work elements, the application of water conservation to show potential impacts to overall demand may subsequently be considered.

3.3.3 Regulatory and Economic Drivers

The regulatory climate is likely to continue to change significantly in the next 50 years. New regulations and aging infrastructure may result in significant capital costs and increased operations costs for utilities. Cost recovery for these expenditures may come primarily from user fees. These changes may impact customer demand and may increase the viability of alternative technologies and services. To illustrate just one potential scenario, in the future each water purveyor may have a complete dual water treatment and supply system: one system that produces drinking water, and another system that produces a 'gray water' system for other uses. The impact of regulatory and economic drivers on water demand is difficult to predict and is not considered in the Study.

3.3.4 Industrial Shifts

As stated previously, the water withdrawal and return projection methodology called for the disaggregation of major industrial users and the evaluation of those industries who use water directly

withdrawn and/or returned into the Basin. Industrial withdrawal and return projections were evaluated based primarily on the historical Gross State Product (GSP) trends. These values were typically applied to increases or decreases in industrial production throughout the Basin during the Study period. By evaluating historical trends in water demand, and the GSP by industry type, this Study accounted for shifts in the regional economy from a manufacturing-based economy to a more service-based economy.

There are several cases in this Study where industrial water user projections were based on GSP data but altered to reflect local and/or unique circumstances imparted by water user contacts. Appendix D contains detailed projections that explain the assumptions behind each water user's projections.

3.4 REVISED WITHDRAWAL AND RETURN PROJECTIONS

Using the information derived from the above analyses, withdrawal and return projections for each user were generated, as appropriate. These projections were computed for the base year or 'current' year, 2008, and in ten-year increments to 2058. The 'current' year rates of withdrawal and return were based on data for the most recent year available for each water user, which generally fell between 1999 thru 2003. The projections were made on an annual average basis.

Monthly flow data, in the form of average monthly withdrawal and/or return flowrates, was available during this analysis for a majority of users. This data was used to provide a monthly variation trend in water withdrawals and/or returns to more realistically reflect seasonal trends in water use. For each user, the average annual monthly flows were divided by the average annual flow to obtain monthly coefficients. These coefficients were then used to estimate the monthly flow rate for any month in future years.

- ***Example*** – Flow data for the Town of Cherryville water treatment plant indicated an annual average withdrawal flow of 0.82 mgd for the year 2002. In November of that particular year, the average withdrawal for the month was 0.76 mgd. Therefore, the November monthly coefficient for the Town of Cherryville water treatment plant was calculated to be 0.93. Multiplying this coefficient by any projected future annual average withdrawal rate will yield the average November withdrawal rate for that year for this user.

Those users whose monthly flow data was not available were assumed to have no monthly variation withdrawals and/or returns (i.e., all monthly coefficients were set to equal to 1.00).

3.5 COMPARISON OF BASELINE PROJECTIONS TO PAST PROJECTIONS

The revised projections were compared to past projections, if available, including LWSPs, master plans, and reports, to determine consistency with previously documented results. The purpose of this step was to provide a quick check on the Study projections, and to quickly analyze and resolve any differences or anomalies.

3.6 FUTURE INTER-BASIN TRANSFERS OF THE CATAWBA-WATEREE RIVER BASIN

In addition to those users that are within the Basin, an evaluation of current and future Inter-Basin Transfers (IBTs) was also completed. This IBT analysis was particularly important to the Study since the Catawba-Wateree River Basin is rather narrow through much of its length, and rapid growth around urban areas within the Basin is impacting growth just outside the Basin. Future IBTs were identified and projected based on a review of rapid growth areas, consideration of available water sources within those areas, and in meetings with those entities currently holding or projecting an IBT.

3.7 RESERVOIR WATERSHED SYSTEM PROJECTIONS

Projections for each user group were aggregated into a total projection for each reservoir's watershed system. This roll-up total reports withdrawals and returns into each reservoir system, and the net consumptive use or water transferred out of a surface water source and not returned as a surface water. A check on the projections for each watershed was made with consideration to overall population projections for that region. Annual average withdrawal and return rate projections were completed for the watersheds for the base or 'current' year, 2008, and in ten-year increments to 2058.

3.8 STUDY TEAM CONSENSUS

Withdrawal and return projections were presented to the Water Supply Study Team for review and comment. Revisions were then made, as appropriate, to finalize projections.

3.9 WATER WITHDRAWAL AND RETURN PROJECTIONS – ANALYSIS SUMMARY

The methods and assumptions applied to each water user analyzed during this Study are recorded in Appendix D. A more concise summary of the water users' withdrawal and return flow projections, as well as aggregate projections by watershed, are included in Appendix C.

Tables 3-2 and 3-3 also provide an aggregate summary by watershed of projected water withdrawals, water returns, and net outflows. Net outflow is defined as the difference between the amount of water withdrawn within a particular reservoir's watershed and the amount of water returned within a particular reservoir's watershed. It is possible to have a negative net outflow (consequently, a net inflow) of water within a particular watershed if the amount of water returned is greater than that withdrawn. Typically, this result occurs due to a portion of the net outflow from an upstream watershed being returned within the Catawba-Wateree Basin to a downstream watershed. Tables 3-2 and 3-3 provide annual average water withdrawal, water return, and net outflow amounts for the 'current' year, base year 2008, and for each decade up to the year 2058. Annual average withdrawal, return, and net outflow rates for years that fall in between the projection years can be interpolated. The 'current' year is representative of the best historical available data for the current users. Most of the data used to derive 'current' values is based on 2002 and/or 2003 information.

It should be noted that, for Duke Power's facilities, the net outflow or consumptive use is reported only as a water withdrawal. This approach was used in lieu of showing both a water withdrawal and return since these rates are higher than any of the other users in the Basin, and because the net outflow is the critical element in this Study since it is used in the determination of the Project reservoirs' safe yield values.

As illustrated in Tables 3-2 and 3-3, the overall net outflow for the entire Basin is expected to increase from approximately 170 mgd (262 cfs) to 478 mgd (740 cfs) by the year 2058. This represents an increase of approximately 181 percent, or an annual growth rate of 1.9%.

Figures 3.1 and 3.2 plot the net outflow for each reservoir's watershed for both the current year and the projected 2058 values. For comparison, these graphs also illustrate the net outflow values in relation to the mean river flow of the Catawba River (as presented in Duke Power's First Stage Consultation Document). As shown in the figures, the net outflows at any particular watershed are always less than 15 percent of the mean river flow, and in most cases less than 5 percent.

Figures 3.3 and 3.4 present the percentage that each user type—public water supply, industrial, agricultural/irrigation, and power—contributes to the overall net outflow in the basin in the current year and the year 2058, respectively. As illustrated, public water supply is projected to increase over the Study period to comprise a greater percentage of the total net outflow.

Figures 3.5 through 3.15 summarize the portion of net outflow that is contributed by each user type for each of the 11 reservoir watersheds.

Table 3-2. Projected Annual Average Withdrawal, Return, and Net Outflow Rates by Watershed (in mgd)

Reservoir	Current[1]	2008	2018	2028	2038	2048	2058
				Year			
Withdrawals							
James	11	12	13	14	15	32	34
Rhodhiss	26	28	30	33	36	40	44
Hickory	18	17	21	25	30	37	44
Lookout Shoals	1	6	7	9	10	12	12
Norman	60	66	99	118	133	169	179
Mountain Island	101	131	153	172	192	207	224
Wylie	92	95	101	120	130	141	155
Fishing Creek	103	132	146	159	172	183	195
Great Falls-Dearborn	1	2	2	2	2	2	2
Cedar Creek	1	1	1	1	1	1	1
Wateree	6	8	9	11	26	27	56
Subtotal	*420*	*498*	*582*	*664*	*747*	*851*	*946*
Returns							
James	9	10	11	12	12	13	14
Rhodhiss	14	15	17	18	20	21	23
Hickory	6	7	8	9	11	14	16
Lookout Shoals	1	1	1	1	1	1	1
Norman	2	2	2	3	3	4	4
Mountain Island	6	8	12	14	16	18	18
Wylie	45	46	52	59	68	77	89
Fishing Creek	165	192	213	234	254	272	291
Great Falls-Dearborn	1	1	2	3	5	7	9
Cedar Creek	1	1	1	2	2	3	3
Wateree	0	0	0	0	0	0	0
Subtotal	*250*	*283*	*319*	*355*	*392*	*430*	*468*
Net Outflows							
James	2	2	2	2	3	19	20
Rhodhiss	12	13	13	15	16	19	21
Hickory	12	10	13	16	19	23	28
Lookout Shoals	0	5	6	8	9	11	11
Norman	58	64	97	115	130	165	175
Mountain Island	95	123	141	158	176	189	206
Wylie	47	49	49	61	62	64	66
Fishing Creek	-62	-60	-67	-75	-82	-89	-96
Great Falls-Dearborn	0	1	0	-1	-3	-5	-7
Cedar Creek	0	0	0	-1	-1	-2	-2
Wateree	6	8	9	11	26	27	56
Subtotal	*170*	*215*	*263*	*309*	*355*	*421*	*478*

1 – Current rates were based on the most recent available years for which withdrawals and returns were recorded. The most recent year for a given water user ranged between 1999 and 2003.

Table 3-3. Projected Annual Average Withdrawal, Return, and Net Outflow Rates by Watershed (in cfs)

				Year			
Reservoir	Current[1]	2008	2018	2028	2038	2048	2058
Withdrawals							
James	17	19	20	22	23	50	53
Rhodhiss	40	43	46	51	56	62	68
Hickory	28	26	32	39	46	57	68
Lookout Shoals	2	9	11	14	15	19	19
Norman	93	102	153	183	206	261	277
Mountain Island	156	203	237	266	297	320	347
Wylie	142	147	156	186	201	218	240
Fishing Creek	159	204	226	246	266	283	302
Great Falls-Dearborn	2	3	3	3	3	3	3
Cedar Creek	2	2	2	2	2	2	2
Wateree	9	12	14	17	40	42	87
Subtotal	*650*	*770*	*900*	*1029*	*1155*	*1317*	*1466*
Returns							
James	14	15	17	19	19	20	22
Rhodhiss	22	23	26	28	31	32	36
Hickory	9	11	12	14	17	22	25
Lookout Shoals	2	2	2	2	2	2	2
Norman	3	3	3	5	5	6	6
Mountain Island	9	12	19	22	25	28	28
Wylie	70	71	80	91	105	119	138
Fishing Creek	255	297	330	362	393	421	450
Great Falls-Dearborn	2	2	3	5	8	11	14
Cedar Creek	2	2	2	3	3	5	5
Wateree	0	0	0	0	0	0	0
Subtotal	*388*	*438*	*494*	*551*	*608*	*666*	*726*
Net Outflows							
James	3	4	3	3	4	30	31
Rhodhiss	18	20	20	23	25	30	32
Hickory	19	15	20	25	29	35	43
Lookout Shoals	0	7	9	12	13	17	17
Norman	90	99	150	178	201	255	271
Mountain Island	147	191	218	244	272	292	319
Wylie	72	76	76	95	96	99	102
Fishing Creek	-96	-93	-104	-116	-127	-138	-148
Great Falls-Dearborn	0	1	0	-2	-5	-8	-11
Cedar Creek	0	0	0	-1	-1	-3	-3
Wateree	9	12	14	17	40	42	87
Subtotal	*262*	*332*	*406*	*478*	*547*	*651*	*740*

1 – Current rates were based on the most recent available years for which withdrawals and returns were recorded. The most recent year for a given water user ranged between 1999 and 2003.

Figure 3.1 - Current vs. 2058 Net Outflow Comparison (in units of mgd)

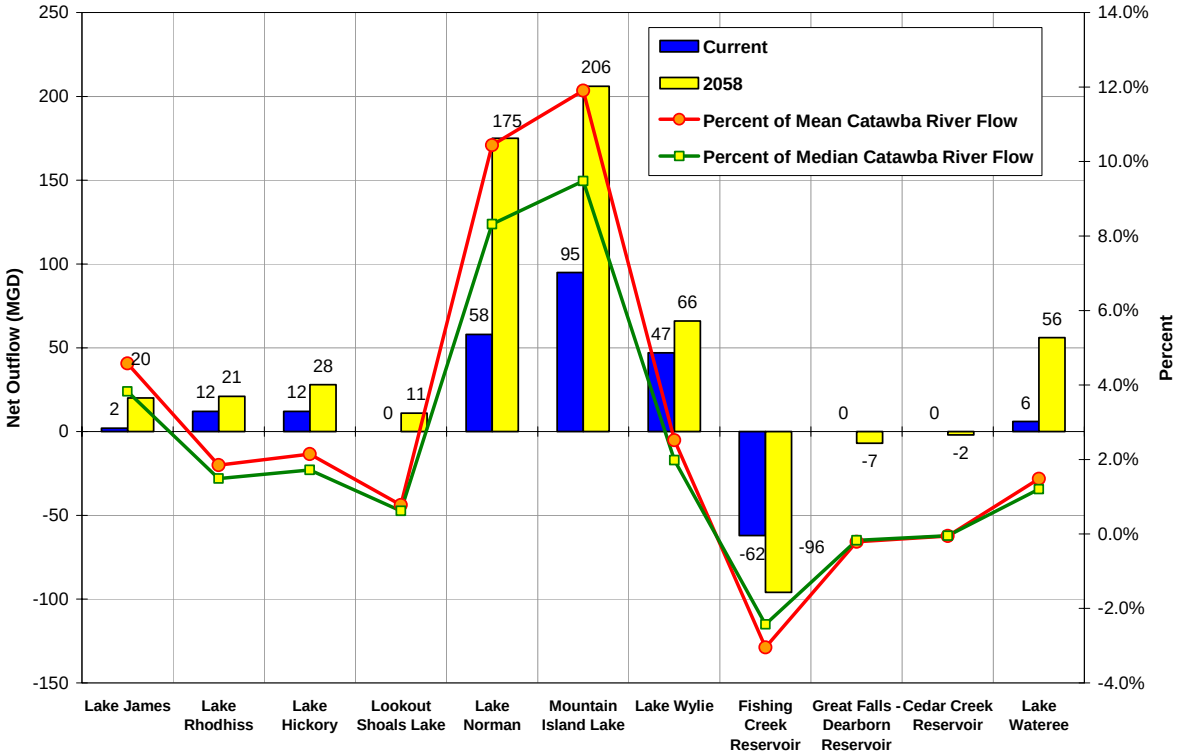


Figure 3.2 - Current vs. 2058 Net Outflow Comparison (in units of cfs)

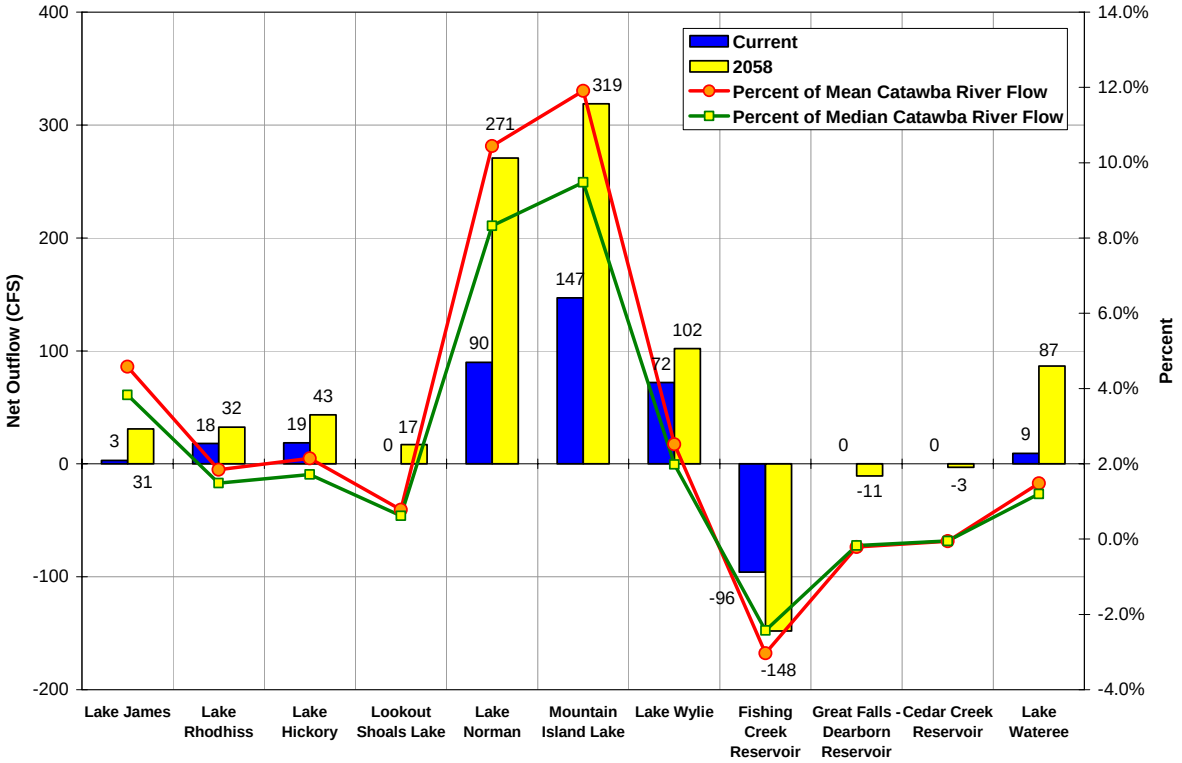


Figure 3.3 - Current Net Outflows for the Catawba-Wateree River Basin (in MGD) and % of Total

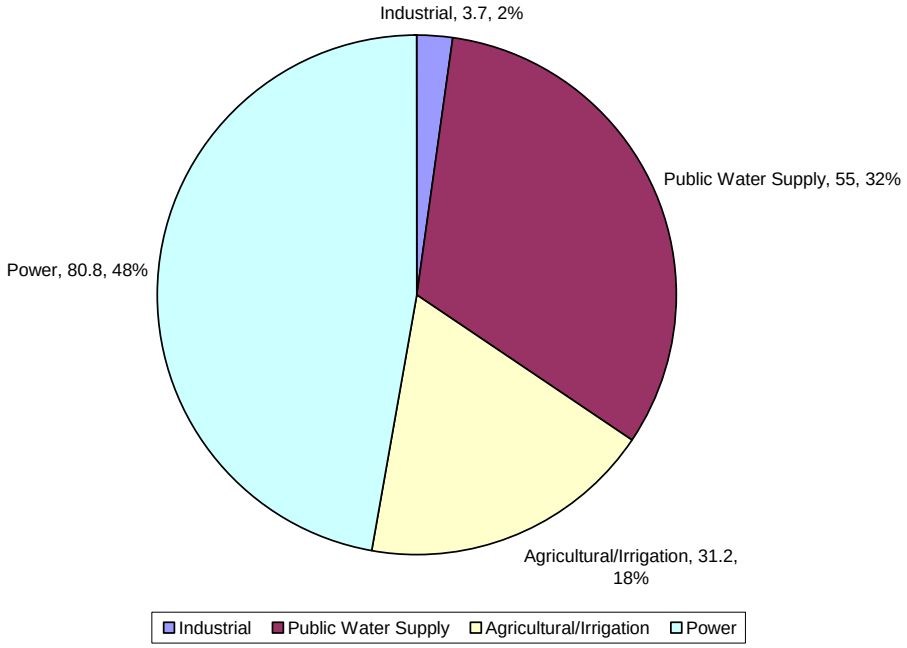


Figure 3.4 - Projected Net Outflows for the Catawba-Wateree River Basin in 2058 (in MGD) and % of Total

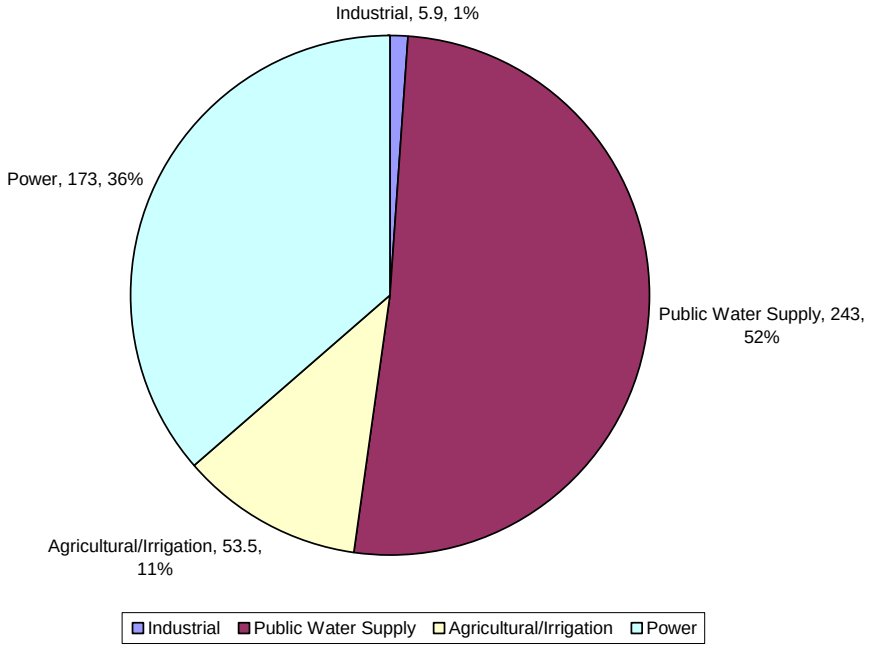


Figure 3.5 - Net Outflows for Lake James by Water User Category (MGD)

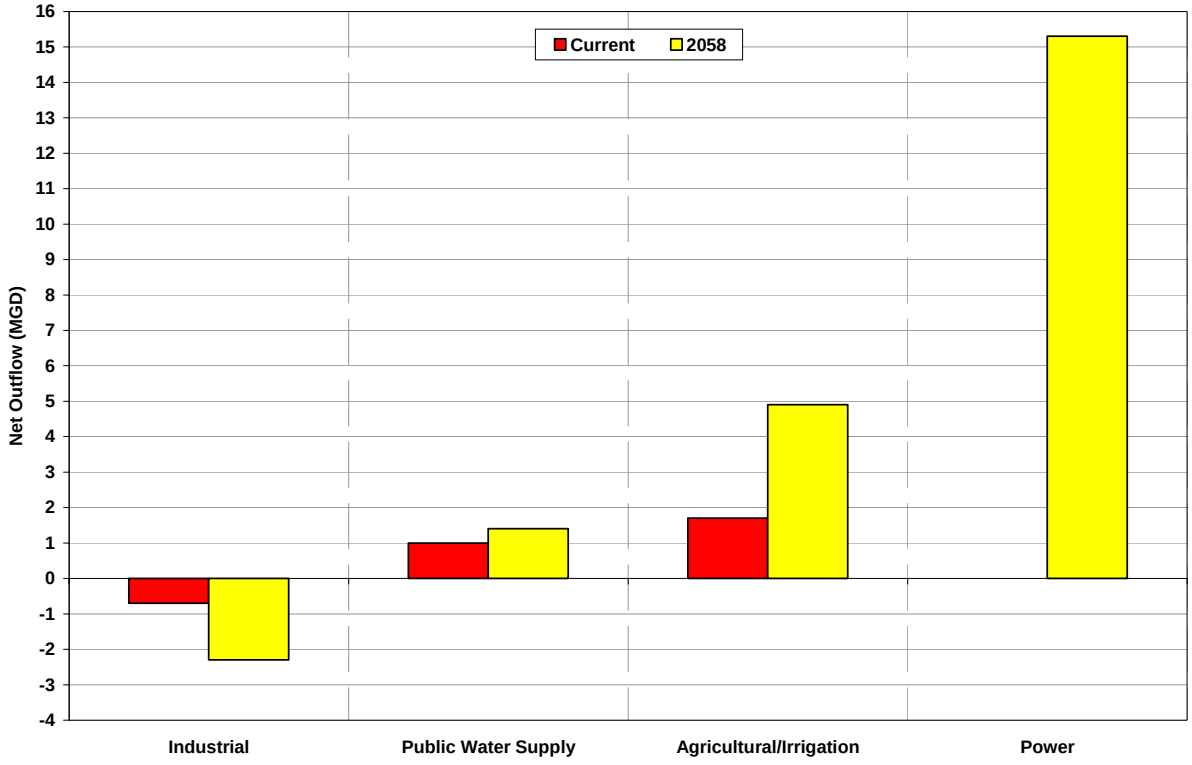


Figure 3.6 - Net Outflows for Lake Rhodhiss by Water User Category (MGD)

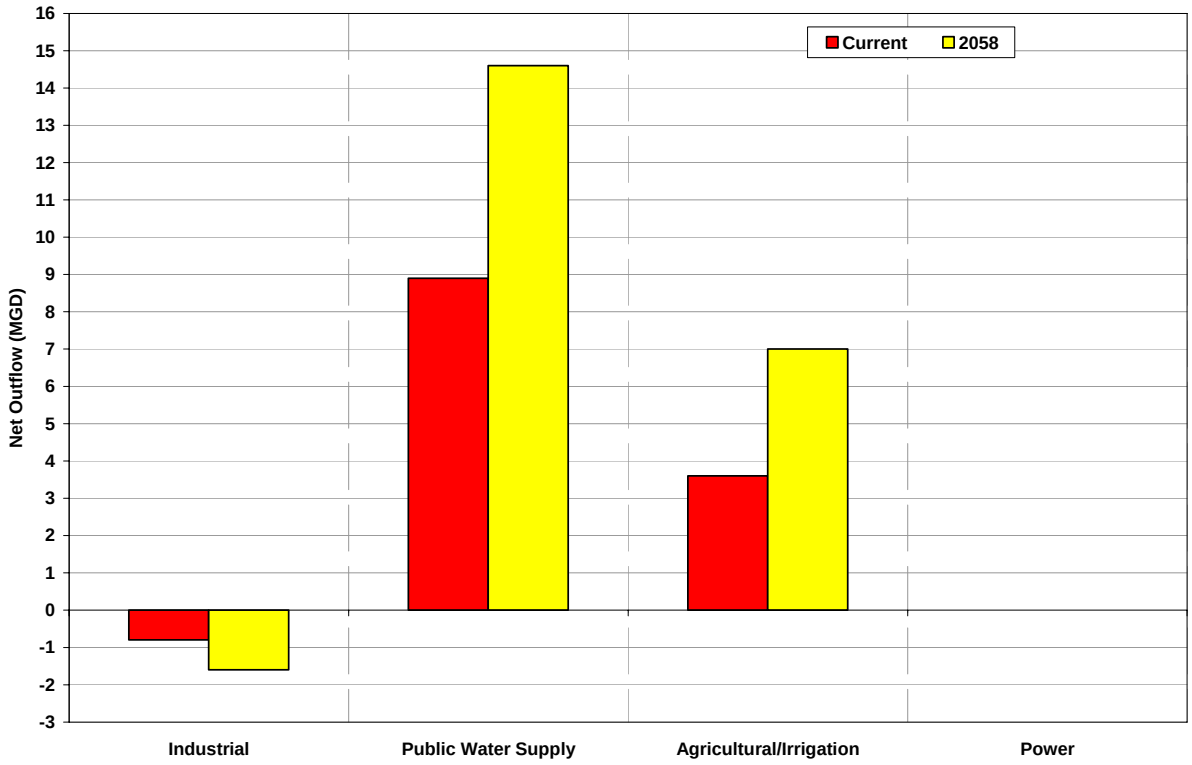


Figure 3.7 - Net Outflows for Lake Hickory by Water User Category (MGD)

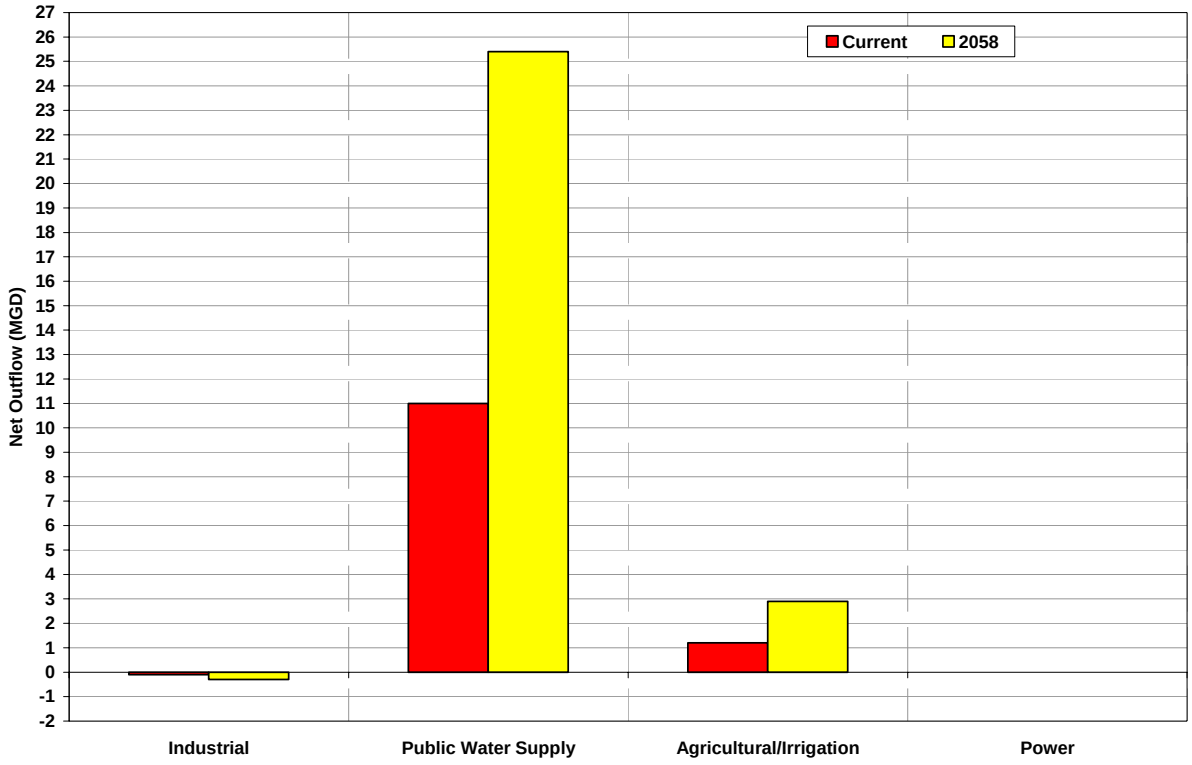


Figure 3.8 - Net Outflows for Lookout Shoals Lake by Water User Category (MGD)

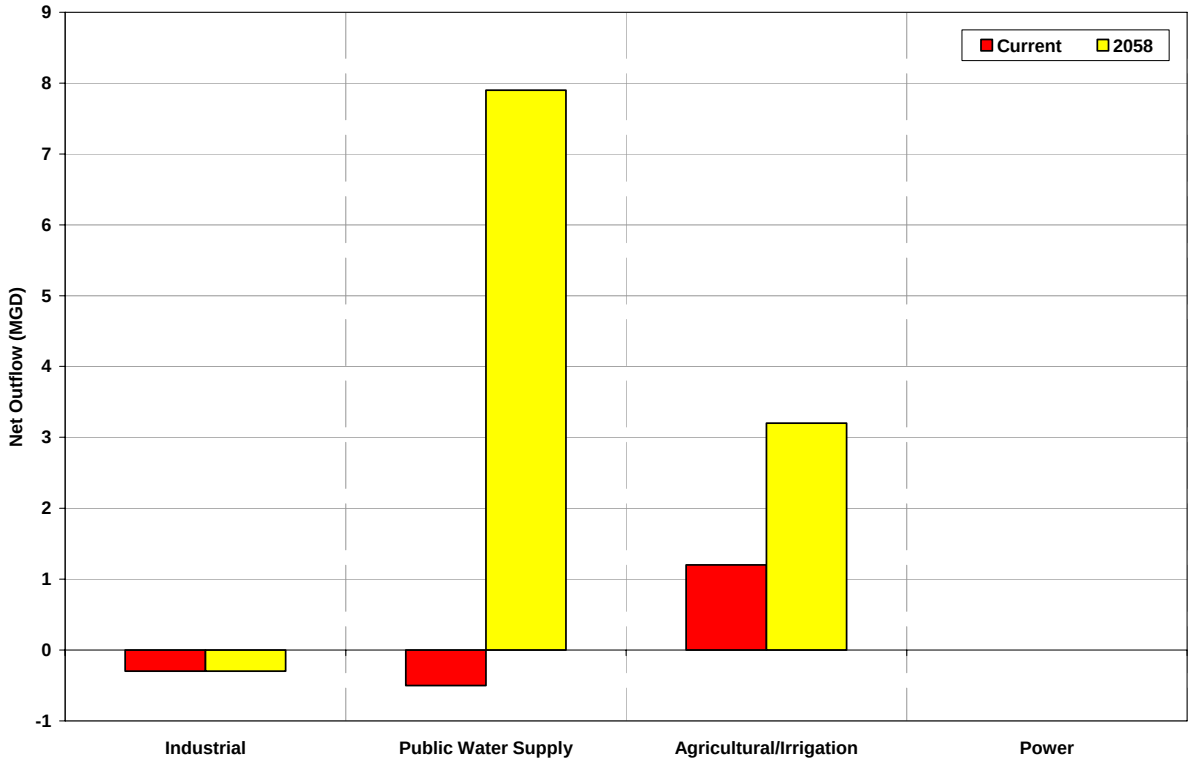


Figure 3.9 - Net Outflows for Lake Norman by Water User Category (MGD)

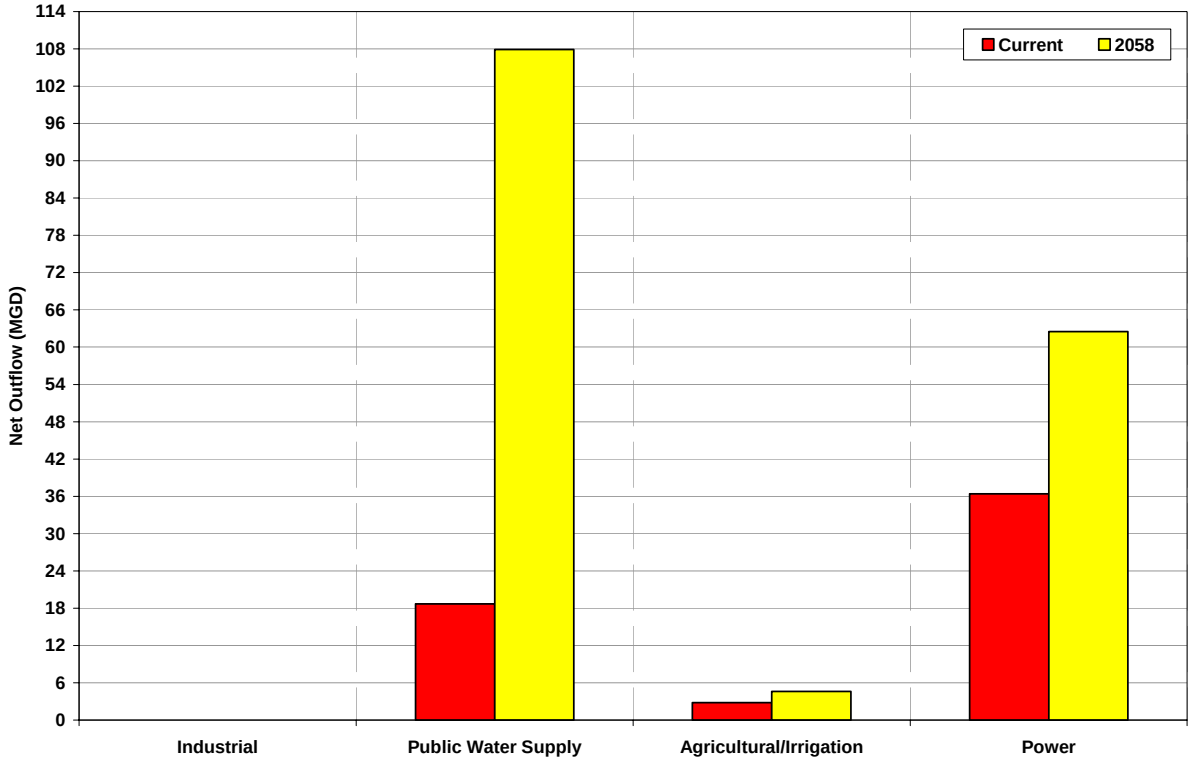


Figure 3.10 - Net Outflows for Mountain Island Lake by Water User Category (MGD)

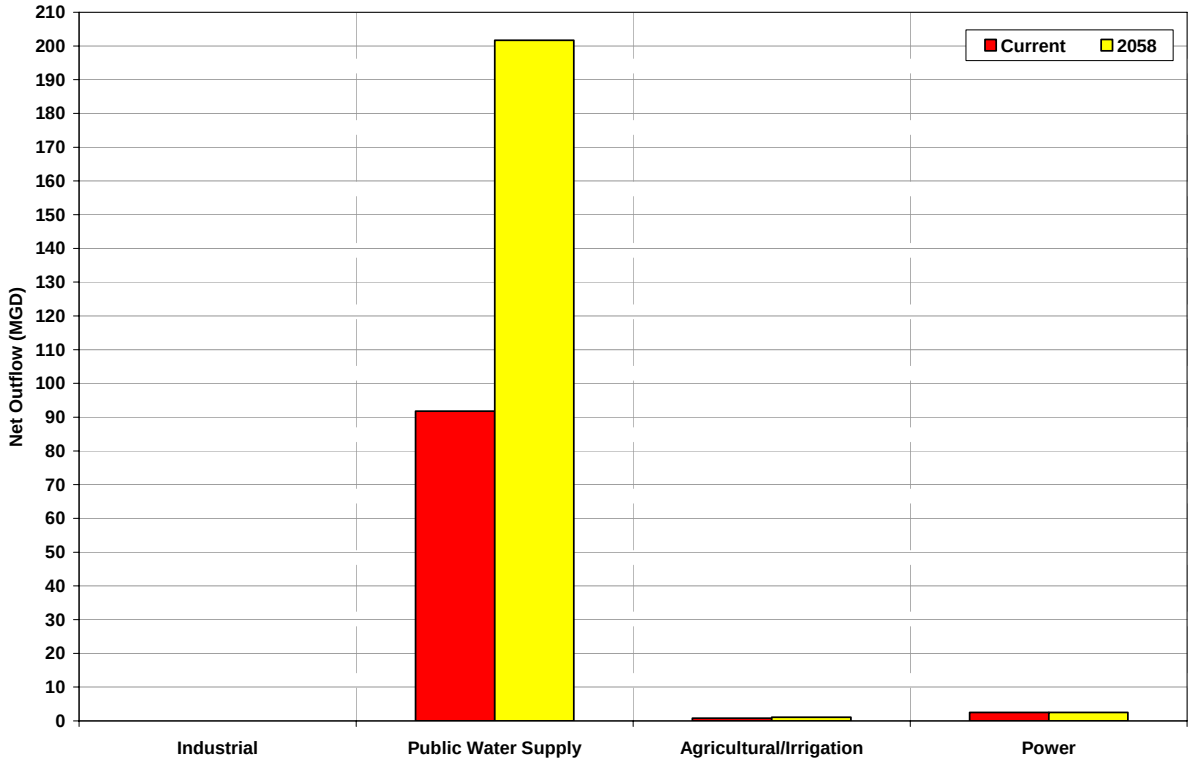


Figure 3.11 - Net Outflows for Lake Wylie by Water User Category (MGD)

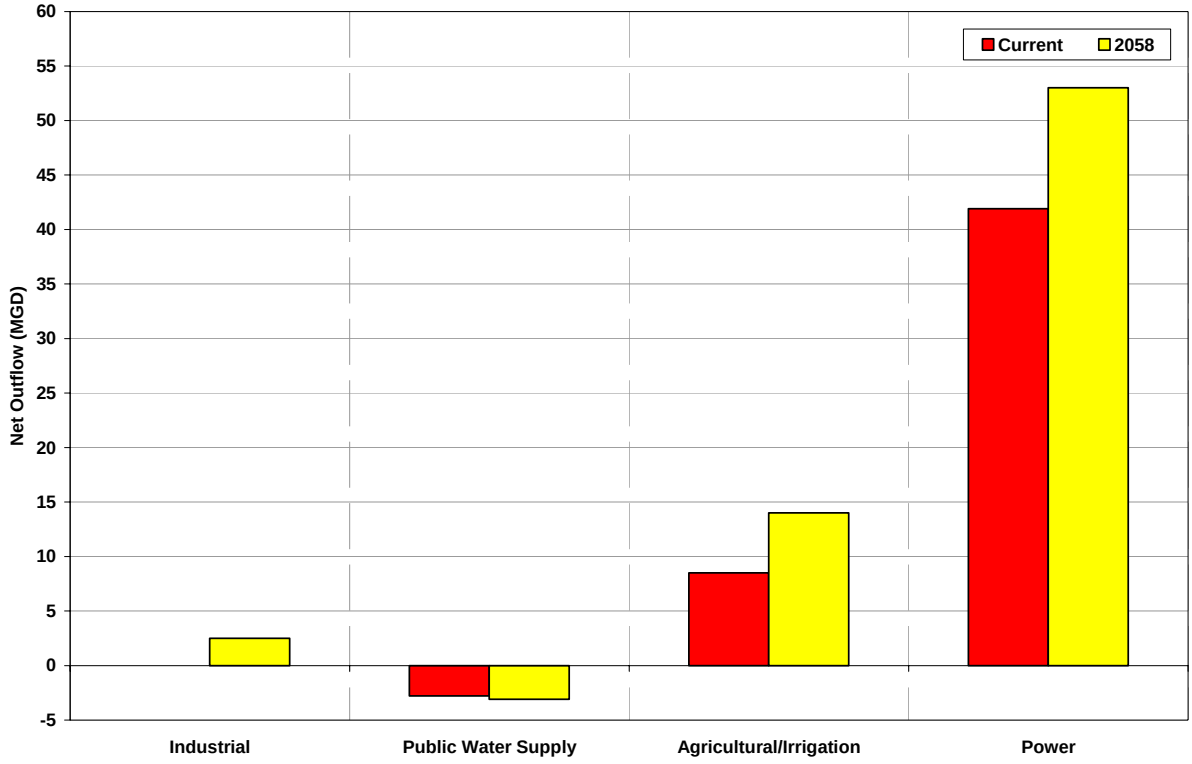


Figure 3.12 - Net Outflows for Fishing Creek Reservoir by Water User Category (MGD)

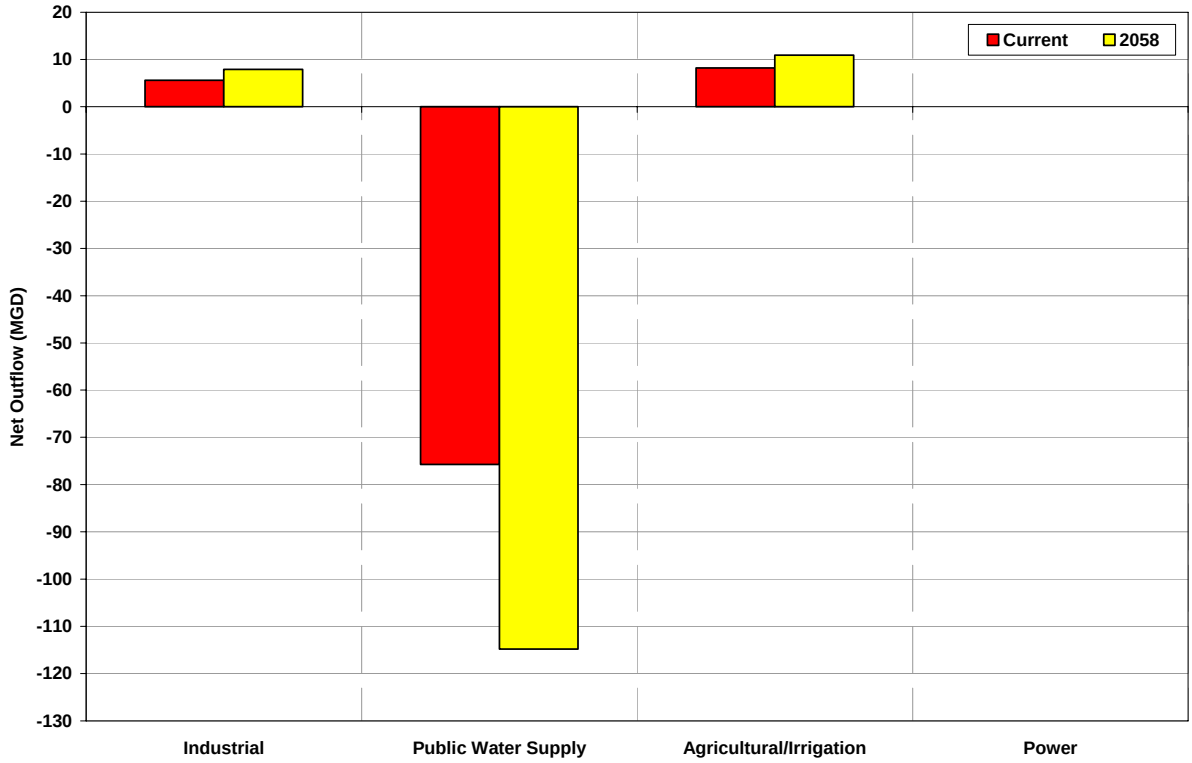


Figure 3.13 - Net Outflows for Great Falls-Dearborn Reservoir by Water User Category (MGD)

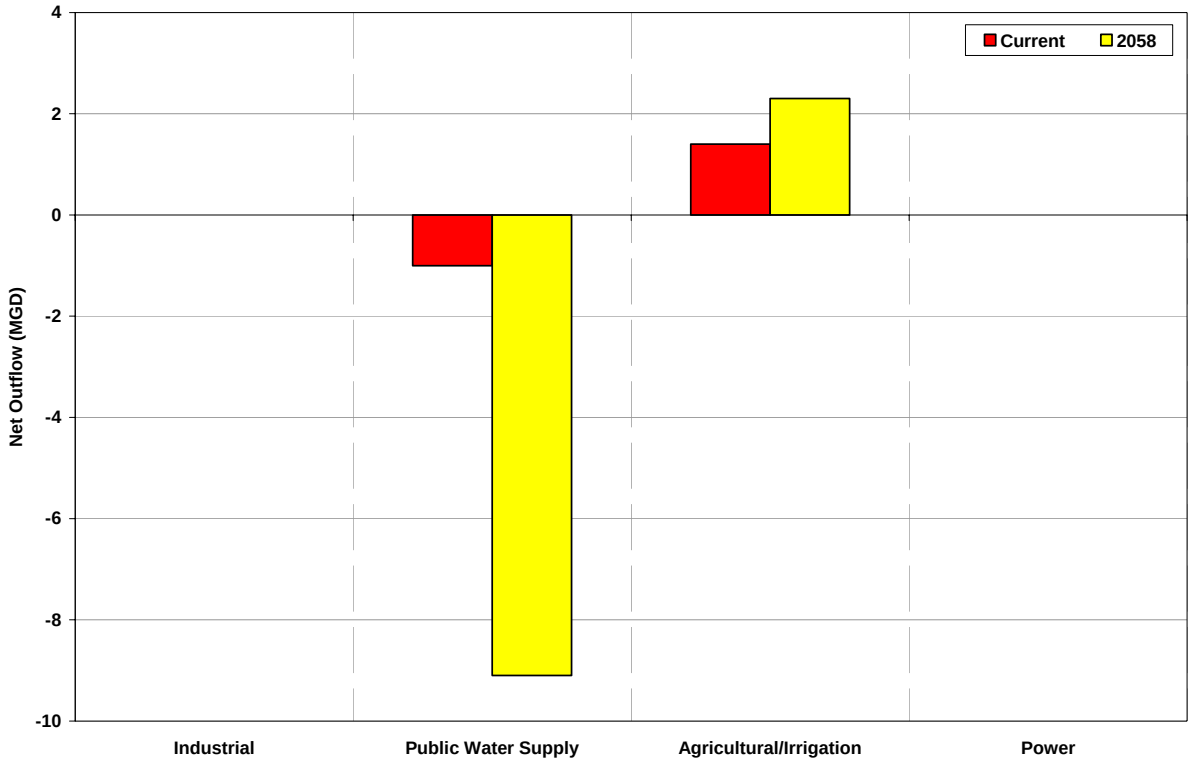


Figure 3.14 - Net Outflows for Cedar Creek-Rocky Creek Reservoir by Water User Category (MGD)

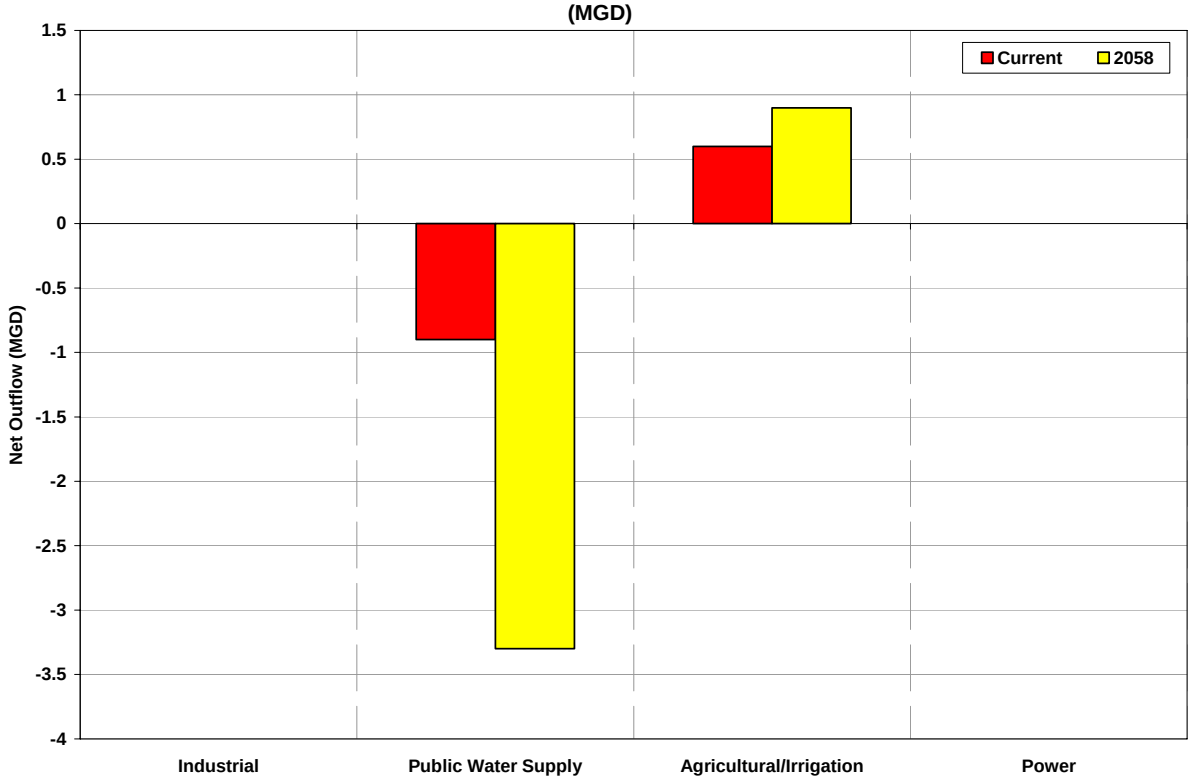
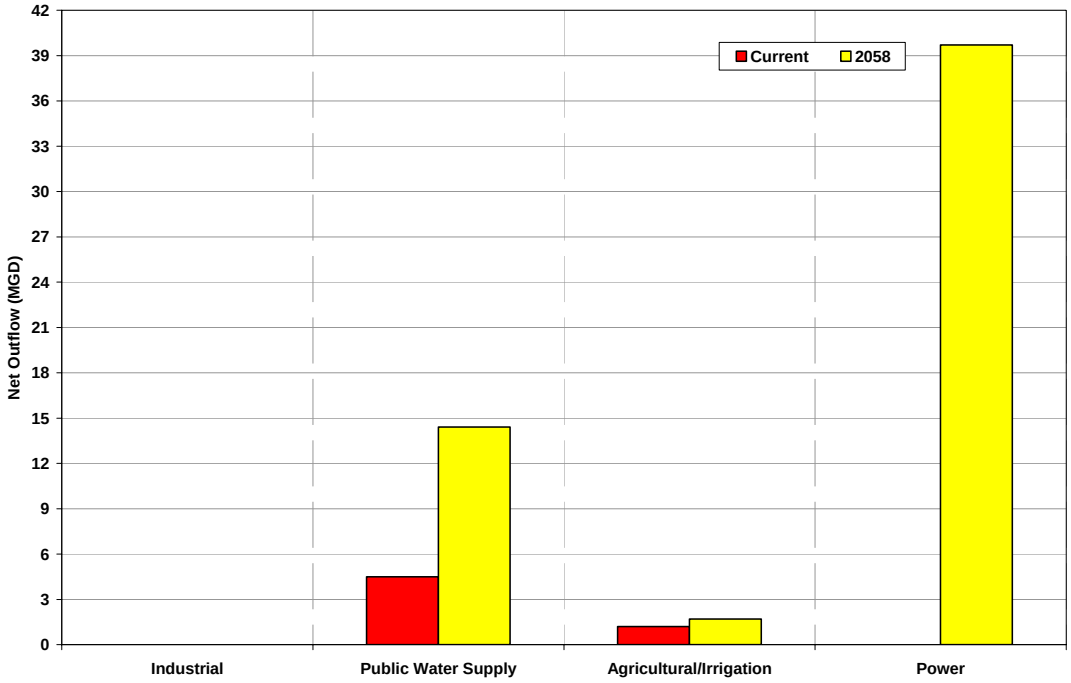


Figure 3.15 - Net Outflows for Lake Wateree by Water User Category (MGD)



3.10 NET OUTFLOW PROJECTION – COMPARISONS WITH POPULATION HISTORY AND FORECASTS

The demand for water from a water supply source is largely driven by the associated population that depends on that water source to meet a variety of needs. After completing detailed projections for future water withdrawals by user category, a comparison was made to historical population trends and population forecasts in the Catawba-Wateree Basin. It should be noted that some of these population forecasts were used to complete some of the detailed projections. Also, in most cases, future water withdrawal and return projections were forecasted using an annual growth rate (AGR), which has a compounding effect to the values over a period of time.

Table 3-4 summarizes this Study's projected AGRs for net outflow increases for the total Basin, and by user type, between the current year and the year 2058. These AGRs can then be compared to a variety of historical population results and projected population projections also included in Table 3-4. The total Basin net outflow AGR for this Study is 1.88 percent, which compares very closely to the population information presented for North and South Carolina, and areas within the Catawba-Wateree River Basin.

3.11 INTER-BASIN TRANSFERS

It is important to be clear on the definition of Inter-Basin Transfers (IBTs) when using this term to describe the movement of water. Different organizations, regulatory agencies, and others often have different interpretations when the term IBT is used. For the purposes of this Study, IBTs are defined as the transfer of surface water that is withdrawn from anywhere within the Catawba-Wateree River Basin and is returned to a watershed outside of the Catawba-Wateree River Basin.

Using this definition, current and projected water withdrawals from the Catawba-Wateree Basin that transfer water to another basin where it is utilized for residential irrigation or disposed of via septic tanks would be included. Quantifying this transfer of water, however, is difficult, based on available data.

Significant (i.e., not all) current and future IBTs projected as part of this Study are outlined in Table 3-5 below. The significant IBTs projected in 2058 are estimated at 103 mgd, with this value representing 22 percent of 2058 net outflows. For North Carolina and South Carolina regulatory information related to IBTs, the reader is referred to the following web links:

- http://www.ncwater.org/Permits_and_Registration/Interbasin_Transfer/
- http://www.scdhec.gov/eqc/water/html/dwibt.html

Table 3-4. Net Outflow Annual Growth Rates (AGR) Compared with Historical Population Data and Future Projections

Water Supply Study – Projected Net Outflows			
Water User Category	Current	2058	AGR
Total Basin	170.7	475.4	1.88%
Industrial	3.7	5.9	0.85%
PWS	55.0	243.0	2.74%
Agricultural/Irrigation	31.2	53.5	0.99%
Duke Power	80.8	173.0	1.39%
Historical Population Data/Population Projections			
Category	Base Year	Future Year	AGR
Historical Data			
Mecklenburg County Population Change – 1980-2000 [1]	404,270	695,454	2.75%
Metro Mecklenburg County – 13 Counties – 1980-2000 [2]	1,370,012	2004,651	1.92%
NC Historical Population – 1970-2000 [3]	5,237,248	8,046,813	1.44%
US Population History – 1949-1999 [4]	149,188,130	272,690,813	1.21%
Median of the 100 Fastest US Growing Counties from 2000 to 2004 [4]	229,796	274,653	4.56%
Population Projections			
US Population Projections – 2000-2050 [4]	282,125,000	419,854,000	0.80%
NC Population Projections – 2000-2030 [3]	8,046,813	12,067,013	1.36%
SC Population Projections 2000-2030 [5]	4,012,012	5,371,150	0.98%

Source: 1 Charlotte Chamber/US Census Bureau
2 Charlotte Chamber
3 North Carolina Office of State Budget and Management – State Demographics
4 U.S. Census Bureau
5 South Carolina Budget and Control Board, Office of Research and Statistics

Table 3-5. Significant Current and Future IBTs

Agency	Current IBT Est. (mgd)	2058 IBT Est. (mgd)	Comment
City of Statesville	0	9	Intake in Lookout Shoals, return flow to the Yadkin River
Charlotte-Mecklenburg Utilities	9	20	Intakes in Mt. Island and Lake Norman, return flows to the Yadkin River
Town of Mooresville	4	29	Intake in Lake Norman and return flows to the Yadkin River
Concord/Kannapolis/Cabarrus County	0	27	Currently pursuing an IBT from the Catawba River (e.g., Lake Norman) to return flow to the Yadkin River
City of York	-1	-5	City of York transfer water into Catawba Basin from the Broad River Basin
Union County/Lancaster County	5	18	Estimated IBT from CRWTP into Lancaster and Union Counties returned to the Yadkin River
Chester Metro	-	5	Estimated with return flow to the Broad River Basin

3.12 GROUNDWATER IMPACTS

It was determined during the course of this Study that the impacts of groundwater on the Catawba-Wateree River Basin were being included in the development and construction of a hydrologic database being completed as a separate element of the relicensing effort. Historically, Catawba River flow was not well documented. Thus, a hydrologic record along the Catawba River and its reservoirs had to be 'constructed' by evaluating many factors including dam release records, reservoir water level records, evaporation, and historical user withdrawal and return information. The construction of this data included the impacts of groundwater inflow to the system as well as groundwater recharge. As the hydrologic data was constructed, a value that represents tributary flow, precipitation, and groundwater interaction was computed. Disaggregating this result into each of these three distinct parameters was not possible. Thus, the groundwater impacts are included in this hydrologic dataset and this dataset is used in the safe yield analysis.

4.1 OBJECTIVE

Safe yield (SY) is a term used in this Study to describe the amount of water theoretically available at a given location in a watershed. It is a commonly used measure of the dependability of a water supply source. The safe yield of a water supply source depends on many factors, including the:

- Availability of water.
- Storage, diversion, and conveyance facilities that comprise the water supply infrastructure system.
- Operations of the infrastructure system.
- Level of certainty of the supply required.

To estimate safe yield, the basic analytical approach generally employed is the calculation of a water budget that allocates and accounts for the water, given the constraints imposed by the facilities and their operations, over the critical low-flow period of the hydrologic record. For water withdrawals located on the Catawba-Wateree Project and its reservoirs, safe yields have historically not been well defined. One objective of this Water Supply Study is the development of safe yields for each of the Project's 11 reservoirs.

Safe yield analyses were completed for the two operating scenarios outlined below:

- ***Baseline Safe Yield*** – This analysis calculates safe yields for the Project's reservoirs using baseline, or current, operating conditions. These baseline conditions include Duke's current FERC license requirements, other agreements honored by Duke, and other current operating practices.

- ***Mutual Gains Safe Yield*** – This analysis calculates safe yields for the Project's reservoirs using the Mutual Gains operating conditions (dated November 28, 2006) negotiated during the relicensing process. The Mutual Gains operating conditions include many new, proposed, operating parameters and constraints, including, but not limited to:
  - Downstream flow requirements from each reservoir.
  - Normal minimum elevations for each reservoir.
  - Implementation of the Low Inflow Protocol (see Section 7.0).

4.2 SAFE YIELD ANALYSIS – GENERAL METHODOLOGY

While safe yield calculations are simple arithmetic for single reservoir, single purpose systems, there can be a significant amount of arithmetic to perform in large multi-purpose systems. For complex systems such as the Catawba-Wateree Project, a simulation model was essential to perform the analysis and determine safe yield values. For this Study, Duke's system operations model CHEOPS™ (Version 8.5) was used. As part of the relicensing effort and other studies, Duke has also constructed 74 years of

hydrologic data throughout the system, which is considered the Period of Record (POR) (see also Section 3.4).

In a complex system, estimating safe yield can be greatly complicated by the nature of the interactions between various components. In an ideal scenario, if the components are operated as a unified system, the safe yield of the system would be reached simultaneously at every location in the system. If the components operate independently of one another, safe yield can be defined for each location separately, moving systematically from upstream to downstream.

The reservoirs in the Catawba-Wateree Project are generally operated as a system. In simple terms, increasing demands on a downstream reservoir results in water being pulled from a number of upstream reservoirs to keep the system in a reasonably balanced state. This approach is especially true under baseline conditions. For the Mutual Gains scenario, minimum lake levels are more limiting to the system as it relates to meeting downstream water demands.

Given the numerous operating conditions, the imminent violation of a flow or storage level constraint at any location in the system defines the safe yield for that location, but does not necessarily establish the safe yields everywhere. There might be additional divertible water still available at some locations, which means that the safe yield for that location has not yet been reached. Simulating the Catawba-Wateree Project with water demands that are not uniformly adjusted across the Basin allows this increment of safe yield to be determined.

At the locations that appear to have the potential for additional safe yield, the demands can be adjusted upwards individually to higher levels. The water demands at locations that have already reached their safe yield would be kept at the levels previously determined while the other locations are systematically adjusted. By keeping the demand levels constant at the previously established safe yield levels at these reservoirs, flows from upstream would be bypassed downstream to the locations where they are needed. As before, the imminent violation of a storage level or required flow constraint will signify that the safe yield has been achieved at a location. The individual demands are then adjusted upwards until a constraint violation is imminent at the next location. This process continues until safe yields are defined at all reservoirs.

For the safe yield analysis, water withdrawal and return projections discussed in Section 3.0 of this Study were used to represent water demands in the CHEOPS™ Model. By beginning with the water demands projected for 2008, the model simulates the Catawba-Wateree Project, keeping track of each reservoir's water surface elevation and noting if any reservoirs violate any constraint(s), or fail. Reservoirs which fail have surpassed their safe yield. For those reservoirs that do not fail, their respective water demands are increased to represent demands in a future year. The model continues to simulate the Project, record constraint violations, and increase water demands where appropriate until all reservoirs fail or until the year 2078, which was determined as the ending year for safe yield analysis. At that point, the safe yield has been defined for each reservoir.

To facilitate safe yield evaluation, some key assumptions are made, including:

- The entire 74-year historical hydrology was used to determine the critical low-flow periods. The critical periods are used to perform the simulation iterations needed to establish safe yield. Once safe yields were established, the entire hydrologic period can be simulated at these demand levels to confirm the safe yields and generate performance statistics.
- The adjusted water demands were incrementally adjusted separately, but in a balanced manner to prevent preferential development of a particular demand (i.e., they were increased in 10-year increments as projected in this Study).
- No individual safe yield could be reduced as a result of the subsequent simulations.
- For water demand projections beyond 2058, a straight-line 1.0 percent annual increase was assumed for both water withdrawals and returns to the year 2078.

By proceeding through the analysis as described above, a reservoir's individual safe yield was defined as the greatest amount of water demand it can satisfy without failing to maintain a water surface elevation above a predetermined constraint level. There is some flexibility in the standards of how the storage level constraint is defined. Typically, the storage level constraint is set at the lowest level that water can be used, for example at dead pool level (i.e., the elevation below which hydroelectric power cannot be generated) or at the elevation of an intake. However, incorporation of a storage reserve or margin of safety could also be incorporated in the definition of safe yield. For example, rather than defining safe yield at the point where a critical elevation is violated, safe yield could be defined when there is an additional 10% of useable storage remaining. The approach used in this Study, however, was to define safe yield as the point at which a reservoir is at the constraining level.

4.3 Application of Future Water Demands and Sedimentation to Determine Safe Yield

Future water demand projections presented in Section 3.0 were used to evaluate safe yield under both the Baseline and Mutual Gains operating conditions. The safe yield analysis applied the withdrawal and return projections to each reservoir beginning with 2008 values. The reservoir elevations were evaluated to see if the failure criteria were met at any location. Equivalent 10-year incremental increases or decreases in withdrawals and returns were made until safe yields were determined.

In addition to incremental withdrawal and return rate increases, the CHEOPS™ model was also constructed to show increased sedimentation in each of the reservoirs over time. Thus, sedimentation changes were similarly increased or decreased with the withdrawals and returns to simulate the impact of sedimentation on available water supply over time. Sedimentation rates and volumes were determined by others and not part of this Study.

4.4 Critical Intake Levels

The physical locations of intakes in the riverine sections and reservoirs of the Catawba-Wateree River are critical to successful calculation of safe yield. During the conduct of this Study, the intake locations were

carefully considered and verified. It should be noted that this verification did not include a detailed topographic survey. Instead, research on individual users was completed and critical operating levels for the existing intakes were determined using the best available data or information. A summary table of intakes is included in Appendix G. For several of the water withdrawals, the intake level indicated may not be the actual physical elevation, but the critical operating level under current conditions. These critical operating levels are believed to be the most reliable compilation to date for the Catawba-Wateree system.

4.5 LOW INFLOW PERIODS

Since safe yield is a measure of a water supply's reliability, it is important to evaluate low flow periods throughout the water supply's hydrologic record. To perform this analysis for the Catawba Basin, the CHEOPS™ model required historical inflows into each reservoir. This inflow included tributary stream flow, groundwater inflow or recharge, surface runoff, and precipitation. A 74-year hydrologic record (1930 – 2003) was constructed (by others) to provide the combined daily flow from all these sources, also known as the daily inflow dataset. The development of this inflow dataset also included a correction factor to ensure an appropriate water balance based on historical records. In order for the CHEOPS™ model to arrive at safe yield values, it was important to evaluate periods of 'drought'. For the purposes of this Study, the term 'drought' is used to describe periods of time when the natural inflow volume was relatively low. Determining which drought is the most severe, relative to safe yield evaluation, was not possible with the available data, so all significant droughts in the period record were identified. The CHEOPS™ model results quickly revealed the drought(s) that exhibited the most impact on the available water supply in the Catawba-Wateree Basin.

Along with an analysis of the hydrologic record, historical (1930 – 2003) energy generation data for all Duke hydropower plants along the Catawba-Wateree River were evaluated to further support identification of suspected drought periods. The methodology used to determine low inflow periods is described in more detail below.

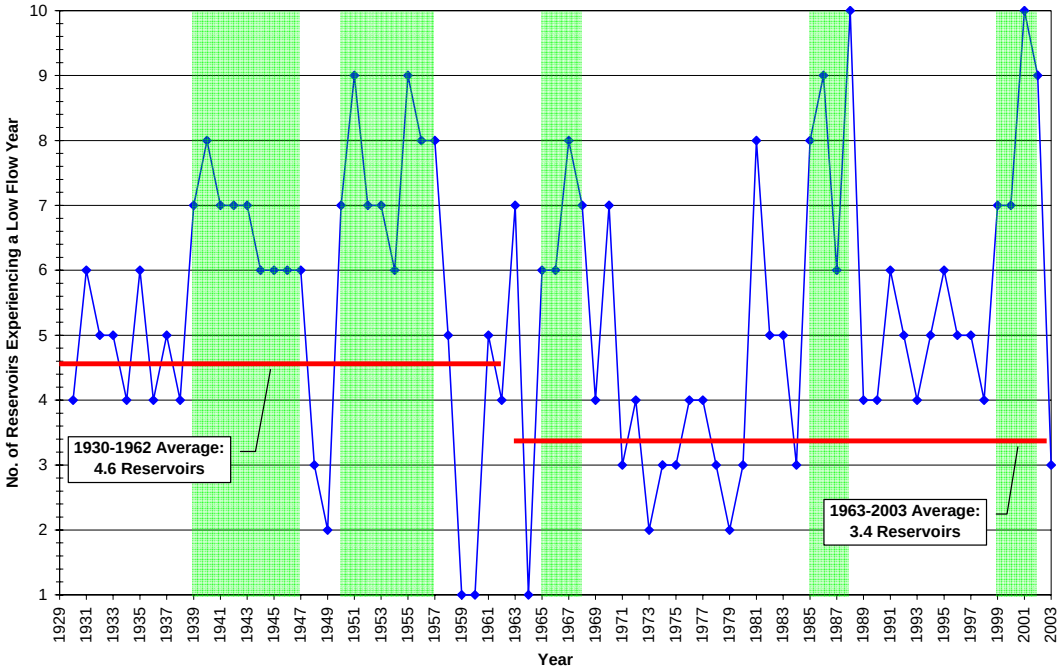
4.5.1 Historical Hydrologic Record Analysis

The inflow dataset provided the daily average inflow into each reservoir for every day between January 1, 1930, and December 31, 2003. A three-step process was undertaken to consolidate the data and determine which extended low-flow periods should be considered in the safe yield analysis. First, the daily inflow values were summed to determine the total volume of water that entered each reservoir in every calendar year in the period of record. This resulted in a total inflow volume of water to each reservoir for the 74 years of record.

The next step involved determining the average total inflow volume received by each reservoir. This produced a benchmark to which each reservoir's yearly inflow values could be compared. For the purposes of this analysis, a reservoir was defined to have a "low-flow" year (LFY) if that year's inflow volume was less than the 74-year average. The data in Appendix H presents this comparison for each reservoir.

In the final step of this approach, the number of reservoirs in a LFY for each year were tallied and evaluated. Since it was assumed that more severe droughts would affect more of the reservoirs, significant low inflow periods were identified by observing when a large number of reservoirs exhibited a LFY. Each year's number of reservoirs experiencing a LFY was compared to one of two average numbers. One was the average number of reservoirs in a LFY between the years 1930 thru 1962, and the second was that same average between the years 1963 thru 2003. The post-1962 average took into account the addition of Lake Norman to the Project. The results of this analysis are shown in Figure 4.1.

Figure 4.1 - Low Flow Periods Determined by the Hydrologic Record



As illustrated in the figure, years with data points above the respective average were determined to be in a more significant low inflow period. There are multiple instances where a significant low inflow period was seen for only one year. These instances were determined less critical than when low inflow periods extended for multiple years. The shaded areas in Figure 4.1 show where significant droughts likely occurred for a period of at least two years, resulting in five main periods of drought.

4.5.2 Historical Energy Generation Data Analysis

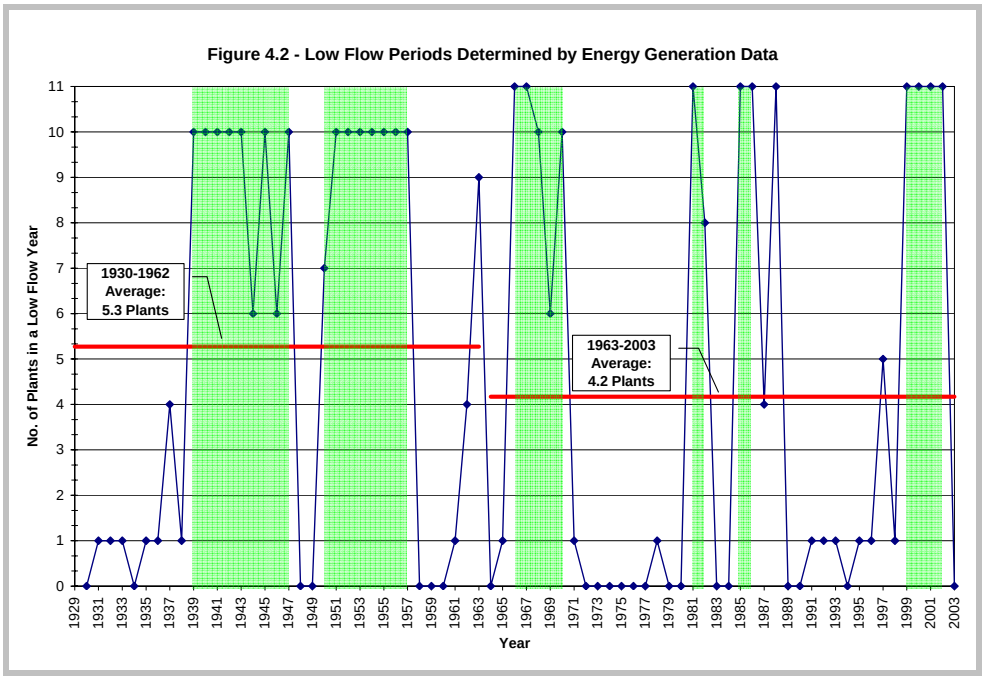
Although this analysis of the hydrologic record yields distinct periods of low inflow, a second analysis was performed to confirm these findings. Duke Power provided historical data on energy generation for all of its hydropower plants along the Catawba-Wateree River for the same Period of Record (1930 thru 2003). It was assumed that the energy generated by Duke hydropower plants would be noticeably lower during periods of extended drought (low inflow). As a standard practice during periods of low inflow, Duke releases less water through its dams to conserve reservoir storage volumes. Less water released translates directly to less hydropower energy generation.

The dataset provided the total energy generated from each hydropower plant on a monthly basis between January 1930 and December 2003. Each hydropower plant corresponded to the particular reservoir it utilized for water storage. Similar to the hydrological record, the energy generation dataset was analyzed with a three-step process. In the first step, the total monthly energy generated was summed to obtain the total energy generated in every calendar year for each reservoir.

The next step involved determining the average yearly energy generated for each plant from the 74 yearly values obtained in the first step. Again, the average served as a benchmark to compare to the yearly energy generation values. A reservoir was defined to have experienced a LFY in a given year if its corresponding power plant produced less energy than the average value. The data in Appendix I presents this comparison for each reservoir.

In the final step, the number of hydropower plants exhibiting a LFY for each year was tallied and evaluated. As with the hydrologic analysis, larger numbers of hydropower plants generating energy below average indicates a more significant drought. Each year's number of hydropower plants experiencing a LFY was compared to an average number, depending on the year. Years between 1930 thru 1962 were compared to one average number, while the years between 1963 thru 2003 were compared to another average number. As discussed before, the post-1962 results took into account the addition of Lake Norman operations in 1963.

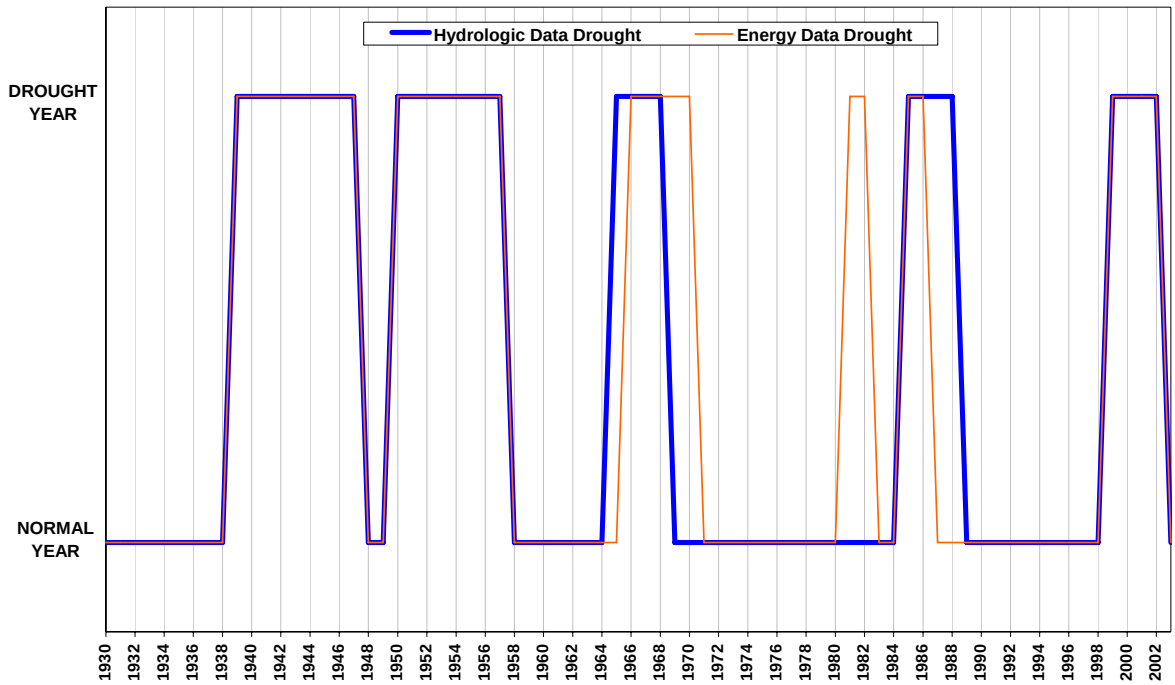
The results of this analysis are shown in Figure 4.2. Any year that indicated more hydropower plants under low-flow conditions than the average was considered to be a low inflow year. Since multiple consecutive years of low inflow tend to indicate a more significant drought period, single low-inflow years were ignored in favor of multiple years. The shaded areas in Figure 4.2 show five time periods that the energy generation data indicates are possible drought conditions.



4.5.3 Comparison of Results for Hydrologic Record and Energy Generation Analyses

The significant drought periods derived from the datasets (hydrologic and energy generation) were subsequently compared to one another. Figure 4.3 illustrates this comparison.

Figure 4.3 - Comparison of Drought Periods Determined by Hydrologic and Energy Generation Datasets



Not only did each dataset indicate five distinct drought periods, they also placed those drought periods at similar points in time. According to both datasets, drought periods occurred in the 1940s, 1950s, mid to late-1960s, 1980s, and late-1990s/early-2000s. Three of these periods (the 1940s, 1950s, and late 1990s/early 2000s) are matched exactly between the datasets. The agreement between these two datasets supports the use of these drought periods in the safe yield analysis.

A period in the 1960s shows a strong correlation as well, although the energy data lags behind the hydrologic data by about a year. This result is not unexpected, as hydropower plants typically cannot reduce energy generation until after a low inflow period has been identified. Although the beginning and end of this low inflow period is more obscure than the three mentioned above, the drought is identifiable and was included for the safe yield analysis.

Both datasets suggest that a low inflow condition also occurred during the 1980s. The energy generation data showed multiple, shorter low inflow periods, whereas the hydrologic record indicated a single, longer drought. This suggested that the 1980s drought may have been milder, with some years just meeting the low-inflow condition. The exact years that contain this drought period were difficult to pinpoint, but it was clear that a drought had occurred during this decade. The early drought indicated by

the energy data in the 1980s was ignored because it was not supported by the hydrologic data. The mid to late-1980s drought was used to represent this drought period in the safe yield analysis.

In order to ensure that the full drought period was captured, the inflow periods chosen for the safe yield modeling began and ended with a "wet" year (i.e., years not considered part of the drought). With this approach, the reservoirs being modeled would have been expected to have full storage volumes to begin a drought period. Also, by ending with a "wet" year, it was assured the model could observe the full effects of a drought period, including storage recovery. As a result of this analysis, the low-flow periods utilized in the evaluation of safe yield are presented in Table 4-1.

Table 4-1. Low-Inflow Periods Utilized for Safe Yield Evaluation

Low-Flow Period	Dates
1	January 1937 – December 1948
2	January 1949 – December 1959
3	January 1964 – December 1971
4	January 1984 – December 1989
5	January 1998 – December 2003

4.6 BASELINE SAFE YIELD EVALUATION

4.6.1 Baseline – Safe Yield Operating Criteria

The Baseline safe yield analysis is focused on determining safe yields for each of the Project's reservoirs under current conditions. The CHEOPS model is used to simulate how Duke Power operates the system under its current FERC license, and how others currently utilize waters from the Project. The current FERC license is not prescriptive for some key operating parameters including minimum lake levels and downstream flow requirements. As a result, Duke currently has considerable flexibility in how the system is operated.

For the Baseline safe yield evaluation, several variables were held constant; these variables are presented in Table 4-2.

Table 4-2. Variables Held Constant for Baseline Safe Yield Evaluation

Potential Variable	Constant	Rationale
Duke Operations	CHEOPS™ based water usage above reservoir target level	This approach assumes that Duke uses only the water that is available above a pre-set reservoir target level.
Water Intake Locations	Unchanged	Since the water intakes represent current physical constraints, they are assumed unchanged.

Under current conditions, Duke operates the system to maintain a predetermined target elevation for each reservoir. These elevations vary by month for some of the reservoirs in the system. During periods of low inflow, Duke's hydro operations group attempts to maintain storage in the system; and, as reservoir levels drop below the preset target elevations, water from upstream reservoirs is transferred downstream to try and maintain the target elevations. In addition, Duke's discretionary water use for hydropower is reduced. If water from upstream reservoirs is not available, or transfer of water would result in an upstream reservoir falling below target elevation, the CHEOPS™ model would then allow the downstream reservoir to drop below its target elevation.

4.6.2 Baseline – Safe Yield Reservoir Constraint

For the Baseline operations, a single safe yield reservoir constraint was modeled to establish a benchmark for the proposed future Mutual Gains operating scenario. The reservoir constraint utilized was the location of the highest water intake in each of the Project's reservoirs. As outlined in Appendix G, there are numerous water intakes in the 11 Project reservoirs. Each of these intakes has a distinct reservoir elevation, below which they are inoperable.

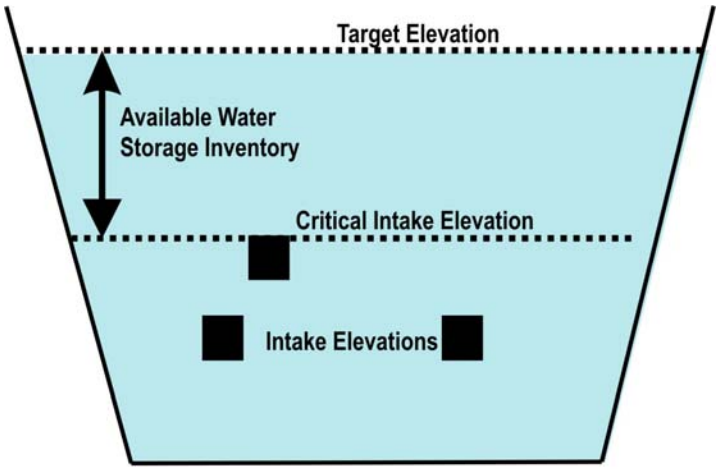


Figure 4.4 - Safe Yield Analysis - Critical Intake Elevation Constraint

For the Baseline safe yield analysis, it was determined that reservoir constraint elevations should be set at the highest intake constraint elevation for each of the 11 reservoirs. By establishing this constraint elevation, the available water storage inventory can be utilized without sacrificing the operability of any water intake, thereby defining the safe yield value for that reservoir. Figure 4.4 illustrates the application of this constraint scenario on the Project reservoirs.

4.6.3 Baseline – Safe Yield Results

To determine the Baseline safe yield, the five low-inflow periods were modeled along with water withdrawal and return rates to 2078. Using the critical intake constraint, Table 4-3 summarizes the reservoirs where violations occurred during CHEOPS model simulations, along with the year of failure.

Table 4-3. Baseline Safe Yield – Reservoir Violation Summary (Critical Intake Constraint)

Year	Low-Inflow Period				
	1	2	3	4	5
2008	-	-	-	-	-
2018	-	-	-	-	-
2028	-	-	-	-	-
2038	-	-	-	-	-
2048	-	-	-	-	5,6
2058	-	1,2,3,4,6	-	-	-
2068	-	1,2,3,4,6,9,10	-	-	6
2078	-	1,2,3,4,6,7	-	6	5,6

Note: Reservoir numbers correspond to:

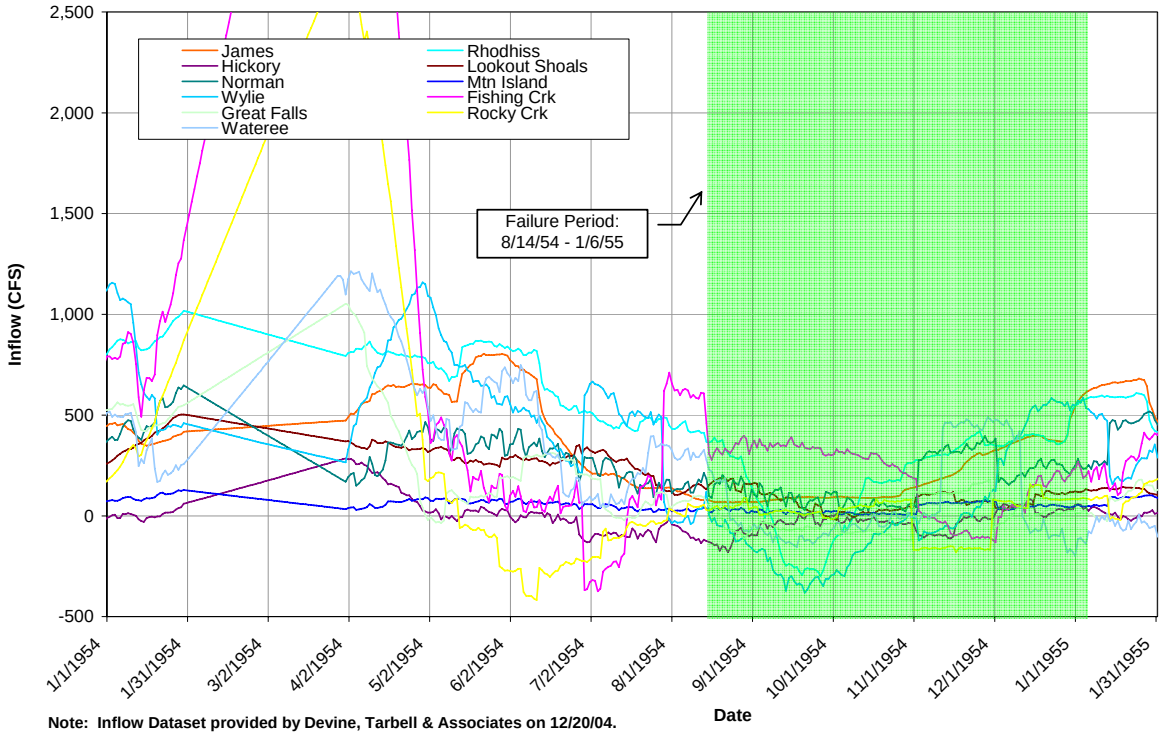
1 = James, 2 = Rhodhiss, 3 = Hickory, 4 = Lookout Shoals, 5 = Norman, 6 = Mountain Island

7 = Wylie, 8 = Fishing Creek, 9 = Great Falls-Dearborn, 10 = Cedar Creek, 11 = Wateree

Low-inflow periods 1 and 3 did not result in a single violation throughout the simulation period. For low-inflow period 4, Mountain Island Lake was observed to fail in 2078. Low inflow periods 2 and 5 exhibited more widespread, more frequent, and earlier occurring reservoir failures. From this comparison, it was apparent that low-inflow periods 2 and 5 should take priority for the safe yield analysis and future safe yield modeling runs.

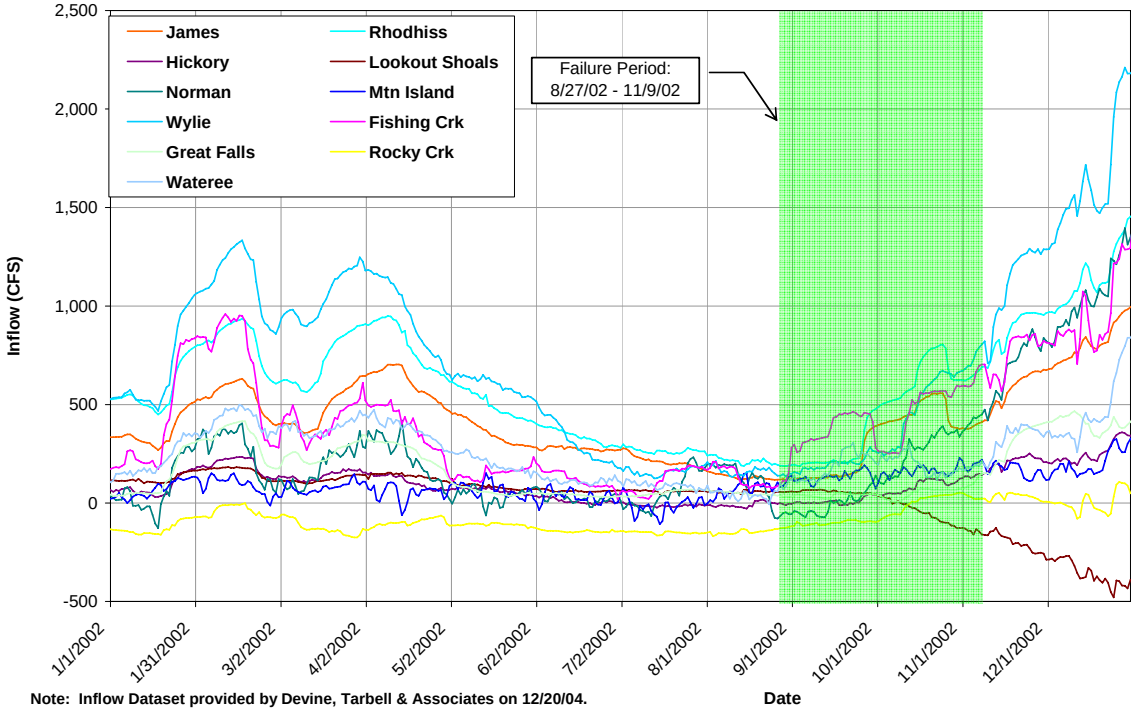
It was difficult to determine which low-inflow period (2 or 5) represents the more severe drought period. While low-inflow period 5 showed signs of an earlier failure date (2048 versus 2058), low-inflow period 2 experienced more failures and those failures primarily occurred in reservoirs that did not fail under any other low-inflow period (James, Rhodhiss, Hickory, Wylie, Great Falls-Dearborn, Cedar Creek). Figures 4.5 and 4.6 present reservoir inflows that occurred during the failure periods for low-inflow periods 2 and 5, respectively. A comparison of the reservoir inflows at these failure points shows that the inflows had indeed dropped to their lowest levels for each low-inflow period. While low-inflow period 2 saw more inflow Basin-wide, most of that inflow entered the basin in the downstream reservoirs. Low-inflow period 5, while exhibiting lower overall inflow into the Basin, was less severe to the upper reservoirs than low-inflow period 2. It appears that low-inflow period 5 was the more severe drought period. However, low-inflow period 2 seemed to be more widespread and particularly more damaging to the upper reservoirs.

Figure 4.5 - Inflow Data Series for Each Reservoir for the Year 1954 (Low Inflow Period 2)



Note: Inflow Dataset provided by Devine, Tarbell & Associates on 12/20/04.

Figure 4.6 - Inflow Data Series for the Year 2002 (Low Inflow Period 5)



Note: Inflow Dataset provided by Devine, Tarbell & Associates on 12/20/04.

4.6.3.1 Low-Inflow Period 5 Results

For the low-inflow period 5 simulations, both Lake Norman and Mountain Island Lake first violated their constraint elevations under 2048 withdrawal and return rates. The violations occurred when nearly 80 percent of the drought period had elapsed, and persisted for approximately three months. However, both reservoirs were pending failure for a significant period of time prior to actual failure. In accordance with Duke's operations, storage from upstream reservoirs was released to support Lake Norman and Mountain Island Lake until further upstream releases would cause reservoir violations upstream. The summary graphs in Appendix J (graph series 1) show that all upstream reservoirs (James, Rhodhiss, Hickory, Lookout Shoals, and Norman) were close to violating their own constraints at the time of the downstream failures.

The withdrawal and return rates assigned to Lake Norman and Mountain Island Lake were then reduced to 2038 levels, while the remaining lakes maintained 2048 withdrawal and return rates. This modification prevented the same failures from occurring, but it was apparent that Lake Norman and Mountain Island Lake still relied heavily on the upstream reservoirs to avert constraint violations. The success of this run implied that the safe yield values for Lake Norman and Mountain Island Lake lie somewhere between 2038 and 2048 net outflow rates.

The next reservoir violations occurred at withdrawals and returns that correspond to the year 2068. Despite having reduced withdrawals and returns, Mountain Island Lake failed at the same point in the drought period as it did in previous simulations. As before, all upper reservoirs were strained to the point of failure to support Mountain Island Lake. This set of violations is due to increasing withdrawals and returns from the upstream reservoirs. Since the upstream reservoirs need to satisfy larger demands in 2068 than they did in 2048, the volume of water available to support Mountain Island Lake is inherently less. Mountain Island Lake is characterized by large water withdrawals and a small drainage area, so its dependency on other reservoirs for water supply is not unexpected. In essence, the failure in Mountain Island Lake is considered a proxy failure for the upstream reservoirs.

The final set of reservoir violations occurred at withdrawals and returns corresponding to the year 2078. Both Lake Norman and Mountain Island Lake again experienced violations, and the pattern of straining upper reservoirs was repeated. These failures can be explained with the same rationale discussed above for previous violations. Additionally, Lake Wylie was observed to be close to violating its constraints. This result was likely due to increasing withdrawal rates combined with the lack of inflow from Mountain Island Lake.

Throughout the entire simulation, all reservoirs downstream of Lake Wylie were able to operate without a reservoir critical intake elevation violation. This result is due to the relatively small net outflows projected, large drainage areas, and inflows from upstream drainage basins that characterize the downstream reservoirs.

The safe yield values obtained from low-inflow period 5 simulations, under the critical intake constraint scenario, are presented in Table 4-4. The safe yield values presented in this Study include a range of years and corresponding withdrawal flows projected for these years for that particular watershed. The lower end of the safe yield value range was determined by extracting the withdrawal flow that was modeled in the time-step (10-year increment) just prior to a reservoir violation. The upper end of the safe yield value range was determined by extracting the withdrawal flow that was modeled in the time-step (10-year increment) when a reservoir violation occurred.

For example, Mountain Island Lake had a critical intake constraint violation in 2048, while a subsequent run of 2038 flows indicated no violations. This time-step (2038) and associated reservoir withdrawal rate (192 mgd) is determined as the safe yield for this reservoir under Baseline conditions.

Table 4-4. Safe Yield Value Range Obtained from Critical Intake Constraint, Low-Inflow Period 5 Simulations

No.	Reservoir	Year	Withdrawal Flow (mgd)	Withdrawal Flow (cfs) [1]
1	James	2058 – 2068[2]	36 – 40	56 – 62
2	Rhodhiss	2058 – 2068[2]	44 – 47	68 – 73
3	Hickory	2058 – 2068[2]	44 – 49	68 – 76
4	Lookout Shoals	2058 – 2068[2]	12 – 13	19 – 21
5	Norman	2038 – 2048	133 – 169	206 – 261
6	Mountain Island	2038 – 2048	192 – 207	297 – 320
7	Wylie	> 2078	>189	>292
8	Fishing Creek	> 2078	>225	>348
9	Great Falls-Dearborn	> 2078	>3	>5
10	Cedar Creek	> 2078	>1	>2
11	Wateree	> 2078	>74	>114

Notes: 1. Withdrawal flows associated with years given may not match exactly with flows outlined in Section 3 and Appendix C. Baseline safe yield analysis was completed in January 2005, prior to minor updates of the withdrawal/return projections.
2. Failure pending to support downstream reservoirs.

4.6.3.2 Low-Inflow Period 2 Results

The safe yield values obtained from low-inflow period 2 simulations, under critical intake elevation 2 constraints, are presented in Table 4-5.

Table 4-5. Safe Yield Value Range Obtained from Critical Intake Level Constraints Low-Inflow Period 2 Simulations

No.	Reservoir	Year	Withdrawal Flow (mgd)	Withdrawal Flow (cfs) [1]
1	James	2048 – 2058	32 – 34	50 – 53
2	Rhodhiss	2048 – 2058	40 – 44	62 – 68
3	Hickory	2048 – 2058	37 – 44	57 – 68
4	Lookout Shoals	2048 – 2058	12	19
5	Norman	>2078	>223	>346
6	Mountain Island	2048 – 2058	207 – 224	320 – 347
7	Wylie	2068 – 2078	171 – 189	265 – 292
8	Fishing Creek	>2078	>225	>348
9	Great Falls-Dearborn	2058 – 2068	2 - 3	3 – 5
10	Cedar Creek	2058 – 2068	1	2
11	Wateree	>2078	>74	>114

Note: 1. Withdrawal flows associated with years given may not match exactly with flows outlined in Section 3 and Appendix C. Baseline safe yield analysis was completed in January 2005, prior to minor updates of the withdrawal/return projections.

4.6.4 Baseline – Safe Yield Conclusions

The Baseline safe yield analysis was completed, in part, to establish a benchmark for comparison to the future Mutual Gains safe yield values. Based on the information outlined above, the following key conclusions can be made based on the Baseline safe yield analysis:

- Low inflow periods 2 and 5 are the key droughts in the hydrologic period of record to consider for determining safe yield.
- Upstream reservoirs in the Catawba-Wateree Project are integrally linked to supplying downstream reservoirs during periods of drought, given the relative size of the reservoirs and their location to water withdrawals and net outflows.
- Using the water withdrawal and return projections from this Study, the safe yield ranges of Mountain Island Lake and Lake Norman are approximately 133 - 169 mgd and 192 – 207 mgd, respectively. These values equate to withdrawal and return projection ranges between years 2038 - 2048, and represent the earliest time at which one of the Project reservoirs can no longer meet increasing net outflows.
- Other reservoirs have safe yield values that would allow net outflows, as projected in this Study, to extend beyond the Year 2038; but all reservoirs, except Fishing Creek and Wateree, showed safe yields being reached by the Year 2078.

Again, the value of this Baseline safe yield analysis is primarily the comparison of these results to those for the future Mutual Gains conditions.

4.7 MUTUAL GAINS SAFE YIELD – EVALUATION

4.7.1 Mutual Gains – Safe Yield Operating Criteria

The Mutual Gains safe yield analysis is focused on determining safe yields for each of the Project's reservoirs under future operating conditions. That is, a simulation of how Duke Power will operate the system under its new FERC License, assuming acceptance by FERC of these operating conditions. The Mutual Gains conditions are a negotiated set of operating criteria which set the operating parameters of the Project, including, but not limited to:

- Recreation flow releases.
- Downstream flow requirements for aquatic habitat.
- Target reservoir elevations.
- Minimum reservoir elevations.
- Implementation of a Low Inflow Protocol.

These operating parameters have been developed through negotiation with the relicensing stakeholder teams and through a series of CHEOPS™ modeling runs. The Mutual Gains operating scenario will become an integral part of Duke Power's agreement with the stakeholder groups and their application to FERC for a new license. Thus, the Mutual Gains safe yield analysis is intended to measure the Project's future ability to support regional water supply during extended drought periods over the next 50 years, or the expected period of relicensing.

While the Mutual Gains operating conditions are more prescriptive and less flexible than Duke's current operations, other elements of the proposed future operation are intended to preserve water supply. Most importantly, the proposed Low Inflow Protocol requires Duke, and others, to make changes in downstream flow requirements and water withdrawals with a goal of improving water supply availability during periods of low inflow into the Project's reservoirs.

Under the Mutual Gains operating conditions, Duke will work to operate the system within a normal operating range and to maintain a predetermined target elevation for each reservoir. These target elevations vary by month for some of the reservoirs in the system. During periods of low inflow, Duke's hydro operations group will work to maintain storage in the system; and, as reservoir levels drop, water from upstream reservoirs will be transferred downstream to try and maintain minimum reservoir elevations. The major difference between this approach and the Baseline conditions is that, once a minimum reservoir elevation has been reached, then this reservoir is restricted from passing additional flow to support downstream reservoirs experiencing declining reservoir conditions. The Low Inflow Protocol allows for minimum reservoir elevations to be reduced, and thus more water storage inventory accessed, as low inflow or drought conditions continue to worsen (see Section 7.0).

The CHEOPS™ model was enhanced during this Study to include operation of the system under the Mutual Gains operating conditions and to include the implementation and impacts of the Low Inflow Protocol.

4.7.2 Mutual Gains – Safe Yield Reservoir Constraints

For the Mutual Gains operations, three safe yield reservoir constraints were modeled.

- ***Reservoir Constraint: Critical Intake Elevation*** – The first constraint utilized was as discussed in the Baseline condition. It is the location of the highest water intake in each of the Project's reservoirs. By establishing this constraint elevation, then the available water storage inventory can be utilized until that level is reached, thereby defining the safe yield value for that reservoir. Figure 4.4 (in the previous section) illustrates the application of this constraint on the Project reservoirs.
- ***Reservoir Constraint: Critical Boat Access –*** The second constraint utilized in the calculation of safe yield under the Mutual Gains condition is the access to boat ramps in each of the reservoirs. Nearly all of the Project's reservoirs have one or more boat ramps that provide access into the lakes. The critical boat access levels are defined as the level that keeps two Duke-owned access areas open on larger lakes, and one on smaller lakes. These critical boat access levels are defined in Appendix G.
- ***Reservoir Constraint: Full Reservoir Usage*** – This constraint assumes full utilization of all available water storage inventory in the system. While this constraint is impractical since the existing Project infrastructure does not allow access to the entire water storage inventory, the Study team wanted to consider the potential impact to safe yield if the full water storage could be utilized.

Table 4-6 summarizes these critical constraints and indicates the percentage of Total Available Storage based on the critical intake constraint elevations.

Table 4-6. Critical Constraint Elevation Summaries

Reservoir	Critical Intake Constraint Elevation (feet relative to local datum) [1]	Estimated Percentage of Total Available Storage Provided Based on Critical Intake Constraint	Critical Boat Access Constraint Elevation (feet relative to local datum)
James	61.0	25%	92.0
Rhodhiss	89.4	2%	91.0
Hickory	94.0	3%	91.0
Lookout Shoals	74.9	2%	92.0
Norman	90.0	40%	91.0
Mountain Island	94.3	2%	91.0
Wylie	92.6	10%	95.5
Fishing Creek	95.0	2%	95.0
Great Falls-Dearborn	87.2	1%	87.2 [3]
Cedar Creek	80.3	2%	96.0
Wateree	92.5	11%	93.0
Total		100%	

Note: 1. All elevations listed are measured in feet relative to the full pond contour with 100.0 feet corresponding to full pond.
2. Total available storage estimated at 707,000 acre-feet.
3. Hydro operations limitation.

4.7.3 Mutual Gains – Safe Yield Results

4.7.3.1 Safe Yield Results – Critical Intake Elevation Constraint

Low inflow periods 2 and 5 were simulated in the CHEOPS™ model to determine safe yield results for the Mutual Gains analysis. To help determine safe yield, end of day reservoir elevations were determined in the model and checked against the critical intake levels. Tables 4-7 and 4-8 present the results of this analysis for low inflow periods 5 and 2, respectively.

While the model results presented in Tables 4-7 and 4-8 appear to illustrate early and frequent failures of some reservoirs, this data requires careful interpretation. For instance, failures indicated in the Great Falls-Dearborn reservoir have been neglected since this reservoir is the smallest reservoir in the system; there are no intakes in the reservoir, and the reservoir level outputs have to be considered along with Fishing Creek Reservoir. Reservoir level excursions below the critical level to approximately 0.5 feet below the critical elevation in Lake Hickory, Mountain Island Lake, and others was determined not to constitute a pending failure given the upstream storage available in much larger reservoirs such as Lake James and Lake Norman. In practice, a fraction of storage in these large volume reservoirs would be utilized to make up the needs in the downstream reservoirs. The modeling limitations of CHEOPS™ does not allow for removal of this 'noise' in the reservoir level outputs.

For low inflow period 5, with 2058 net outflow conditions, four of the first seven reservoirs experienced failure, including 21 daily excursions for Lake Norman and a 1.5 foot drop below critical elevations in Mountain Island Lake. Thus, it was determined that the safe yield for reservoirs 1-7 (James – Wylie) would be reached between 2048 and 2058 projected net outflows. Appendix J includes the 2058 graphical results for Low Inflow Period 5. Reservoirs 8 thru 11 (Fishing Creek – Wateree) reached 2078 net outflows without any major violations.

For low inflow period 2, with 2068 net outflow conditions, four of the first seven reservoirs experienced failure, including 28 daily excursions for Lake Wylie. Thus, it was determined that the safe yield for reservoirs 1 thru 7 (James – Wylie) would be reached between 2058 and 2068 projected net outflows.

Table 4-9 provides a reservoir critical intake violation summary for low inflow periods 2 and 5.

Table 4-7. Low Inflow Period 5 - Safe Yield Operating Results from CHEOPS Model, Critical Intake Elevation Constraint

	Year Withdrawal/Return Flows Modeled							
Reservoir	2008	2018	2028	2038	2048	2058	2068	2078
Number of End of Day Elevations Below the Critical Elevation								
James	0	0	0	0	0	0	0	0
Rhodhiss	0	0	0	0	0	0	0	1
Hickory	25	24	27	29	31	34	43	34
Lookout Shoals	0	0	0	0	0	0	0	0
Norman	0	0	0	0	0	21	0	146
Mountain Island	44	60	97	138	143	222	257	295
Wylie	0	0	1	27	18	41	7	70
Fishing Creek	0	0	0	0	0	0	0	0
Great Falls – Dearborn	14	9	10	12	16	19	3	19
Cedar Creek	0	0	0	0	0	0	0	0
Wateree	0	0	0	0	0	0	0	0
Maximum Drawdown Below Critical Elevation (ft)								
James	0	0	0	0	0	0	0	0
Rhodhiss	0	0	0	0	0	0	0	0.06
Hickory	0.33	0.51	0.52	0.53	0.55	0.57	0.58	0.43
Lookout Shoals	0	0	0	0	0	0	0	0
Norman	0	0	0	0	0	0.39	0	1.68
Mountain Island	0.29	0.33	0.35	0.39	0.40	1.48	0.78	3.26
Wylie	0	0	0.06	0.29	0.35	0.23	0.24	5.09
Fishing Creek	0	0	0	0	0	0	0	0
Great Falls – Dearborn	14.53	7.67	8.88	10.54	8.99	10.87	13.81	23.21
Cedar Creek	0	0	0	0	0	0	0	0
Wateree	0	0	0	0	0	0	0	0

Table 4-8. Low Inflow Period 2 - Safe Yield Operating Results from CHEOPS Model, Critical Intake Elevation Constraint

	Year Withdrawal/Return Flows Modeled							
Reservoir	2008	2018	2028	2038	2048	2058	2068	2078
Number of End of Day Elevations Below the Critical Elevation								
James	0	0	0	0	0	0	0	0
Rhodhiss	0	0	0	0	0	0	0	0
Hickory	16	17	32	38	44	48	60	74
Lookout Shoals	0	0	0	0	0	0	0	0
Norman	0	0	0	0	0	0	0	0
Mountain Island	65	93	116	120	199	254	364	432
Wylie	0	0	0	0	0	0	28	77
Fishing Creek	0	1	1	4	1	1	1	1
Great Falls – Dearborn	13	19	17	21	23	21	22	19
Cedar Creek	0	0	0	0	0	0	0	0
Wateree	0	0	0	0	0	0	0	0
Maximum Drawdown Below Critical Elevation (ft)								
James	0	0	0	0	0	0	0	0
Rhodhiss	0	0	0	0	0	0	0	0
Hickory	0.40	0.41	0.48	0.60	0.69	0.76	0.82	0.81
Lookout Shoals	0	0	0	0	0	0	0	0
Norman	0	0	0	0	0	0	0	0
Mountain Island	0.15	0.33	0.35	0.38	0.4	0.43	0.49	0.74
Wylie	0	0	0	0	0	0	0.75	4.66
Fishing Creek	0	0.05	0.06	0.16	0.06	0.13	0.15	0.19
Great Falls – Dearborn	13.64	27.2	22.36	27.2	27.2	27.2	27.2	27.2
Cedar Creek	0	0	0	0	0	0	0	0
Wateree	0	0	0	0	0	0	0	0

Table 4-9. Mutual Gains Safe Yield – Reservoir Violation Summary (Critical Intake Elevation Constraint)

Year	Low-Inflow Period	
	2	5
2008	-	-
2018	-	-
2028	-	-
2038	-	-
2048	-	-
2058	-	1,2,3,4,5,6,7
2068	1,2,3,4,5,6,7	-
2078	-	-

Note: Reservoir numbers correspond to:

1 = James, 2 = Rhodhiss, 3 = Hickory, 4 = Lookout Shoals, 5 = Norman, 6 = Mountain Island

7 = Wylie, 8 = Fishing Creek, 9 = Great Falls-Dearborn, 10 = Cedar Creek, 11 = Wateree

Table 4-10 outlines the safe yield values (withdrawal flows) that were derived from this analysis and the corresponding year that these withdrawal flows have been projected in this Study.

Table 4-10. Safe Yield Value Range Obtained from Critical Intake Constraint Low-Inflow Periods 2 and 5 Simulations

No.	Reservoir	Year	Withdrawal Flow (mgd)	Withdrawal Flow (cfs)
1	James	2048 – 2058	32 – 34	50 – 53
2	Rhodhiss	2048 – 2058	40 – 44	62 – 68
3	Hickory	2048 – 2058	37 – 44	57 – 68
4	Lookout Shoals	2048 – 2058	12	19
5	Norman	2048 – 2058	169 – 179	261 – 277
6	Mountain Island	2048 – 2058	207 – 224	320 – 347
7	Wylie	2048 - 2058	141 – 155	218 - 240
8	Fishing Creek	> 2078	>238	>368
9	Great Falls-Dearborn	> 2078	>3	>4
10	Cedar Creek	> 2078	>1	>2
11	Wateree	> 2078	>74	>114

4.7.3.2 Safe Yield Results – Critical Boat Access Constraint

Low inflow periods 2 and 5 were also simulated in the CHEOPS™ model to determine safe yield results under the Mutual Gains operating conditions and for the Critical Boat Access Constraint. To help determine safe yield, end of day reservoir elevations were determined in the model and checked against the critical boat access constraint levels. Tables 4-11 and 4-12 present the results of this analysis.

Table 4-11. Low Inflow Period 5 - Safe Yield Operating Results from CHEOPS Model

	Year Withdrawal/Return Flows Modeled							
Reservoir	2008	2018	2028	2038	2048	2058	2068	2078
Number of End of Day Elevations Below the Critical Boat Access Constraint Elevation								
James	41	60	55	116	126	121	118	118
Rhodhiss	0	0	0	0	0	0	0	0
Hickory	40	33	30	23	26	23	21	23
Lookout Shoals	0	1	0	0	0	0	0	1
Norman	0	0	0	0	0	0	13	0
Mountain Island	61	83	85	83	95	113	108	110
Wylie	640	633	618	624	633	630	617	639
Fishing Creek	0	0	0	0	0	0	0	0
Great Falls - Dearborn	14	11	6	6	6	7	6	6
Cedar Creek	10	6	6	3	6	8	8	9
Wateree	0	0	0	0	0	0	0	0
Maximum Drawdown Below the Critical Boat Access Constraint Elevation (ft)								
James	0.58	0.64	0.79	1.08	1.08	1.08	1.08	1.08
Rhodhiss	0	0	0	0	0	0	0	0
Hickory	0.33	0.19	0.44	0.50	0.50	0.51	0.51	0.51
Lookout Shoals	0	0.01	0	0	0	0	0	0.13
Norman	0	0	0	0	0	0	0.14	0
Mountain Island	0.29	0.29	0.29	0.29	0.29	0.29	0.27	0.29
Wylie	2.93	3.16	2.72	3.12	2.96	3.13	3.14	3.14
Fishing Creek	0	0	0	0	0	0	0	0
Great Falls – Dearborn	14.53	6.20	6.46	4.73	4.73	5.51	5.76	5.76
Cedar Creek	3.74	3.64	3.55	3.42	3.37	3.26	3.06	3.31
Wateree	0	0	0	0	0	0	0	0

Table 4-12. Low Inflow Period 2 – Safe Yield Operating Results for CHEOPS Model

	Year Withdrawal/Return Flows Modeled							
Reservoir	2008	2018	2028	2038	2048	2058	2068	2078
Number of End of Day Elevations Below the Critical Boat Access Constraint Elevation								
James	92	85	85	85	82	85	93	99
Rhodhiss	0	0	0	0	0	0	0	0
Hickory	16	17	14	31	28	26	27	29
Lookout Shoals	0	0	0	0	0	0	0	0
Norman	0	0	0	0	0	0	0	0
Mountain Island	65	84	84	100	108	107	120	124
Wylie	234	235	242	249	338	345	396	570
Fishing Creek	0	1	0	2	0	1	2	0
Great Falls – Dearborn	13	14	12	15	12	16	16	17
Cedar Creek	11	10	8	9	10	9	15	11
Wateree	0	0	0	0	0	0	0	0
Maximum Drawdown Below the Critical Boat Access Constraint Elevation (ft)								
James	2.25	2.04	2.04	2.04	1.89	2.04	2.31	2.55
Rhodhiss	0	0	0	0	0	0	0	0
Hickory	0.40	0.40	0.40	0.51	0.52	0.54	0.49	0.57
Lookout Shoals	0	0	0	0	0	0	0	0
Norman	0	0	0	0	0	0	0	0
Mountain Island	0.15	0.15	0.15	0.15	0.29	0.29	0.29	0.28
Wylie	2.11	2.03	2.07	2.01	2.07	1.99	2.06	2.00
Fishing Creek	0	0.03	0	0.08	0	0.04	0.06	0
Great Falls – Dearborn	13.64	27.20	9.49	27.20	9.97	6.48	27.20	27.20
Cedar Creek	7.96	7.38	7.37	7.29	6.28	7.55	7.55	7.54
Wateree	0	0	0	0	0	0	0	0

The results of this analysis indicate early and frequent failures of many of the reservoirs. Using only 2008 net outflows in the model, the following five reservoirs violate the boat access constraint level for both low inflow periods 2 and 5:

- Lake James
- Lake Hickory
- Mountain Island Lake
- Lake Wylie
- Cedar Creek

These types of widespread reservoir violations are due, in part, to the location of the boat access constraint levels in relationship to the minimum lake levels allowed in the Mutual Gains operating scenario. Table 4-6 summarized the critical intake constraint elevations along with the critical boat access constraint elevation for each reservoir. As illustrated in Table 4-6, several of the reservoirs have relatively high boat access constraint elevations. In particular, Lake Wylie's critical boat access constraint elevation is 95.5 feet MSL (relative to local datum), which is actually higher than the normal minimum elevation for this reservoir. In simulating the Mutual Gains operating conditions, a relatively large downstream flow requirement at Lake Wylie and a relatively high reservoir constraint level places the entire upper reservoir system in a stressed condition. The CHEOPS model simulates the transfer of water downstream in an attempt to meet the downstream flow requirements and maintain reservoir elevations. However, based on the storage inventory and other factors, the Low Inflow Protocol does not move into progressive stages so as to allow access to more storage from upstream reservoirs. The result is immediate (2008) failures in Lake Wylie in both low-inflow periods. Other reservoirs in the system also struggle as they either attempt to meet downstream water demands or have relatively high critical boat access constraint elevations.

Based on this analysis, Table 4-13 presents the safe yield values associated with the boat access constraint levels.

Table 4-13. Safe Yield Value Range Obtained from Critical Boat Access Constraints, Low Inflow Periods 2 and 5 Simulations

No.	Reservoir	Year	Withdrawal Flow (mgd)	Withdrawal Flow (cfs)
1	James	< 2008	< 12	< 19
2	Rhodhiss	> 2078	> 52	> 80
3	Hickory	< 2008	< 17	< 26
4	Lookout Shoals	> 2078	> 15	> 23
5	Norman	2068 – 2078	202 – 223	312 – 346
6	Mountain Island	< 2008	< 131	< 203
7	Wylie	< 2008	< 95	< 147
8	Fishing Creek	> 2078	> 238	> 368
9	Great Falls-Dearborn	> 2078 [1]	> 3	> 5
10	Cedar Creek	< 2008	< 1	< 2
11	Wateree	> 2078	> 74	> 114

Note: 1. No Critical Boat Access Constraint Elevation

4.7.3.3 Safe Yield Results – Full Reservoir Usage

As previously mentioned, access to all of a reservoir's water storage inventory to support the overall water demands is impractical based on the Project's existing infrastructure. For instance, reservoir levels cannot be easily dropped below the lowest intake in a reservoir or below Duke's hydro operations intake elevation (see Appendix G for these elevations). However, evaluating the safe yield of the Project's reservoirs assuming access to the full reservoir storage was deemed important by the Study Team.

Since the CHEOPS model is not programmed to access this storage, then an objective evaluation of safe yield can be completed using results from low inflow periods 2 and 5 for the critical intake constraint. Table 4-14 shows the 2078 modeling results for each reservoir under the critical intake constraint scenario.

Table 4-14. Low Inflow Periods 2 and 5 - Safe Yield Operating Results from CHEOPS Model – Critical Intake Constraint

Reservoir	Low Inflow Period and Year Withdrawal/Return Flows Modeled			
	No. of End of Day Elevations Below the Critical Elevation 2-2078	Maximum Drawdown Below Critical Elevation (ft) 2-2078	No. of End of Day Elevations Below the Critical Elevation 5-2078	Maximum Drawdown Below Critical Elevation (ft) 5-2078
James	0	0	0	0
Rhodhiss	0	0	1	0.06
Hickory	74	0.81	34	0.43
Lookout Shoals	0	0	0	0
Norman	0	0	146	1.68
Mountain Island	432	0.74	295	3.26
Wylie	77	4.66	70	5.09
Fishing Creek	1	0.19	0	0
Great Falls-Dearborn	19	27.2	19	23.21
Cedar Creek	0	0	0	0
Wateree	0	0	0	0

By evaluating these results, it is easy to see that, if the full water storage inventory can be accessed, then the safe yield of the Project's reservoirs will exceed the 2078 net outflows. While many of the reservoirs dropped below critical elevation, none of the reservoirs depleted the water storage. This result is due, in part, to the impact of the Low Inflow Protocol in preserving the water system storage. Since withdrawals, returns, and net outflows were not determined beyond 2078, the safe yield values for this constraint can only be said to exceed 2078 net outflow projections.

4.7.4 Mutual Gains – Safe Yield Conclusions

The Mutual Gains safe yield analysis was completed to establish future safe yield values for the Project's reservoirs during the term of the new FERC license. Based on the information outlined above, the following key conclusions can be made based on the Mutual Gains safe yield analysis:

- The development of the Mutual Gains operating conditions was completed through negotiation with the Project's stakeholders, and through a series of CHEOPS™ modeling runs. One objective of this operating condition was to promote a reliable future water supply during periods of low inflow. The Baseline safe yield values resulted in projected net outflows to be limited in some reservoirs between the years 2038 - 2048. The Mutual Gains safe yield modeling runs have indicated safe yield ranges of the first seven reservoirs being reached between the years 2048 – 2058.

- The remaining reservoirs have safe yield values extending beyond Year 2078 for all constraint scenarios modeled.

- The implementation of the Low Inflow Protocol makes a substantial impact on the Project's ability to maintain critical water storage inventory during periods of low inflow; and to access needed storage if hydrologic conditions continue to worsen.

- The safe yield values associated with the critical boat access constraint elevations fall into one of two categories. For those reservoirs where this constraint elevation is relatively high, the Mutual Gains operating condition indicates failure at or before the year 2008 projected net outflows. For those reservoirs where the constraint elevation is not as high, then projected net outflows are able to reach beyond 2078 projections. However, careful interpretation of this result is necessary. Because the Mutual Gains operating condition includes the impact of the Low Inflow Protocol, early failures in Lake James, Lake Hickory, Mt. Island Lake, and Lake Wylie force the projected net outflows to be limited to 2008 conditions.

- To ensure a reliable safe yield from the Project's reservoirs throughout the next 50 years, Duke Power and the other water users must adhere closely to the Mutual Gains operating conditions, including implementation of the Low Inflow Protocol.

4.8 SAFE YIELD SUMMARY

The determination of the safe yield for water supply from the Catawba-Wateree Project's reservoirs is a complex and challenging task. The relationship and operation of the Project's reservoirs, the physical limitations of the existing water supply infrastructure, and the various operating constraints that can be evaluated are variables in the mathematical computation of safe yield. The CHEOPS™ model has been a valuable tool to simulate the operation of the Project under various operating conditions. Some of the variables that have been considered to arrive at safe yield results include, but are not limited to:

- Operating conditions: Baseline (current), Mutual Gains.
- Low inflow periods evaluated.
- Projected future water withdrawals and returns, and the locations of these withdrawals and returns.
- Low inflow protocol triggers and actions.
- Locations of reservoir level constraints and/or physical infrastructure locations.

For this Study, both a Baseline safe yield and a Mutual Gains safe yield have been calculated. For the Mutual Gains safe yield, three different operating reservoir level constraints were evaluated. Table 4-15 provides a quick summary of the results for each of these safe yield evaluations.

Table 4-15. Safe Yield Evaluation - Summary

Reservoir	Projected Range of Safe Yield Values (mgd) [Assoicated Year Withdrawal is Projected to be Reached]			
	Baseline Critical Intake [1]	Mutual Gains Critical Intake	Mutual Gains Boat Access	Mutual Gains Full Reservoir Access
James	32-34 (2048-2058)	32-34 (2048-2058)	< 12 (< 2008)	> 44 (> 2078)
Rhodhiss	40-44 (2048-2058)	40-44 (2048-2058)	> 52 (> 2078)	> 52 (> 2078)
Hickory	37-44 (2048-2058)	37-44 (2048-2058)	< 17 (< 2008)	> 54 (> 2078)
Lookout Shoals	12 (2048-2058)	12 (2048-2058)	> 15 (> 2078)	> 15 (> 2078)
Norman	133-169 (2038-2048)	169-279 (2048-2058)	202-203 (2068-2078)	> 223 (> 2078)
Mountain Island	192-207 (2038-2048)	207-224 (2048-2058)	< 131 (< 2008)	> 272 (> 2078)
Wylie	171-189 (2068-2078)	141-155 (2048-2058)	< 95 (< 2008)	> 189 (> 2078)
Fishing Creek	> 238 (> 2078)	> 238 (> 2078)	> 238 (> 2078)	> 238 (> 2078)
Great Falls-Dearborn	2-3 (2058-2068)	> 3 (> 2078)	> 3 (> 2078) [2]	> 3 (> 2078)
Cedar Creek	1 (2058-2068)	> 1 (> 2078)	< 1 (< 2008)	> 1 (> 2078)
Wateree	> 74 (> 2078)	> 74 (> 2078)	> 74 (> 2078)	> 74 (> 2078)

Notes: 1. Withdrawal flows associated with years given may not match exactly with flows outlined in Section 3 and Appendix C. Baseline safe yield analysis was completed in January 2005, prior to minor updates of the withdrawal/return projections.
2. No critical boat access constraint elevation.

Based on the results presented in this section, the following key conclusions can be made regarding safe yield:

- Low inflow periods 2 (1950s drought) and 5 (the 1998-2002 drought) are the key drought periods in the hydrologic period of record to consider for determining safe yield.

- Upstream reservoirs in the Catawba-Wateree Project are integrally linked to supplying downstream reservoirs during periods of low inflow, given the relative size of the reservoirs and their location to water withdrawals and net outflows.

- The development of the Mutual Gains operating conditions was completed through negotiation with the Project's stakeholders, and through a series of CHEOPS™ modeling

runs. One objective of this operating condition was to promote a reliable water supply during periods of low inflow. The Baseline safe yield values resulted in projected net outflows to be limited in some reservoirs between the years 2038 - 2048. The Mutual Gains safe yield modeling runs have indicated safe yield ranges of the first seven reservoirs being reached between the years 2048 - 2058.

- The implementation of the Low Inflow Protocol makes a substantial impact on the Project's ability to maintain critical water storage inventory during periods of low inflow; and to access needed storage if hydrologic conditions continue to worsen.

- The safe yield values associated with the critical boat access constraint elevations fall into one of two categories. For those reservoirs where this constraint elevation is relatively high, the Mutual Gains operating condition indicates failure at or before the year 2008 projected net outflows. For those reservoirs where the constraint elevation is not as high, then the projected net outflows are able to reach beyond 2078 projections, due in part to the projected net outflows of the other reservoirs being limited to 2008 conditions after failure.

- Changes in any of the variables discussed above, or throughout this document, that may impact safe yield results will require an update to the modeling runs to determine revised safe yield values.

- To ensure a reliable safe yield from the Project's reservoirs throughout the next 50 years, Duke Power and the other water users must adhere closely to the Mutual Gains operating conditions, including implementation of the Low Inflow Protocol.

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5.1 OBJECTIVE

A Geographic Information System (GIS) database was created during this Study to document water withdrawals and returns in the Catawba-Wateree River Basin. This database is a useful tool in reporting and documenting the findings of this Study. Furthermore, this GIS database is available for future use by the Study Team members (and others), and it may be enhanced to support long-term water and wastewater planning for the region. The GIS database is included in electronic format in Appendix M.

5.2 GIS DEVELOPMENT – METHODOLOGY

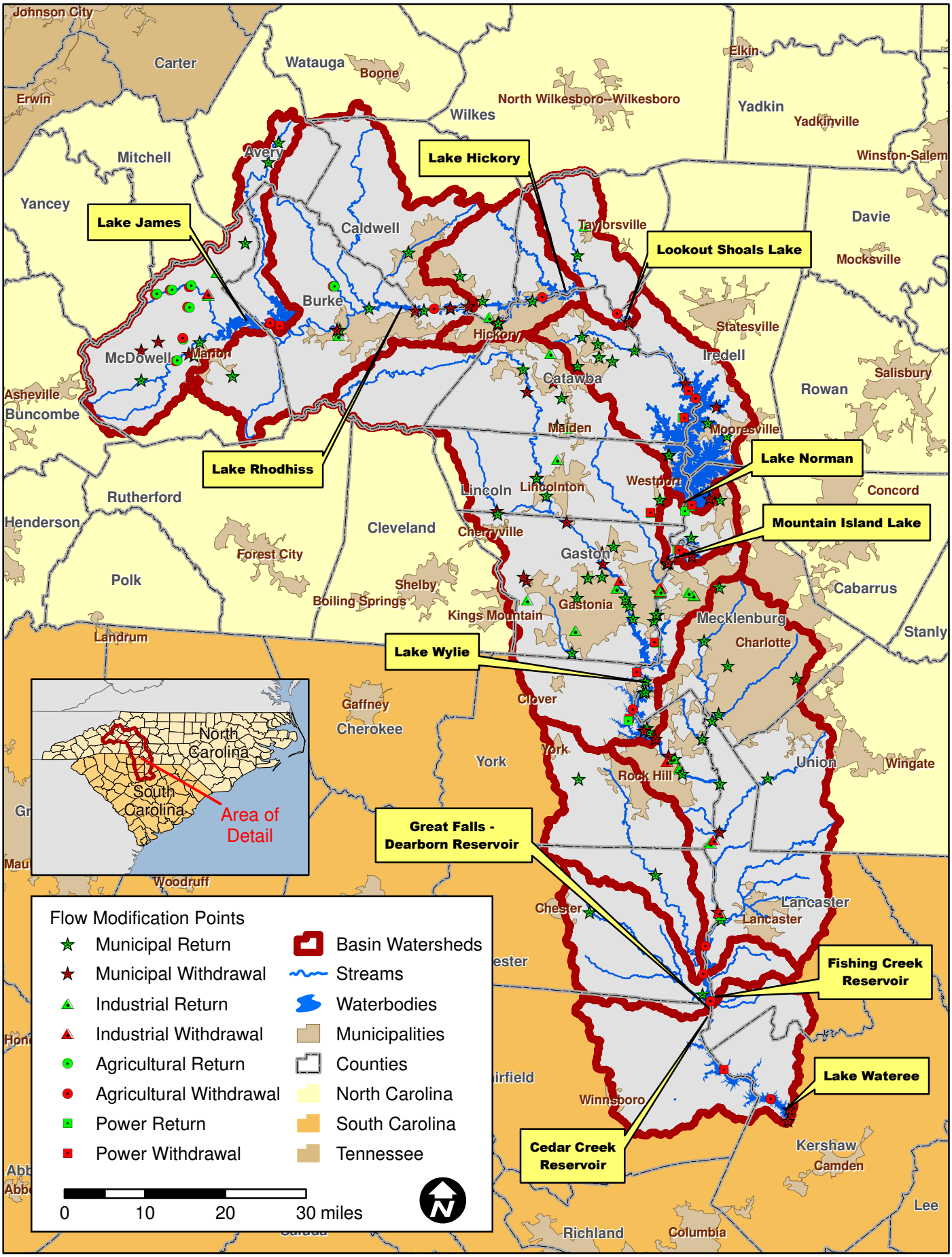
The GIS database consists of a series of layers that show the geographic location of Project features. Each layer in the database includes an attribute table that stores information about the features shown on the map. Using GIS software, these layers are displayed on a computer screen or can be printed in hard copy, and inter-relationships among features can be examined and analyzed. The following layers have been created for this Study:

- ***Flow Modification Points (FMPs) Layer*** – Each defined feature in this layer is a single point that represents a location where water is either withdrawn from or returned to a reservoir or free-flowing water body. Points are defined in the database for those locations where average daily withdrawals or returns are greater than 100,000 gallons per day (gpd), for withdrawals where an assigned value has been made (e.g., an agricultural demand per reservoir), or as a placeholder for known, potential, future withdrawals. This layer is identified in Figure 5.1.
- ***Basin Layer*** – The watershed for each of the 11 Project reservoirs is delineated to help users identify FMP locations and their relationship to the Project reservoirs. This layer is also identified in Figure 5.1.

Additional layers are included in the GIS database to provide background topographical and physical feature information. These layers were not modified as part of this Study, but they are included to provide a visual reference and background data. The background layers include:

- State, county, and municipal boundaries.
- Major roads.
- Catawba-Wateree Project reservoirs.
- Streams and rivers.

These background layers were obtained from GIS data clearinghouses and public domain datasets.



GIS Information

Figure 5-1

5.3 COORDINATE SYSTEM

Most of the flow modification points were located in GIS shapefiles provided by the North Carolina Department of Environment and Natural Resources (NC-DENR) and the South Carolina Department of Natural Resources (SC-DNR). Some of the point locations were later adjusted based on updated information received during the data collection process. The projection of the data provided by NC-DENR was in the North Carolina State Plane coordinate system, with units of meters. The projection of the data provided by SC-DNR was in the Universal Transverse Mercator (UTM) coordinate system, Zone 17, with units of meters. The North Carolina State Plane coordinate system is valid in portions of South Carolina, which include the Catawba-Wateree system. Therefore, the datasets obtained from North and South Carolina were re-projected to the North Carolina State Plane coordinate system with units of feet. All new data for this Study was created in the North Carolina State Plane coordinate system with units of feet.

5.4 GIS DATA DICTIONARY

Each feature in the layer of flow modification points is a single point that represents a location where water is either withdrawn from or returned to a surface water body. For each feature, the attributes listed in Table 5-1 are stored in the database. Additional fields may be added to the FMP layer.

The second layer in the GIS database shows the watersheds for the 11 Project reservoirs. The watersheds have the attributes presented in Table 5-2 assigned to them.

5.5 GIS QUERY TOOL

The GIS database is built using ArcGIS software, manufactured by ESRI, Inc. The database can be viewed by anyone using ESRI ArcGIS software. For those without access to GIS software, an ArcReader Portable Map Format document is provided. This PMF document is easily read using the freely-available ArcReader software. ArcReader allows the user to view the GIS data layers in the PMF document and query the data to show features that meet certain criteria. The user can zoom in or out, pan, and measure distances between features. The program also allows the user to turn different layers on or off, as well as to color-code data features based on values in the database. The user can also print a hard copy map. ArcReader will be distributed with the GIS database for convenience. More information about ArcReader is available at http://www.esri.com/software/arcgis/arcreader/index.html.

Table 5-1. Data Fields for Flow Modification Points

Field Name	Data Type	Description
Project ID	Text	A series of letters and numbers to easily identify the FMPs within the Basin.
County	Text	The county where the point is located.
State	Text	The state where the point is located, either North Carolina or South Carolina.
Watershed	Text	The reservoir watershed where the point is located. This value will be the name designation as defined by the FERC Relicensing Project of one of the 11 reservoirs of the Catawba-Wateree Project.
Type	Text	Described the transaction to the system, either withdrawal or return.
Category	Text	The type of water use. This value will be either agricultural, groundwater remediation (i.e., recharging of aquifers with or discharging aquifer groundwater to Catawba-Wateree waters for remediation purposes), municipal, domestic (i.e. private water supply systems), industrial, or power.
State_ID	Text	Many of the flow modification points were defined in data files provided by state agencies. If available, this field stores the state identification number assigned to the withdrawal or return.
Loc Source	Text	The source of the geographic coordinates for the FMPs.
Entity	Text	The government agency or corporation responsible for the withdrawal or return.
Facility	Text	The name of the facility associated with the withdrawal or return.
Water	Text	The specific stream or reservoir where the point is located; for a return, the receiving stream or reservoir.
Pmt_mgd_03	Number	The current permitted return or withdrawal in million gallons per day (mgd), as defined in data files provided by state agencies, or otherwise determined.
Q_92_mgd	Number	The 1992 average daily flow, in mgd, as determined in the Study.
Q_97_mgd	Number	The 1997 average daily flow in mgd, as determined in the Study.
Q_02_mgd	Number	The 2002 average daily flow, in mgd, as determined in the Study.
Q_03_mgd	Number	The 2003 average daily flow in mgd, as determined in the Study.
Q_08_mgd	Number	The projected 2008 average daily flow in mgd, as projected in the Study.
Q_18_mgd	Number	The projected 2018 average daily flow in mgd, as projected in the Study.
Q_28_mgd	Number	The projected 2028 average daily flow in mgd, as projected in the Study.
Q_38_mgd	Number	The projected 2038 average daily flow in mgd, as projected in the Study.
Q_48_mgd	Number	The projected 2048 average daily flow in mgd, as projected in the Study.
Q_58_mgd	Number	The projected 2058 average daily flow in mgd, as projected in the Study.

Note: All flow values refer to the withdrawal or return, not the flow in the receiving water.

Table 5-2. Data Fields for Reservoir System

Field Name	Data Type	Description
Watershed	Text	This value will be the name designation as defined by the FERC Relicensing Project of one of the 11 reservoirs of the Catawba-Wateree Project.
Qsum_W_03	Number	The sum of the average daily flow of all withdrawals from the reservoir drainage basin in 2003, as determined in the Study.
Qsum_W_08	Number	The sum of the average daily flow of all withdrawals from the reservoir drainage basin in 2008, as projected in the Study.
Qsum_W_18	Number	The sum of the average daily flow of all withdrawals from the reservoir drainage basin in 2018, as projected in the Study.
Qsum_W_28	Number	The sum of the average daily flow of all withdrawals from the reservoir drainage basin in 2028, as projected in the Study.
Qsum_W_38	Number	The sum of the average daily flow of all withdrawals from the reservoir drainage basin in 2038, as projected in the Study.
Qsum_W_48	Number	The sum of the average daily flow of all withdrawals from the reservoir drainage basin in 2048, as projected in the Study.
Qsum_W_58	Number	The sum of the average daily flow of all withdrawals from the reservoir drainage basin in 2058, as projected in the Study.
Qsum_D_03	Number	The sum of the average daily flow of all returns to the reservoir drainage basin in 2003, as determined in the Study.
Qsum_D_08	Number	The sum of the average daily flow of all returns to the reservoir drainage basin in 2008, as projected in the Study.
Qsum_D_18	Number	The sum of the average daily flow of all returns to the reservoir drainage basin in 2018, as projected in the Study.
Qsum_D_28	Number	The sum of the average daily flow of all returns to the reservoir drainage basin in 2028, as projected in the Study.
Qsum_D_38	Number	The sum of the average daily flow of all returns to the reservoir drainage basin in 2038, as projected in the Study.
Qsum_D_48	Number	The sum of the average daily flow of all returns to the reservoir drainage basin in 2048, as projected in the Study.
Qsum_D_58	Number	The sum of the average daily flow of all returns to the reservoir drainage basin in 2058, as projected in the Study.

5.6 GIS – LONG-TERM MAINTENANCE

The Flow Modification Points, locations, and attributes should be updated periodically. It is recommended that this update occur on at least a five-year interval. By updating this data every five years, critical information can be maintained for use in other engineering or environmental studies, for regional water supply planning efforts, and for use during Low Inflow Protocol when the Catawba-Wateree Drought Management Advisory Group (see Section 7.0) is activated. These five-year updates will also parallel Low Inflow Protocol updates and Local Water Supply Plan efforts required by NC-DENR, both of which occur on five-year intervals.

The background GIS data layers should also be updated at this time. To streamline the background data update process as much as possible, it is recommended that national- or regional-scale background layers from public sources be obtained. Specifically, it is recommended that the National Hydrography Dataset available from the US Geological Survey be used as the source for the hydrography layers, and data based on the US Bureau of the Census TIGER datasets, available from ESRI in its widely-distributed Maps and Data product or from its website, be used as the source for major roads and the state, county, and municipal boundaries.

Further updates of the GIS database should be led through the efforts of Duke Power.

6.1 OBJECTIVE

Duke Power created the 11 reservoirs that comprise the Catawba-Wateree Project decades ago to generate affordable electricity to support regional economic growth. In addition to the reliable, economic electricity generated by these reservoirs, they also provide many additional benefits to the communities in the Piedmont region of North and South Carolina. These benefits include municipal and industrial water supplies and storage, drought and high water management, wastewater assimilation, and recreation. Duke primarily uses the Project's 13 hydroelectric stations to produce electricity "on peak" (i.e., during the part of each day when electricity demand is the highest). Due to the small size of the hydroelectric units and their rapid start-up and shutdown capability compared to Duke's coal and nuclear-fueled generating units, Duke also uses the Catawba-Wateree Project hydro stations for "load following" (i.e., adjusting overall electric generation to match the ever-changing electrical load on the Duke system). Currently, the Catawba-Wateree hydro stations collectively produce approximately 1,755,000 megawatt-hours in an average year. This amount is nearly enough electricity to supply all the homes in the cities of Morganton, Hickory, Mt. Holly, Gastonia, Rock Hill, Lancaster, and Camden combined, plus nearly one-fifth of the homes in Charlotte.

Duke and its electric customers absorb the cost of maintaining these reservoirs. Continued regional growth, as well as the operational changes resulting from the ongoing hydro-relicensing process, will increase the demand for the limited water supply and will result in a long-term, gradual reduction in the amount of water available to produce hydroelectricity. This reduction in hydropower, which is Duke's lowest costing, most efficient, most flexible, and cleanest generation source, will result in higher costs for electric customers. Duke will have to burn more fuel at its fossil-fueled stations or purchase higher-cost power elsewhere to make up for the lost hydroelectricity. Duke is concerned about the potential impacts to its electric customers as well as the long-term economic viability of its hydro stations. As a result, Duke used this Water Supply Study as a vehicle to evaluate cost and water management options used by other reservoir owners.

Since the Water Supply Study is directed by a Study Team comprised of industry professionals who represent water users that may be affected by future policy changes, it was determined (by Duke) to be the best venue for completing a survey of other reservoir owners (e.g., other utilities, US Army Corps of Engineers, Tennessee Valley Authority, etc.) to gather information on their water withdrawal permitting practices, drought response measures, and policies for charging water withdrawal fees.

6.2 WATER WITHDRAWAL MANAGEMENT SURVEY

A water withdrawal management survey form (Survey) was developed with input from the Water Supply Study Team. The Survey covered a wide variety of informational topics that are categorized as follows:

- Background Information on the institution or organization completing the Survey.
- Reservoir use permitting.

- Withdrawal fees.
- Drought management.
- Other issues.

A copy of the Survey is included in Appendix K.

6.3 WATER WITHDRAWAL MANAGEMENT SURVEY PARTICIPANTS AND RESULTS

6.3.1 Survey Participants

The following general criteria were used to identify potential survey participants:

- Lake owners within the United States, with a particular focus on the Southeastern United States.
- Large system lake owners and/or those with multiple reservoirs whose purpose is to generate hydroelectricity.

A number of companies were identified to be surveyed, particularly where a key contact individual was known by one of the Water Supply Study Team members. FERC licensees from across the country were also reviewed to identify other potential respondents.

All total, 29 lake owners were identified as potential participants for the Survey. The Survey was distributed electronically and by phone/facsimile. Follow-up telephone calls were made to maximize the sample size. Of the 29 potential participants, a total of 23 participated in the Survey to some level, translating to a response rate of 79 percent. Many of the respondents completed detailed answers and returned the questionnaire for review. Others responded to a phone interview of the questionnaire. Of the 23 respondents, seven organizations did not complete a full Survey since they stated that they had no intake owners on their lakes.

The following organizations identified for the Survey did not have intakes operating on their lakes:

- Portland GE (Oregon)
- Pacific GCE (Idaho, Oregon)
- Consumer's Energy (Michigan)
- Minnesota Power (Minnesota)
- Xcel Energy (Colorado)
- Exelon (Maryland)
- Wisconsin Public Service Co. (Wisconsin)

The following entities surveyed did have intakes operating on their lakes:

- Aluminum Company of America (ALCOA) (North Carolina)
- Appalachian Power Company (Virginia, West Virginia)
- Brazos River Authority (Texas)

- Confidential Utility 1
- Confidential Utility 2
- Dominion Resources (North Carolina, Virginia)
- Fall Line Hydro Company (Georgia)
- Progress Energy (North Carolina)
- Santee Cooper (South Carolina)
- South Carolina Electric and Gas (SCE&G) (South Carolina)
- Tennessee Valley Authority (TVA) (Tennessee)
- United States – Army Corps of Engineers (US-ACE) (National)
- Pacificorp (California)
- Summit Hydropower, Inc. (Connecticut)
- Brascan (New York)
- New York Power Authority (New York)

The results of the Survey are presented in the following sections. It should be noted that most respondents were very thorough in completion of the Surveys.

6.3.2 Reservoir Use Permitting

Several questions were asked regarding reservoir use permitting, including permit approvals required, legal instruments utilized, and length of time for permitting activities. The responses were relatively varied for each of the questions. Table 6-1 below provides a generalized summary of the responses.

Table 6-1. Reservoir Use Permitting – Survey Results

Survey Question	Responses
What organizations require water withdrawal permits for new or expanded withdrawals?	Responses were varied, including FERC, respondent, state regulatory agencies, appropriate environmental assessment organizations, and US-ACE.
Did any of the existing intake owners have intakes on the river at the lake's location before the lake was built?	Responses were mixed, with some reservoirs having intakes prior to inundation and others that did not.
What legal conveyance instrument is used to approve the intakes and what is the term of that instrument?	Conveyance instruments cited: Easements, agreements. Term cited: Expected life of intake, perpetual easements, based on license expiration, 25 years, life of project, (subject to FERC), one year (self-renewable).
Any significant differences in the lake use permitting process for existing intakes that need to expand versus newly proposed intakes?	All respondents noted no significant difference between new and existing intake permitting processes.
Typically, how long does it take to gain approval for intake construction from the point that a formal proposal is made to the lake owner until formal approval is given?	Responses varied from two weeks to five years based on complexity/size of the intake. The likely median value of responses was one to two years.

6.3.3 Withdrawal Fees

Eleven of the 16 lake owners (or 69 percent) who completed the Water Withdrawal Management Survey, and who have intakes on their lakes, assess fees to some or all of the intake owners. Table 6-2 succinctly summarizes the findings of the survey relative to withdrawal fees. Many conclusions can be drawn from this data, including:

- Most respondents consistently apply fees to most or all of the intake owners.
- Lost power generation and/or capacity are the primary basis for determining the fees to be charged for water withdrawal intakes. A couple of respondents incorporate the cost of storage into the fee calculation.
- For many of the lake owners, fees were implemented many years ago.
- The total fees collected for many of the respondents seemed nominal, while a couple of the respondents did list substantial fees collected.
- Slightly more than half of the respondents assess fees during spill events from their reservoirs.
- No organization reported a varying withdrawal fee structure based on reservoir levels.
- Several respondents had litigation history relative to implementing withdrawal fees. Those with litigation history had their decisions upheld with justification being required for the fee structure.
- Most lake owners require the intake owners on their lakes to track and report consumption of water.
- None of the respondents reported using fees for special purposes or noted significant collection issues.
- Only one of the respondents reported a minimum withdrawal rate required for fees to apply.

This information was gathered to benchmark how others in the industry operate and work with intake owners on their lakes. This data was presented and reviewed with the Water Supply Study Team to solicit feedback and create a dialogue for sharing information relative to the potential use and implementation of water withdrawal fees.

6.3.4 Drought Management

Only five of the respondents noted the use of any sort of regional Drought Management Plan or Low Inflow Protocol. There was little consistency among those agencies indicating the use of such a plan, and most provided little detail on how these plans were triggered or what the expected response was from other water users. It can be inferred from the information provided that no respondent was operating with a detailed, regional, cooperative drought response plan during periods of low inflow. One respondent noted that conservation targets are requested from water users based on drought level trigger points determined by the state in which the reservoirs are located. Another respondent noted that raw water purchasers are required to file a drought contingency plan as part of their purchase request, and that this plan may require specific responses during low flow.

Table 6-2. Summary of Survey Responses Relative to Withdrawal Fees

Respondent	Fees Assessed	Basis of Fee	Fee Imple m. Date	Annual Fee Collections	Fees Assessed During Spill Events	Fees Vary with Reservoir Level	Fee Litigation History	Fee Calculation Methodology
ALCOA	Yes, some intake owners	Lost power generation	1940s	<$20,000	Yes	No	None	Dollar value of lost generation due to withdrawn water volume.
AEP/Applachian Power Co.	Yes, all intake owners	Lost power generation, reservoir benefit	1976	<$7,000	Yes	No	None	Dollar value of lost generation due to withdrawn water volume and pumping head benefit.
Brazos River Authority	Yes, all intake owners except those with senior water rights	Reservoir O&M; Take or Pay Contracts	1941	$7.7 million in FY 2004	Yes	No (Quantity diverted may vary)	Yes, need for rate justification	Dollar value to purchase volume of water from impoundment, based on lake O&M cost.
Confidential Utility 1	Yes, for intakes constructed after 1989	Lost power generation, storage	1989	No data given	No	No	Yes, fees upheld for "reasonable compensation"	Dollar value to replace energy lost due to withdrawn water volume, to store actual water withdrawn, and to store permitted water withdrawn.
Confidential Utility 2	Yes, most intake owners	Lost power generation	1980s	$0.02 - $0.15 per 1,000 gallons	No	No	Yes	Dollar value of lost generation due to actual or permitted withdrawn water volume (depending on water user type).
Dominion	Yes	Lost power generation	No data	No data	No data	No data	No data	Dollar value to replace energy generation lost due to withdrawn water volume.
Fall Line Hydro Company	Yes	Lost power generation	1999	$90,000 (one time)	No	No	None	Dollar value of lost generation due to withdrawn water volume.
Progress Energy	Yes, large users	Lost power (coal-fired generation)	1967	$15,000 for 16 mgd	Yes	No	None	Dollar value to replace energy generation capacity with fossil fuel facilities due to withdrawn water volume.
Santee Cooper	Yes	Lost power generation	1947	Agr/Irr: $9,000 to $15,000/year; Public Water Supply: $4.5 million/yr.	Yes	No	None	Dollar value of lost generation due to withdrawn water volume.
SCE&G	Yes	Lost power generation	1979	$12,000	Yes	No	None	Dollar value to replace energy generation capacity by internal combustion (summer)/fossil fuel (winter) due to withdrawn water volume.

Table 6-2. Summary of Survey Responses Relative to Withdrawal Fees

Respondent	Fees Assessed	Basis of Fee	Fee Imple m. Date	Annual Fee Collections	Fees Assessed During Spill Events	Fees Vary with Reservoir Level	Fee Litigation History	Fee Calculation Methodology
TVA	No	N/A	N/A	N/A	N/A	N/A	N/A	N/A
US-ACE	Yes, nearly all intake owners	Lost power generation, storage	1952	$12,000. Lump Sum Payments; $25,000 - $1.5 million	Yes	No	None	Highest dollar value of benefits foregone, revenues foregone, replacement costs, or updated storage costs

General Notes:

1. None of the above listed lake owners have agreements for downstream releases, although one respondent was in negotiation with a downstream user.
2. None of the fees listed above were reported to be used for a special purpose (e.g., water quality studies, water conservation improvements).
3. Reporting requirements are typically based on water metering data from users and reported on a monthly, quarterly, or annual basis.
4. None of the lake owners stated directly that fees were used to encourage conservation, although one entity speculated this may have been an original driver.
5. No lake owner reported any issues with the collection of fees.

6.3.5 Other Issues

In the 'other issues' category, the Water Withdrawal Management Survey queried respondents on a variety of operational issues. Inter-Basin Transfers (IBTs) were one of these issues. Only two of the respondents noted any cap on IBTs, and in both cases the cap was dictated by state regulatory agencies or authorities. None of the respondents noted the use of fees to limit IBTs.

A second question was focused on location and depths of proposed intakes. Most respondents noted that intake location and depth was primarily driven by the proposed water user, with the lake owner and state regulatory agencies having some input into the final location and depth of intakes. The data seemed to suggest that the lake owner's primary involvement was in the determination and communication of potential minimum reservoir levels.

Respondents were also asked what design and operational limits are typically placed on intakes and who determines those limits. The information provided to this question was not easy to evaluate. However, it can be inferred that, other than permitted withdrawal flows and intake velocities, few special operational limits were required. Further, the operational limits were typically determined by state and federal regulatory/resource agencies.

Finally, lake owners were asked if they had a formal or informal process of collaboration on common interests such as aquatic weed management, water quality improvements, water conservation requirements, and long-term supply/demand projections. Three respondents indicated some level of collaborative process. First, the Brazos River Authority (BRA) has a Citizen's Advisory Panel (CAP) that was formed in 2004. This group has 23 voting stakeholders that have varying interests on the lake. They serve either two- or three-year terms, are nominated by citizens, and are approved by BRA. The CAP provides input and recommendations to the BRA Board. Second, SCE&G meets bi-monthly with the Lake Murray Association, the largest and most active lake-wide group in their area. SCE&G also noted that it meets with a variety of homeowner associations and other community organizations to discuss lake-related issues—ranging from aquatic weed management to July 4th fireworks. Finally, TVA noted that, in the past 15 years, it had worked on two different occasions with a cross-section of stakeholders to complete studies relative to lake operation.

6.4 FUTURE POLICY-MAKING CONSIDERATIONS

Duke, and the other stakeholders in the Catawba-Wateree Project, recognize the importance of prudent decision making regarding the evaluation of water withdrawal management practices including the implementation of fees. The results of this Study, along with other stakeholder negotiations related to the relicensing Agreement will determine, in part, how future water withdrawals are managed.

7.1 OBJECTIVE

As part of the relicensing effort, Duke Power has led the development of a Low Inflow Protocol (LIP) for the Catawba-Wateree Project. The purpose of the LIP is to establish procedures for reductions in water use during periods of low inflow to the Catawba-Wateree Project. The LIP was developed on the basis that all parties with interests in water quantity will share the responsibility to establish priorities and to conserve the limited water supply. The Water Supply Study Team members, as well as other stakeholders in the Project, have provided input into the development of the LIP. The LIP will be included as Attachment G to the relicensing Agreement.

7.2 LOW INFLOW PROTOCOL SUMMARY

The LIP provides trigger points and procedures for how the Catawba-Wateree Project will be operated by Duke Power, as well as water withdrawal reduction measures and goals for other water users during periods of low inflow (i.e., periods when there is not enough water flowing into the Project reservoirs to meet the normal water demands while maintaining reservoir levels within normal ranges). During periods of normal inflow, reservoir levels will be maintained within prescribed normal operating ranges. During times that inflow is not adequate to meet all of the normal demands for water and maintain reservoir levels as normally targeted, Duke will progressively reduce hydro generation. If hydrologic conditions worsen until certain trigger points are reached, Duke will declare a Stage 0 – Low Inflow Watch and begin meeting with applicable agencies and water users to discuss and review the LIP. If hydrologic conditions continue to worsen and additional trigger point levels are realized, Duke will declare various stages of a Low Inflow Condition (e.g., Stage 1, Stage 2, Stage 3, and Stage 4). Each progressive stage of the Low Inflow Condition will call for greater reductions in hydro station releases and water withdrawals, and allow additional use of the available water storage inventory.

The goal of the staged LIP is to take the actions needed in the Catawba-Wateree River Basin to delay the point at which the Project's available water storage inventory is fully depleted. While there are no human actions that can guarantee that the Catawba-Wateree Basin will never experience operability limitations at water intake structures due to low reservoir levels or low streamflows, the LIP is intended to provide additional time to allow precipitation to restore streamflow, reservoir levels, and groundwater levels to normal ranges. The amount of additional time that is gained during the LIP depends primarily on the diagnostic accuracy of the trigger points, the amount of regulatory flexibility that Duke has to operate the Project, and the effectiveness of Duke Power and the water users in working together to implement their required actions and achieve significant water use reductions.

In order to ensure continuous improvement of the LIP and its future implementation during low inflow periods, the LIP will be re-evaluated and modified periodically by the Catawba-Wateree Drought Management Advisory Group (CW-DMAG). The CW-DMAG is a group of committed water users and agencies who have a role or vested interested in the implementation response to the LIP.

The LIP trigger points, water reduction measures and goals, and description of the CW-DMAG are outlined in the most recent draft of the LIP included in Appendix L.

The Water Supply Study has been completed in cooperation with a Study Team comprised of industry professionals whose representative organizations are also stakeholders in Duke's Catawba-Wateree Project. These stakeholders have contributed much time, energy, expense, and technical information to help further the results of this Study. The representative organizations listed below have contributed greatly to the success of this Water Supply Study.

1. City of Morganton, NC
2. City of Lenoir, NC
3. Town of Valdese, NC
4. City of Hickory, NC
5. Town of Mooresville, NC
6. City of Gastonia, NC
7. Charlotte-Mecklenburg Utilities, NC
8. Union County/Lancaster County, NC, SC
9. City of Rock Hill, SC
10. City of York, SC
11. York County, SC
12. Chester County Water and Sewer District, SC
13. City of Camden, SC
14. Lugoff-Elgin Water Authority, SC
15. North Carolina Department of Environment and Natural Resources – Division of Water Resources
16. South Carolina – Department of Natural Resources
17. Duke Power

APPENDIX A

STUDY PLAN

Catawba-Wateree Hydro Project (FERC No. 2232)

Study Plan Scope Document

Study Plan Name: Water Supply Study **Study Plan Designation:** Operations 04

Study Short Description: A water supply study that inventories current water demand and projects future water demand, identifies consistent actions needed from water users to support a Low Inflow Protocol (LIP) for the Catawba-Wateree Project (Project) and provides for a review of options of impact fee structures used by other hydro project licensees and the pros and cons of identified fee structures.

Applicable Hydro Projects/Developments: Bridgewater, Rhodhiss, Oxford, Lookout Shoals, Cowans Ford, Mountain Island, Wylie, Fishing Creek, Great Falls/Dearborn, Rocky Creek/Cedar Creek, Wateree

Prerequisite Study Designation: None

The purpose of this document is to describe the study scope, basic methodology and how results will be used. Study Teams and Resource Committees may develop supplemental study methodology details if and when they determine them to be necessary.

I. Study Objective

The objective of this study is to document the current water withdrawals and discharges in those portions of the Catawba-Wateree basin that affect the operation of the Project and estimate future water withdrawals and discharges based on reasonable growth projections. The information concerning projected water withdrawals developed in this study will be used to evaluate proposed changes to hydroelectric operations and in the development of a Low Inflow Protocol (LIP) (Study Plan: Operations 05) that will be the basis for future operation of the Project during periods of low inflow. The study will also consider the impacts of project operations on the safe yield of the Project's reservoirs for public water supply, especially during low inflow periods.

The study will specifically produce the following:

- Water user input into long-term (e.g. 50-year) projections of water withdrawals and discharges on the Project and a comparative tool that can be used to evaluate the impact of project operation changes on the safe yield of the Project's reservoirs.
- Water user input into the method of loading projected withdrawals and returns in Duke Power's reservoir operations model.
- Water user input into development of a set of consistent actions to implement for use in the LIP.
- A review of options for impact fee structures used by other hydro project licensees and a listing of the pros and cons of the identified fee structures.

II. Basis

All entities that have or will locate a water intake on one of the Project's reservoirs or on the main stem of the Catawba or Wateree rivers downstream of a Project reservoir benefit from the storage and regulation provided by the Project. Under the current license conditions and water demands, there are periods when total water demand exceeds total inflow, thus causing reservoir levels to drop. As total water demand continues to grow and new license conditions bring additional demands (e.g. increased minimum flows) and operational changes are implemented (e.g. reservoir drawdown limits, shifting use of hydroelectric generation, etc.), the potential for conflict over water use will increase. A systematic approach (e.g. Low Inflow Protocol) is needed to describe how water users will share the responsibility of managing the

limited water supply in the future, especially during periods when water demands and natural losses force reductions in operating targets. In order to evaluate future operational scenarios and develop a LIP, Duke Power needs realistic projections of water withdrawals and discharges throughout at least the next license period as input into its **CHEOPS™** operations model.

In addition, some relicensing stakeholders have requested a continuation of Duke Power's historical practice of not requiring compensation from water withdrawers for the impacts that their water withdrawals have on Project operations. While it is common practice for owners of FERC-licensed reservoirs to require compensation for non-project water withdrawals (e.g. Lake Gaston in NC, Lake Murray in SC), Duke Power has thus far reserved its right to require compensation, but has not actually begun charging for water withdrawals that use the storage provided by the Project. This study will provide a review of the impacts of non-Project withdrawals and examples of compensation methods used by others and a review of water quantity or quality improvements that could be partially supported with funds from future impact fees. Although Duke Power will retain the final decision on the design and implementation of any future fees relative to water withdrawals, the entire relicensing effort will benefit from this dialogue.

III. Geographic and Temporal Scope

The study will cover water withdrawals and discharges greater than 100,000 gallons per day in those portions of the Catawba-Wateree basin that affect the operation of the Project. Generally, these withdrawals and discharges are directly on the reservoirs and regulated river sections that exist between some of the developments. Withdrawals and discharges on tributaries will be estimated if required for use in the reservoir operations model. In addition, existing and potential future interbasin transfers into and out of the basin will be estimated.

IV. Summary of Existing Data

The following is a list of existing data available that may be useful in the development of this study:

- Reservoir elevation-storage data for all reservoirs
- Detailed information on hydro operation drawdown limits
- Detailed information on reservoir boat access drawdown limits
- List and approximate location of existing water intakes on the Project reservoirs and in the regulated river sections within the Project
- Existing and pending FERC authorizations and Duke-issued conveyances for withdrawals and discharges
- Partial information on current average withdrawal rates and pumping capacity limits
- Partial information on critical level for intakes
- Inflow dataset from Operations 01 study
- Detailed information on total projected water demands and discharges in the basin contained in a draft Environmental Assessment of Charlotte-Mecklenburg Utilities' request for expansion of their Mountain Island intake (data was based only on published data/literature for all but CMUD data)
- Local Water Supply Plans of North Carolina Communities (updated every five years)
- Withdrawals in SC registered in compliance with the SC Surface Water Withdrawal and Reporting Act
- Interbasin Transfers in SC permitted through the SC Interbasin Transfer Act
- South Carolina Water Plan (1998 or latest)

V. Methodology

The study will require that the Water Supply Study Team lead the selection of an independent consultant with experience in basin-wide water supply planning to conduct the detailed water withdrawal and discharge research and prepare the existing and future water withdrawal estimates. The data developed on existing and future water withdrawal estimates will be used in Duke Power's reservoir operations model (CHEOPS™) to estimate the impact of existing and future water withdrawals on reservoir operations and the impacts of reservoir operations on water withdrawals under various stakeholder derived scenarios. The consultant will also conduct a water supply safe yield analysis of the reservoirs so that impacts of future operating scenarios on water supplies can be evaluated.

The study will be divided into two phases as follows:

Phase I:
Phase I of the study will rely upon currently available data and will provide an initial understanding of the magnitude of current and future water demands that affect Project operations. Tasks in Phase I are:

- Compilation of current permitted withdrawals and discharges greater than 100,000 gallons per day, including interbasin transfers.
- Clarification and reconciliation of the information presented in the Local Water Supply Plans of North Carolina communities and in the Water Plan of South Carolina.
- Development of a basin-wide database, utilizing Geographic Information System (GIS) technology, based on state government standards as appropriate, that links water withdrawals and associated water return (effluent discharge) locations and volumes.
- Examination of the impacts of the 1998-2002 drought on groundwater recharge and evapotranspiration for future scenario modeling purposes.
- Development of a set of 50-year future water demand projections using a methodology that is recommended by the consultant and adopted by the Water Supply Study Team. The projections should include estimates based on expected growth in the basin, with sensitivities provided for low growth and high growth. Estimates of future interbasin transfers need to be included also. In addition, the Project safe yield will be developed in order to determine the impact on water supplies under various proposed operating conditions.

Phase II:
Phase II of the study will build support for a long-term, basin-wide water supply planning and drought management structure and will gather information regarding impact fees for water withdrawals, including the pros and cons of options identified. Tasks in Phase II are:

- Evaluate options for the long-term maintenance of the database developed in Phase I, including what entity should maintain it once relicensing is over.
- Recommend a consistent drought contingency plan policy that all water users can utilize along with Duke Power to responsibly manage the limited water supply during low inflow periods. The plan will recommend the trigger levels for water withdrawers to start implementing their individual conservation programs as appropriate. The plan will consider the needs of relicensing stakeholders that do not withdraw water.
- Identify impact fee structures used by other hydro project licensees and list the pros and cons of the identified fee structures. Provide estimates of the potential magnitude of contributions from each option.
- Identify opportunities for improved water quantity and/or quality management that could be at least partially supported with funds from future impact fees.

VI. Schedules and Required Conditions

The Phase I results need to be completed in time to input the information into Duke Power's reservoir operations model that will be used to evaluate stakeholder-derived scenarios. Assuming the scenarios will be developed during the first half of 2005, the following is the schedule for this study:

Task:	**Completion**
Phase I:	
Study Team approval of Consultant methodology for long-term water demand projections and safe yield analysis	February 27, 2004
Review of water withdrawal and discharge information	April 30, 2004
Review and analysis of C-W groundwater recharge and/or evapotranspiration loss during drought periods (1998-2002) suitable for reservoir model input	May 31, 2004
Water withdrawal database and development and safe yield analysis	July 30, 2004
Long-term water demand Projections, groundwater recharge, and safe yield analysis draft Phase I Report	August 31, 2004
Study Team Phase I draft report review	September 30, 2004
Incorporate Study Team comments	October 7, 2004
Resource Committee review of draft Phase I report	October 29, 2004
Incorporate Resource Committee comments	November 8, 2004
Advisory Groups and State Relicensing Teams Phase I Draft report review	December 31, 2004
Final Phase I Report	January 31, 2005
Phase II:	
Database management and drought contingency plan recommendation interim report	January 31, 2005
Study Team draft interim report review	February 28, 2005
Incorporate Study Team comments	March 7, 2005
Resource Committee draft interim report review	March 31, 2005
Incorporate Resource Committee comments	April 7, 2005
Advisory Groups and State Relicensing Teams	

draft interim report review	May 31, 2005
Summary of impact fee structures used by other lake owners (including pros and cons) and summary of opportunities for improved water quantity and/or water quality management that could be partially supported with funds from future impact fees	May 31, 2005
Study Team Phase II draft report review	June 30, 2005
Incorporate Study Team comments	July 7, 2005
Resource Committee Phase II Review	July 29, 2005
Incorporate Resource Committee comments	August 8, 2005
Advisory Groups and State Relicensing Teams Phase II draft report review	September 30, 2005
Final Phase II Report	October 31, 2005

VII. Use of Study Results

The data developed during Phase I of the study will be used in the reservoir operations model to estimate the impact of existing and future water withdrawals and discharges on reservoir operations under various stakeholder-derived scenarios. Future operating scenarios will also be evaluated for impacts on the Project safe yield. In addition, the data from Phase I will be used in the development of the LIP that will be followed by stakeholders during periods of low inflow to the Project.

The options and recommendations concerning drought contingency plans developed during Phase II of the study will be used by the water users during periods in which the LIP is invoked. In addition, the information and options identified concerning impact fees will be useful in discussions at the meetings of the six relicensing stakeholder teams.

VIII. Study Participants

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	Name	Organization	Phone #	E-Mail
		Water Plant		
	Michael Hancock	Lugoff-Elgin Water Authority	803-438-2991	lugoffh20@aol.com
	Mike Medlin	Chester County Water and Sewer	803-385-5123	mmedlin@infoave.net
	David Harmon	York County	803-628-3200	david.harmon@yorkcountygov.com
	Charles Helms	City of York	803-684-7172	chelms@yorkcitysc.com
	David Cook	City of Valdese	828-879-2127	dcook@ci.valdese.nc.us
	Mack Edmisten	City of Lenoir	828-757-2160	mackedmisten@hotmail.com
	Tom Couch	City of Camden	803-425-7693	tcouch@camdensc.org
	Wilce Martin	City of Mooresville	704-663-3800	wmartin@ci.mooresville.nc.us

IX. List of Attachments

N/A

X. List of References

N/A

APPENDIX B

DATA REQUEST LETTER AND INFORMATION QUESTIONNAIRE

Date

Name
Title
Entity
Address
City, State Zip

Re: Catawba-Wateree Water Supply Study
Information Request
HDR Project 11237-2287

Dear Name:

As you may be aware, Duke Power has authorized a water supply study (Study) as part of its Catawba-Wateree hydroelectric relicensing process. This Study includes a basin-wide analysis of potential future water withdrawals and discharges, safe-yield analysis, and long-term water supply considerations. This Study will include water demand projections and other relevant data, which will assist in future planning of the Catawba-Wateree system over the next 50 years.

HDR Engineering, Inc. of the Carolinas (HDR) is performing this Study in cooperation with representatives from the following Study Advisory Team:

- Duke Power
- NCDENR Division of Water Resources
- SC Department of Natural Resources
- City of Camden
- Charlotte-Mecklenburg Utilities
- Chester County Water and Sewer
- City of Gastonia
- City of Hickory
- Lancaster County Water and Sewer Authority
- City of Lenoir
- Lugoff-Elgin Water Authority
- City of Morganton
- City of Rock Hill
- Town of Valdese
- City of York
- York County

In order to perform a thorough analysis of the water supply needs within the Catawba-Wateree system, we are requesting your assistance in gathering pertinent data for assessing water demands and water discharges. Please send us a contact person with whom we can work to gather this data, including a phone number and email address. The contact information may be emailed to Jennifer Chambers-Heard at jennifer.chambers-heard@hdrinc.com.

The following is a list of the data that we are requesting. We are aware that gathering this data will take some time and we appreciate your efforts to begin assembling the data as soon as possible.

- 2002 Local Water Supply Plan submittal to NCDENR Division of Water Resources (for NC systems).
- Water System Business Plan, if applicable (for SC systems)
- 1992, 1997, 2002 average water demands by month (for SC systems)
- 2003 average water demands by month, and the location of where this flow is metered.

HDR Engineering, Inc. of the Carolinas

128 S Tryon Street
Suite 1400
Charlotte, NC 28202-5004

Phone: (704) 338-6700
Fax: (704) 338-6760
www.hdrinc.com

- Average wastewater flows by month for all NPDES permitted facilities in years 1992, 1997, 2002, and 2003.
- 2003 water billing records for monthly consumption by customer class (residential, commercial, institutional, industrial, etc) or by customer's standard industrial code.
- Breakdown of large industrial users (greater than 50,000 gallons per day) by the user's standard industrial code or class (i.e., furniture, textile, chemical, etc).
- Inter-basin transfer permits if applicable; and/or future consideration of inter-basin transfer.
- A copy of your drought management plan or drought response plan.
- A copy of any recent (last 10 years) water or wastewater master planning studies.

As mentioned earlier, one of the objectives of the Study is to document water demands that may impact the operation of the Catawba-Wateree System during the next 50 years. Once we have reviewed the data provided by you and projected the water demands and discharges for the system, we intend to arrange a meeting in which we would like to review the projections with interested parties.

We appreciate your cooperation in this important Study. If you have any questions, please contact me at 704-338-6802.

Best regards,

HDR Engineering, Inc. of the Carolinas

Kevin Mosteller, PE, VP
Project Manager

LKM/jch

Water Supply Study
Catawba – Wateree Hydroelectric Relicensing Project

Withdrawal/Discharge Questionnaire

Source Water/Intake

1. Do you purchase finished water from another utility or do you operate your own intake?
   a. If you purchase finished water, from which utilities do you purchase? Where are the connection point(s) within the system? What is your contract amount?
2. If you operate your own intake(s), what is the location of the intake(s)?
   a. What are the coordinates of the intake?
   b. At what elevation(s) can/do you withdraw water?
   c. At what lake/river elevation do you start to experience problems in your raw water system (e.g. pump cavitation)?
3. Do you have any plans for intake modifications or considerations for the addition of a new intake?

Withdrawal/Discharge Information

1. Review information submitted in the 2002 Local Water Supply Plans (LWSPs) (for NC Systems).
   a. Water demands.
   b. Water discharges.
   c. NPDES permitted facility locations.
   d. Other systems to which water is sold.
   e. If applicable, complete missing information from LWSPs.
   f. How were the water demand projections presented in the 2002 LWSP calculated?
2. Collect and review monthly water withdrawal (flow) records for 1992, 1997, 2002 (for SC Systems).
3. Where is the withdrawal and/or discharge flows metered?
4. Collect and review 2003 average water demands per month.
5. Collect and review industries (within your system) with an average day demand greater than 50,000 gpd.
6. Collect and review wastewater flow discharge records for 1992, 1997, 2002, and 2003.
7. Collect and review information on the current total population served, and customer classifications for water supply (e.g. residential, commercial, industrial); or by SIC code. To the extent possible, collect this information for the historical data as well.

Service Areas

1. What is the extent of your potable water service area?
    a. Is this information available on GIS or AutoCAD?
    b. What master planning information is available on potential service area expansion?
2. What is the extent of your wastewater collection system service area?
    a. Is this information available on GIS or AutoCAD?
    b. What master planning information is available on potential service area expansion?

1998-2002 Drought

1. How would you generally categorize the impact of the 1998-2002 Drought on your water supply availability?
2. Did you purchase water from another system because of the drought?
    a. If so, how much and for how long?
3. Did you implement voluntary or mandatory water restrictions?
    a. If so, for how long?
4. Do you have a water conservation plan, drought management plan or similar document?
    a. If so, please copy and/or summarize.

Inter-Basin Transfer

1. Do you have a grandfathered inter-basin transfer?
    a. If so, how much?
2. Do you currently have an inter-basin transfer permit?
    a. If so, please summarize.
3. Do you have plans to apply for an inter-basin transfer permit in the future?
4. To the extent that you can forecast water demand over the next 50 years, what inter-basin transfer could you envision (into or out of) relative to your potential service area?

APPENDIX C

WITHDRAWAL AND RETURN SUMMARY SHEETS

Catawba-Wateree River Basin Withdrawals - Summary Sheet (in mgd)

App D Page Ref	Proj ID	Entity	Facility	Source Water	1992	1997	1999	2002	2003	Current	2008	2018	2028	2038	2048	2058
LAKE JAMES																
		Industrial														
58	NWJ-1	Coats American	Sevier Finishing Plant	North Fork Catawba River	NA	NA	1.0	NA	NA	1.0	1.2	1.4	1.7	2.0	2.3	2.7
		Public Water Supply (PWS)														
140	NWJ-2	City of Marion	Marion WTP	Buck Creek	1.7	1.9	NA	1.5	NA	1.5	1.9	2.2	2.5	2.9	3.3	3.8
140	NWJ-3	City of Marion	Marion WTP (see above for proj.)	Clear Creek	-	-	-	-	-	-	-	-	-	-	-	-
140	NWJ-4	City of Marion	Marion WTP (see above for proj.)	Mackey Creek	-	-	-	-	-	-	-	-	-	-	-	-
		Power														
	NWJ-5	Duke Energy Corporation	Future - New	Lake James	NA	NA	NA	NA	NA	-	0.0	0.0	0.0	0.0	15.3	15.3
		Agricultural/Irrigation														
14	NWJ-6	Buck Creek Trout Farm	Buck Creek Trout Farm	Buck Creek	NA	NA	1.3	NA	NA	1.3	1.3	1.3	1.3	1.3	1.3	1.3
90	NWJ-7	Harris Creek Trout Farm	Harris Creek Trout Farm	Harris Creek	NA	NA	0.9	NA	NA	0.9	0.9	0.9	0.9	0.9	0.9	0.9
164	NWJ-8	NC Wildlife Resources Commission	Armstrong State Fish Hatchery - Upper	Armstrong Creek	NA	NA	0.8	NA	NA	0.8	0.8	0.8	0.8	0.8	0.8	0.8
165	NWJ-9	NC Wildlife Resources Commission	Armstrong State Fish Hatchery - Lower	Armstrong Creek	NA	NA	3.3	NA	NA	3.3	3.3	3.3	3.3	3.3	3.3	3.3
166	NWJ-10	NC Wildlife Resources Commission	Armstrong State Fish Hatchery	Bee Rock Creek	NA	NA	0.5	NA	NA	0.5	0.5	0.5	0.5	0.5	0.5	0.5
167	NWJ-11	NC Wildlife Resources Commission	Marion State Fish Hatchery	Catawba River	NA	NA	0.3	NA	NA	0.3	0.3	0.3	0.3	0.3	0.3	0.3
	NWJ-12	Basin Agricultural/Irrigation Demand	Varies	Varies	NA	NA	NA	1.7	NA	1.7	1.8	2.2	2.6	3.1	3.9	4.9
				LAKE JAMES SUB-BASIN TOTAL FLOW	**1.7**	**1.9**	**8.0**	**3.2**	**0.0**	**11.3**	**11.9**	**12.7**	**13.7**	**14.9**	**31.8**	**33.7**
LAKE RHODHISS																
		PWS														
84	NWR-1	Town of Granite Falls	Granite Falls WTP	Lake Rhodhiss	1.0	1.1	NA	1.3	NA	1.3	1.5	1.7	1.9	2.2	2.5	2.9
113	NWR-2	City of Lenoir	Lenoir WTP	Lake Rhodhiss	4.9	6.3	NA	6.5	NA	6.5	6.7	7.2	7.7	8.2	8.8	9.4
153	NWR-3	City of Morganton	Catawba River WTP	Catawba River	11.2	12.0	NA	8.3	7.6	7.6	8.9	9.8	10.9	12.1	13.4	14.9
211	NWR-4	Town of Valdese	Valdese WTP	Lake Rhodhiss	4.9	6.0	NA	6.0	NA	6.0	6.2	6.6	7.0	7.4	7.8	8.3
		Agricultural/Irrigation														
168	NWR-5	NC Wildlife Resources Commission	Table Rock State Fish Hatchery	Irish Creek	NA	NA	0.9	NA	NA	0.9	0.9	0.9	0.9	0.9	0.9	0.9
	NWR-6	Basin Agricultural/Irrigation Demand	Varies	Varies	NA	NA	NA	3.6	NA	3.6	3.8	4.2	4.7	5.3	6.1	7.0
				LAKE RHODHISS SUB-BASIN TOTAL FLOW	**22.0**	**25.4**	**0.9**	**25.7**	**7.6**	**25.9**	**28.0**	**30.4**	**33.1**	**36.1**	**39.6**	**43.5**
LAKE HICKORY																
		PWS														
95	NWH-1	City of Hickory	Hickory WTP	Lake Hickory	10.2	10.8	NA	12.6	15.9	15.9	14.3	17.4	21.1	25.7	31.3	38.1
130	NWH-2	Town of Longview	Longview WTP	Lake Hickory	1.3	1.6	NA	1.0	NA	1.0	1.5	1.7	2.0	2.4	2.8	3.3
		Agricultural/Irrigation														
	NWH-3	Basin Agricultural/Irrigation Demand	Varies	Varies	NA	NA	NA	1.2	NA	1.2	1.3	1.5	1.8	2.1	2.5	2.9
				LAKE HICKORY SUB-BASIN TOTAL FLOW	**11.5**	**12.4**	**0.0**	**14.8**	**15.9**	**18.1**	**17.0**	**20.6**	**25.0**	**30.2**	**36.6**	**44.3**
LOOKOUT SHOALS LAKE																
		PWS														
201	NWL-1	City of Statesville	Statesville WTP	Lookout Shoals Lake	0.0	0.0	0.0	0.0	0.0	0.0	4.5	5.5	6.6	8.0	9.0	9.0
		Agricultural/Irrigation														
	NWL-2	Basin Agricultural/Irrigation Demand	Varies	Varies	NA	NA	NA	1.2	NA	1.2	1.3	1.6	1.9	2.2	2.7	3.2
				LOOKOUT SHOALS LAKE SUB-BASIN TOTAL FLOW	**0.0**	**0.0**	**0.0**	**1.2**	**0.0**	**1.2**	**5.8**	**7.1**	**8.5**	**10.2**	**11.7**	**12.2**
LAKE NORMAN																
		Industrial														
	Closed	Burlington Industries	Mooresville Plant	Lake Norman	NA	1.8	NA	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Catawba-Wateree River Basin Withdrawals - Summary Sheet (in mgd)

App D Page Ref	Proj ID	Entity	Facility	Source Water	1992	1997	1999	2002	2003	Current	2008	2018	2028	2038	2048	2058
		PWS														
49	NWN-1	Charlotte-Mecklenburg	North Mecklenburg WTP	Lake Norman	NA	NA	NA	16.7	14.7	14.7	18.0	29.6	37.6	41.4	46.9	48.2
119	NWN-2	Lincoln County	Lincoln County WTP	Lake Norman	1.0	2.3	NA	2.1	NA	2.1	2.3	2.9	3.7	4.7	6.1	7.7
149	NWN-3	Town of Mooresville	Mooresville WTP	Lake Norman	1.9	2.3	2.8	3.6	3.9	3.9	6.6	11.9	17.6	22.5	26.1	28.8
216	NWN-4	Concord/Kannapolis/Cabarrus Co.	Future - New-IBT	Lake Norman	NA	NA	NA	NA	NA	0.0	0.0	5.0	10.0	15.0	23.0	27.3
		Power														
	NWN-5	Duke Energy Corporation	Marshall Steam Station	Lake Norman	0.0	0.0	NA	0.0	13.1	13.1	13.1	13.1	13.1	13.1	13.1	13.1
	NWN-6	Duke Energy Corporation	McGuire Nuclear Station	Lake Norman	0.0	0.0	NA	0.0	23.3	23.3	23.3	23.3	23.3	23.3	23.3	23.3
	NWN-7	Duke Energy Corporation	Future - New	Lake Norman	NA	NA	NA	NA	NA	0.0	0.0	9.6	9.6	9.6	26.1	26.1
		Agricultural/Irrigation														
	NWN-8	Basin Agricultural/Irrigation Demand	Varies	Varies	NA	NA	NA	2.8	NA	2.8	2.9	3.2	3.5	3.8	4.2	4.6
				LAKE NORMAN SUB-BASIN TOTAL FLOW	**2.9**	**6.4**	**2.8**	**25.2**	**55.0**	**59.9**	**66.2**	**98.5**	**118.3**	**133.4**	**168.8**	**179.2**
MOUNTAIN ISLAND LAKE																
		PWS														
49	NWM-1	Charlotte-Mecklenburg	Franklin and Vest WTP	Mountain Island Lake	71.2	95.5	NA	93.5	83.4	83.4	110.0	125.0	140.0	155.0	165.0	175.0
76	NWM-2	City of Gastonia	Gastonia WTP	Mountain Island Lake	16.0	15.9	NA	12.8	12.4	12.4	15.4	22.2	25.7	29.8	34.6	40.2
158	NWM-3	City of Mount Holly	Mount Holly WTP	Mountain Island Lake	1.9	2.0	NA	1.9	NA	1.9	2.2	2.6	3.0	3.4	4.0	4.7
		Power														
	NWM-4	Duke Energy Corporation	Riverbend Steam Station	Mountain Island Lake	NA	NA	NA	NA	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
		Agricultural/Irrigation														
	NWM-5	Basin Agricultural/Irrigation Demand	Varies	Varies	NA	NA	NA	0.8	NA	0.8	0.8	0.9	0.9	1.0	1.0	1.1
				MOUNTAIN ISLAND LAKE SUB-BASIN TOTAL FLOW	**89.1**	**113.4**	**0.0**	**109.1**	**98.3**	**101.0**	**130.9**	**153.1**	**172.1**	**191.8**	**207.2**	**223.5**
LAKE WYLIE																
		Industrial														
60	NWY-1	Confidential Industry	Confidential Industry	Lake Wylie	NA	NA	1.8	NA	NA	1.8	1.8	1.8	1.8	1.8	1.8	1.8
45	NWY-2	Clariant Corporation	Mt. Holly Plant	Lake Wylie	NA	NA	1.0	NA	0.3	0.3	0.3	0.5	0.8	1.2	1.8	2.8
65	NWY-3	Cramer Mountain Finishing LLC	Cramer Mountain Finishing	South Fork Catawba River	NA	NA	1.2	NA	NA	1.2	1.4	1.7	2.0	2.3	2.7	3.2
93	NWY-4	Hedrich Industries	Lake Norman Quarry	Forney Creek	NA	NA	0.6	NA	NA	0.6	0.7	0.8	1.0	1.1	1.4	1.6
192	NWY-5	Siemens Westinghouse	Siemens Westinghouse	Lake Wylie	NA	NA	10.8	NA	NA	10.8	10.8	10.8	10.8	10.8	10.8	10.8
		PWS														
4	NWY-6	City of Belmont	Belmont WTP	Lake Wylie	4.6	4.4	NA	2.5	NA	2.5	3.3	3.8	4.3	5.0	5.7	6.6
7	NWY-7	Bessemer City	J.V. Tarpley WTP	Long Creek	2.2	1.3	NA	0.9	NA	0.9	1.5	1.8	2.2	2.6	3.2	3.8
7	NWY-8	Bessemer City	J.V. Tarpley WTP (see above for proj.)	Arrowood	-	-	-	-	-		-	-	-	-	-	-
31	NWY-9	City of Cherryville	Cherryville WTP	Indian Creek	1.7	1.6	NA	0.8	NA	0.8	0.9	1.0	1.2	1.3	1.5	1.6
69	NWY-10	Town of Dallas	Dallas WTP	South Fork Catawba River	0.5	0.5	NA	NA	NA	0.5	0.6	0.6	0.6	0.6	0.6	0.6
103	NWY-11	Town of High Shoals	High Shoals WTP	South Fork Catawba River	0.1	0.1	NA	NA	NA	0.1	0.1	0.1	0.1	0.1	0.1	0.1
124	NWY-12	City of Lincolnton	Lincolnton WTP	South Fork Catawba River	4.7	4.2	NA	NA	NA	4.2	4.9	5.7	6.7	7.8	9.1	10.7
179	NWY-13	City of Newton	Newton WTP	Jacobs Fork	3.6	2.2	NA	2.2	NA	2.2	2.8	3.2	3.7	4.3	5.0	5.7
179	NWY-14	City of Newton	Newton WTP (see above for proj.)	City Lake	NA	2.2	NA	2.5	NA	2.5	-	-	-	-	-	-
198	NWY-15	Town of Stanley	Stanley WTP	Hoyle Creek	0.6	0.7	NA	0.6	NA	0.6	0.6	0.6	0.6	0.6	0.6	0.6
		Power														
	NWY-16	Duke Energy Corporation	Allen Steam Plant	Lake Wylie	NA	NA	NA	NA	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
	NWY-17	Duke Energy Corporation	Lincoln Combustion Turbine Facility	Killian Creek	NA	NA	NA	NA	NA	0.0	NA	NA	NA	NA	NA	NA
		PWS														

Catawba-Wateree River Basin Withdrawals - Summary Sheet (in mgd)

App D Page Ref	Proj ID	Entity	Facility	Source Water	1992	1997	1999	2002	2003	Current	2008	2018	2028	2038	2048	2058
186	SWY-1	Rock Hill	City of Rock Hill WTP	Lake Wylie	NA	11.7	NA	13.6	12.9	12.9	14.3	17.4	21.2	25.8	31.5	38.4
22	SWY-2	NOT USED	-	-	-	-	-	-	-	-	-	-	-	-	-	-
		Power														
	SWY-3	Duke Energy Corporation	Catatwba Nuclear Station	Lake Wylie	NA	NA	NA	NA	35.8	35.8	35.8	35.8	35.8	35.8	35.8	35.8
	SWY-4	Duke Energy Corporation	Future - New	Lake Wylie	NA	NA	NA	NA	NA	-	0.0	0.0	11.1	11.1	11.1	11.1
		Agricultural/Irrigation														
	SWY-5	Basin Agricultural/Irrigation Demand	Varies	Varies	NA	NA	NA	8.5	NA	8.5	8.8	9.6	10.4	11.4	12.6	14.0
				LAKE WYLIE SUB-BASIN TOTAL FLOW	**17.8**	**28.8**	**15.4**	**31.6**	**55.1**	**92.3**	**94.7**	**101.3**	**120.3**	**129.8**	**141.3**	**155.4**
FISHING CREEK RESERVOIR																
		Industrial														
28	SWF-1	Celanese Acetate	Celriver Plant	Catawba River	53.0	44.2	45.3	36.1	39.5	39.5	60.0	60.0	60.0	60.0	60.0	60.0
11	SWF-2	Bowater	Pulp and Paper Mill	Catawba River	38.0	36.5	32.5	25.3	29.9	29.9	30.0	31.5	33.1	34.8	36.6	38.5
195	SWF-3	Springs Industrial	Grace Complex	Catawba River	10.6	NA	NA	10.6	9.1	9.1	10.9	11.5	12.0	12.7	13.3	14.0
175	SWF-4	Nation Ford Chemical	Manufacturing Plant	Catawba River	0.9	NA	NA	1.1	1.0	1.0	1.2	1.6	2.2	2.9	4.0	5.3
		PWS														
187	SWF-5	Rock Hill (Emergency/Backup)		Catawba River	6.3	NA	NA	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
106	SWF-6	Union County/Lancaster County	Catawba River Plant	Catawba River	NA	NA	NA	12.5	11.9	11.9	17.4	25.8	32.0	37.5	41.7	46.4
33	SWF-7	Chester Metro	Chester WTP	Fishing Creek Reservoir	2.6	3.6	3.7	3.5	3.1	3.1	4.0	7.0	10.2	13.8	17.2	19.9
		Agricultural/Irrigation														
	SWF-8	Basin Agricultural/irrigation Demand	Varies	Varies	NA	NA	NA	8.2	NA	8.2	8.4	8.8	9.3	9.8	10.3	10.9
				FISHING CREEK RESREVOIR SUB-BASIN TOTAL FLOW	**111.4**	**84.2**	**81.5**	**97.2**	**94.5**	**102.7**	**131.9**	**146.2**	**158.9**	**171.5**	**183.1**	**195.0**
GREAT FALLS - DEARBORN RESERVOIR																
		Agricultural/Irrigation														
	SWG-1	Basin Agricultural/irrigation Demand	Varies	Varies	NA	NA	NA	1.4	NA	1.4	1.5	1.6	1.7	1.9	2.1	2.3
				GREAT FALLS-DEARBORN RESERVOIR SUB-BASIN TOTAL FLOW	**0.0**	**0.0**	**0.0**	**1.4**	**0.0**	**1.4**	**1.5**	**1.6**	**1.7**	**1.9**	**2.1**	**2.3**
CEDAR CREEK RESERVOIR																
		Agricultural/Irrigation														
	SWC-1	Basin Agricultural/irrigation Demand	Varies	Varies	NA	NA	NA	0.6	NA	0.6	0.6	0.7	0.7	0.8	0.8	0.9
				CEDAR CREEK RESERVOIR SUB-BASIN TOTAL FLOW	**0.0**	**0.0**	**0.0**	**0.6**	**0.0**	**0.6**	**0.6**	**0.7**	**0.7**	**0.8**	**0.8**	**0.9**
LAKE WATEREE																
		PWS														
16	SWW-1	Camden	City of Camden WTP	Lake Wateree	2.2	2.5	2.9	2.8	2.5	2.5	2.7	3.2	3.7	4.2	4.9	5.7
134	SWW-2	Lugoff Elgin Water Authority	Lugoff-Elgin WTP	Lake Wateree	0.7	2.0	NA	2.3	2.0	2.0	3.6	4.8	6.0	6.8	7.8	8.7
		Power														
	SWW-3	Duke Energy Corporation	Future - New	Lake Wateree	NA	NA	NA	NA	NA	0.0	0.0	0.0	0.0	13.1	13.1	39.7
		Agricultural/Irrigation														
	SWW-4	Basin Agricultural/irrigation Demand	Varies	Varies	NA	NA	NA	1.2	NA	1.2	1.2	1.3	1.4	1.5	1.6	1.7
				LAKE WATEREE SUB-BASIN TOTAL FLOW	**2.9**	**4.5**	**2.9**	**6.3**	**4.5**	**5.7**	**7.5**	**9.3**	**11.0**	**25.7**	**27.4**	**55.8**

NOTE: Duke Power Withdrawals are actually net consumptive use or "outflows" from the system. No return projections are given for these facilities since the values reported here are for net outflow.

Catawba-Wateree River Basin Returns - Summary Sheet (in mgd)

App D Page Ref	Proj ID	Entity	Facility	Receiving Water	1992	1997	1999	2002	2003	Current	2008	2018	2028	2038	2048	2058
LAKE JAMES																
		Industrial														
2	NDJ-1	Baxter Healthcare Corporation	Baxter Healthcare Corporation	North Fork Catawba River	NA	0.8	NA	0.9	1.0	1.0	1.1	1.4	1.7	2.0	2.3	2.6
59	NDJ-2	Coats American Inc.	Sevier Finishing Plant	North Fork Catawba River	NA	1.2	0.9	0.6	0.7	0.7	1.1	1.2	1.5	1.7	2.0	2.4
		Public Wastewater Systems (PWS)														
142	NDJ-3	City of Marion	Marion WTP	Nicks Creek	NA	0.2	NA	NA	NA	0.0	0.2	0.2	0.3	0.3	0.4	0.4
143	NDJ-4	City of Marion	Catawba WWTP	Catawba River	NA	0.1	NA	NA	NA	0.0	0.1	0.1	0.1	0.1	0.1	0.2
182	NDJ-5	Town of Old Fort	Old Fort WWTP	Curtis Creek	NA	0.6	NA	0.4	0.4	0.4	0.4	0.5	0.6	0.7	0.9	1.1
		PWS - Domestic														
9	NDJ-6	Blue Ridge C.C. Development LLC	Blue Ridge C.C. Development LLC	North Fork Catawba River	NA	NA	NA	NA	NA	0.0	0.2	0.2	0.2	0.2	0.2	0.2
128	NDJ-7	Linville Harbor Pr. Owners Assoc.	Linville Harbor Pr. Owners Assoc.	Linville River	NA	0.1	NA	0.1	NA	0.1	0.1	0.2	0.2	0.2	0.2	0.3
129	NDJ-8	Linville Resorts, Inc	Linville Resorts Incorporated	Linville River	NA	0.0	NA	NA	NA	0.0	0.2	0.2	0.2	0.2	0.2	0.2
		Agricultural/Irrigation														
15	NDJ-9	Buck Creek Trout Farm	Buck Creek Trout Farm	Buck Creek	NA	NA	1.3	NA	NA	1.3	1.3	1.3	1.3	1.3	1.3	1.3
91	NDJ-10	Harris Creek Trout Farm	Harris Creek Trout Farm	Harris Creek	NA	NA	0.9	NA	NA	0.9	0.9	0.9	0.9	0.9	0.9	0.9
169	NDJ-11	NC Wildlife Resources Commission	Armstrong State Fish Hatchery - Upper	Armstrong Creek	NA	NA	0.8	NA	NA	0.8	0.8	0.8	0.8	0.8	0.8	0.8
170	NDJ-12	NC Wildlife Resources Commission	Armstrong State Fish Hatchery - Lower	Armstrong Creek	NA	NA	3.3	NA	NA	3.3	3.3	3.3	3.3	3.3	3.3	3.3
171	NDJ-13	NC Wildlife Resources Commission	Armstrong State Fish Hatchery	Bee Rock Creek	NA	NA	0.5	NA	NA	0.5	0.5	0.5	0.5	0.5	0.5	0.5
172	NDJ-14	NC Wildlife Resources Commission	Marion State Fish Hatchery	Catawba River	NA	NA	0.3	NA	NA	0.3	0.3	0.3	0.3	0.3	0.3	0.3
				LAKE JAMES SUB-BASIN TOTAL FLOW	**0.0**	**2.9**	**7.9**	**2.0**	**2.1**	**9.3**	**10.3**	**11.0**	**11.7**	**12.5**	**13.3**	**14.3**
LAKE RHODHISS																
		Industrial														
190	NDR-1	SGL Carbon Corporation	SGL Carbon Corporation	Silver Creek	NA	3.7	NA	1.7	0.8	0.8	0.9	1.0	1.1	1.3	1.4	1.6
		PWS														
115	NDR-2	City of Lenoir	Lenoir WTP	Lake Rhodhiss	NA	0.1	NA	0.1	NA	0.1	0.1	0.1	0.2	0.2	0.2	0.2
116	NDR-3	City of Lenoir	Lower Creek WWTP	Lower Creek	NA	2.4	NA	2.1	2.5	2.5	2.7	2.9	3.1	3.3	3.5	3.8
145	NDR-4	City of Marion	Corpening Creek WWTP	Corpening Creek	NA	0.9	NA	0.6	0.8	0.9	0.8	1.0	1.1	1.3	1.5	1.8
155	NDR-5	City of Morganton	Catawba River Pollution Control Facility	Catawba River	5.9	6.3	NA	3.6	4.2	4.2	4.7	5.2	5.8	6.4	7.1	7.9
156	NDR-6	City of Morganton	Catawba River WTP	Lake Rhodhiss	NA	0.1	NA	0.2	NA	0.2	0.2	0.2	0.2	0.2	0.3	0.3
213	NDR-7	Town of Valdese	Lake Rhodiss WWTP	Lake Rhodhiss	4.1	4.9	NA	4.5	4.6	4.6	5.2	5.5	5.8	6.1	6.5	6.9
		Agricultural/Irrigation														
173	NDR-8	NC Wildlife Resources Commission	Table Rock State Fish Hatchery	Irish Creek	NA	NA	NA	NA	NA	0.9	0.9	0.9	0.9	0.9	0.9	0.9
				LAKE RHODHISS SUB-BASIN TOTALFLOW	**10.0**	**18.5**	**0.0**	**12.8**	**12.9**	**14.2**	**15.5**	**16.8**	**18.2**	**19.7**	**21.4**	**23.4**
LAKE HICKORY																
		Industrial														
102	NDH-1	Huffman Finishing, Inc.	Huffman Finishing	Lake Hickory	NA	0.2	NA	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3
		PWS														
97	NDH-2	City of Hickory	Hickory WTP	Lake Hickory	NA	0.3	NA	0.3	NA	0.3	0.3	0.4	0.5	0.6	0.8	0.9
98	NDH-3	City of Hickory	Northeast WWTP	Lake Hickory	NA	3.2	NA	3.5	4.0	4.0	4.7	5.7	7.0	8.5	10.3	12.6
117	NDH-4	City of Lenoir	Gunpowder Creek WWTP	Gunpowder Creek	NA	1.0	NA	0.9	1.1	1.1	1.0	1.1	1.2	1.2	1.3	1.4
86	NDH-5	Town of Granite Falls	Granite Falls WWTP	Gunpowder Creek	NA	0.5	NA	0.4	0.5	0.5	0.5	0.6	0.7	0.8	0.9	1.1
				LAKE HICKORY SUB-BASIN TOTALFLOW	**0.0**	**5.2**	**0.0**	**5.2**	**5.7**	**6.0**	**6.7**	**8.0**	**9.5**	**11.3**	**13.6**	**16.3**
LOOKOUT SHOALS LAKE																
		Industrial														

Catawba-Wateree River Basin Returns - Summary Sheet (in mgd)

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189	NDL-1	Schneider Mills, Inc.	Schneider Mills WWTP	Muddy Fork	NA	0.6	NA	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
		PWS														
203	NDL-2	Town of Taylorsville	Taylorsville WWTP	Lower Little River	NA	0.4	NA	0.3	0.5	0.5	0.5	0.6	0.7	0.8	0.9	1.1
			LOOKOUT SHOALS LAKE SUB-BASIN TOTAL FLOW		**0.0**	**1.0**	**0.0**	**0.6**	**0.8**	**0.8**	**0.8**	**0.9**	**1.0**	**1.1**	**1.3**	**1.4**
LAKE NORMAN																
		PWS														
38	NDN-1	City of Claremont	McLin Creek WWTP	McLin Creek	0.1	0.2	NA	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.4
40	NDN-2	City of Claremont	North WWTP	Mull Creek	NA	0.1	NA	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2
42	NDN-3	City of Claremont	South WWTP	McLin Creek	NA	0.1	NA	NA	NA	0.1	0.1	0.1	0.1	0.1	0.2	0.2
62	NDN-4	City of Conover	Northeast WWTP	Lyle Creek	NA	0.7	NA	0.7	0.8	0.8	0.9	1.0	1.2	1.3	1.6	1.8
64	NDN-5	City of Conover	Southeast WWTP	McLin Creek	NA	0.3	NA	0.3	0.4	0.4	0.4	0.4	0.5	0.6	0.7	0.8
99	NDN-6	City of Hickory	Hickory WWTP	Lyle Creek	NA	0.1	NA	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
121	NDN-7	Lincoln County	Lincoln County WTP	Lake Norman	NA	0.1	NA	0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.3	0.3
		PWS - Domestic														
1	NDN-8	Aqua North Carolina	Aqua North Carolina	Lake Norman	NA	NA	NA	NA	NA	0.1	0.1	0.1	0.1	0.2	0.2	0.2
92	NDN-9	Heater Utilities, Inc.	Diamond Head WWTP	Lake Norman	NA	NA	NA	NA	NA	0.1	0.1	0.1	0.1	0.1	0.1	0.1
		Power														
	NDN-10	Duke Energy Corporation	Marshall Steam Station	Lake Norman	NA	NA	NA	NA	NA	0.0	NA	NA	NA	NA	NA	NA
	NDN-11	Duke Energy Corporation	McGuire Nuclear Power Plant	Lake Norman	NA	NA	NA	NA	NA	0.0	NA	NA	NA	NA	NA	NA
			LAKE NORMAN SUB-BASIN TOTAL FLOW		**0.1**	**1.4**	**0.0**	**1.3**	**1.5**	**2.0**	**2.0**	**2.3**	**2.6**	**3.0**	**3.5**	**4.0**
MOUNTAIN ISLAND LAKE																
		PWS														
50	NDM-1	Charlotte-Mecklenburg Utilities	North Mecklenburg WTP	McDowell Creek	NA	NA	NA	0.2	0.2	0.2	0.3	0.4	0.6	0.6	0.7	0.7
52	NDM-2	Charlotte-Mecklenburg Utilities	McDowell Creek WWTP	McDowell Creek	NA	2.5	NA	4.9	5.7	5.7	7.4	11.6	13.9	15.7	17.5	17.5
		Power														
	NDM-3	Duke Energy Corporation	McGuire Nuclear Power Plant	Mountain Island Lake	NA	NA	NA	NA	NA	0.0	NA	NA	NA	NA	NA	NA
	NDM-4	Duke Energy Corporation	Riverbend Steam Station	Mountain Island Lake	NA	NA	NA	NA	NA	0.0	NA	NA	NA	NA	NA	NA
			MOUNTAIN ISLAND LAKE SUB-BASIN TOTALFLOW		**0.0**	**2.5**	**0.0**	**5.1**	**5.9**	**5.9**	**7.7**	**12.0**	**14.5**	**16.3**	**18.2**	**18.2**
LAKE WYLIE																
		Industrial														
46	NDY-1	Clariant Corporation	Mount Holly East (MHE) Facility	Lake Wylie	1.2	1.2	1.2	0.6	0.9	0.9	1.0	1.3	1.6	2.1	2.7	3.5
72	NDY-2	Delta Apparel, Inc	Delta Apparel Incorporated	Clark Creek	NA	0.8	NA	0.9	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9
73	NDY-3	FMC Corporation	Lithium Division Plant	Abernethy Creek	NA	0.5	NA	0.5	1.7	1.7	0.6	0.7	0.9	1.1	1.4	1.8
136	NDY-4	Magellan Terminals Holdings LP	Charlotte II Terminal	Long Creek	NA	0.1	NA	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
177	NDY-5	National Fruit Product Company, Inc	National Fruit Product Co Inc	Carpenter Creek	NA	0.2	NA	NA	NA	0.2	0.2	0.2	0.2	0.3	0.3	0.3
184	NDY-6	Pharr Yarns, Inc	Pharr Yarns Industrial WWTP	South Fork Catawba River	NA	0.1	NA	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	Closed	Rhodia, Inc.	Rhodia Incorporated	-	NA	NA	NA	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
205	NDY-7	Textron, Inc	Textron Incorporated	Crowders Creek	NA	0.1	NA	NA	NA	0.1	0.1	0.1	0.1	0.1	0.2	0.2
207	NDY-8	TransMontaigne Terminaling, Inc	Charlotte/Paw Creek Terminal #1	Paw Creek	NA	0.3	NA	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
208	NDY-9	TransMontaigne Terminaling, Inc	Charlotte/Paw Creek Terminal #2	Paw Creek	NA	0.3	NA	NA	NA	0.0	0.0	0.0	0.0	0.0	0.0	0.0
215	NDY-10	Yorkshire Americas, Inc	Yorkshire Americas Incorporated	South Fork Catawba River	NA	0.3	NA	0.3	0.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
82	NDY-11	General Electric Company-Hickory	General Electric Company-Hickory	Cline Creek	NA	0.1	NA	NA	NA	0.1	0.1	0.1	0.1	0.2	0.2	0.2
193	NDY-12	Siemens Westinghouse	Siemens Westinghouse		NA		10.8	NA	NA	10.8	10.7	10.7	10.7	10.7	10.7	10.7
		PWS														

Catawba-Wateree River Basin Returns - Summary Sheet (in mgd)

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5	NDY-13	City of Belmont	Belmont WTP	South Fork Catawba River	NA	0.2	NA	NA	NA	0.2	0.2	0.2	0.2	0.2	0.3	0.3
6	NDY-14	City of Belmont	Belmont WWTP	Lake Wylie	NA	3.3	NA	1.8	1.9	1.9	2.0	2.3	2.7	3.1	3.5	4.0
32	NDY-15	City of Cherryville	Cherryville WWTP	Indian Creek	NA	1.2	NA	0.5	0.8	0.8	0.8	0.9	1.0	1.2	1.3	1.5
79	NDY-16	City of Gastonia	Gastonia WTP	Long Creek	0.4	0.5	NA	0.6	0.8	0.8	0.5	0.8	0.9	1.0	1.2	1.4
80	NDY-17	City of Gastonia	Crowders Creek WWTP	Crowders Creek	3.2	2.8	NA	2.9	3.0	3.0	3.3	3.9	4.6	5.4	6.4	7.6
81	NDY-18	City of Gastonia	Long Creek WWTP	Long Creek	5.9	5.1	NA	5.9	6.9	6.9	7.4	8.7	10.2	12.0	14.0	16.4
100	NDY-19	City of Hickory	Henry Fork WWTP	Henry Fork	NA	3.1	NA	2.2	2.6	2.6	3.1	3.8	4.6	5.7	6.9	8.4
126	NDY-20	City of Lincolnton	Lincolnton WTP	South Fork Catawba River	NA	NA	NA	0.6	0.9	0.9	0.7	0.9	1.0	1.2	1.4	1.6
127	NDY-21	City of Lincolnton	Lincolnton WWTP	South Fork Catawba River	NA	3.5	NA	2.6	3.0	3.0	3.2	3.8	4.5	5.2	6.1	7.2
132	NDY-22	City of Lowell	Lowell WWTP	South Fork Catawba River	NA	0.4	NA	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.5	0.5
160	NDY-23	City of Mount Holly	Mount Holly WTP	Lake Wylie	NA	NA	NA	NA	NA	0.0	0.1	0.1	0.1	0.1	0.1	0.1
162	NDY-24	City of Mount Holly	Mount Holly WWTP	Lake Wylie	NA	1.7	NA	2.4	2.3	2.3	2.6	3.1	3.7	4.5	5.4	6.6
181	NDY-25	City of Newton	Clark Creek WWTP	Clark Creek	NA	2.6	NA	3.5	3.7	3.7	4.0	4.6	5.4	6.2	7.2	8.4
122	NDY-26	Lincoln County	Forney Creek WWTP	Forney Creek	NA	0.1	NA	0.3	0.4	0.4	0.5	0.6	0.8	1.0	1.2	1.6
66	NDY-27	Town of Cramerton	Eagle Road WWTP	South Fork Catawba River	NA	1.6	NA	1.0	1.3	1.3	1.4	1.6	1.7	2.0	2.2	2.5
71	NDY-28	Town of Dallas	Dallas WWTP	Long Creek	NA	0.2	NA	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4
137	NDY-29	Town of Maiden	Maiden WWTP	Clark Creek	NA	0.4	NA	0.4	0.5	0.5	0.5	0.5	0.6	0.6	0.7	0.7
146	NDY-30	Town of McAdenville	McAdenville WWTP	South Fork Catawba River	NA	0.1	NA	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
200	NDY-31	Town of Stanley	Lola Street WWTP	Mauney Creek	0.5	0.5	NA	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
		PWS - Domestic														
18	NDY-32	Carolina Water Service, Inc	Queens Harbor WWTP	Lake Wylie	NA	NA	NA	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
19	NDY-33	Carolina Water Service, Inc	Riverpointe WWTP	Lake Wylie	NA	NA	NA	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
101	NDY-34	Hideways WWTP	Hideways WWTP	Lake Wylie	NA	NA	NA	NA	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1
		Power														
	NDY-35	Duke Energy Corporation	Allen Steam Plant	Lake Wylie	NA	NA	NA	NA	NA	0.0	NA	NA	NA	NA	NA	NA
	NDY-36	Duke Energy Corporation	Lincoln Combustion Turbine Facility	Killian Creek	NA	0.1	NA	NA	NA	0.0	NA	NA	NA	NA	NA	NA
		PWS - Domestic														
23	SDY-1	Carolina Water Service, Inc.	Tega Cay 2	Lake Wylie	0.2	0.2	NA	0.2	NA	0.2	0.2	0.3	0.3	0.3	0.3	0.3
24	SDY-2	Carolina Water Service, Inc.	Tega Cay 3	Lake Wylie	0.1	0.1	NA	0.2	NA	0.2	0.3	0.4	0.7	1.0	1.0	1.0
		Power														
	SDY-3	Duke Energy Corporation	Catawba Nuclear Station	Allison Creek	NA	NA	NA	NA	NA	0.0	NA	NA	NA	NA	NA	NA
				LAKE WYLIE SUB-BASIN TOTAL FLOW	**11.5**	**31.4**	**12.0**	**28.6**	**33.0**	**44.7**	**45.8**	**51.9**	**59.1**	**67.5**	**77.2**	**88.8**
FISHING CREEK RESERVOIR																
		PWS														
53	NDF-1	Charlotte-Mecklenburg Utilities	Franklin WTP	Stewart Creek	NA	1.4	NA	1.6	NA	1.5	1.7	1.9	2.1	2.3	2.5	2.6
54	NDF-2	Charlotte-Mecklenburg Utilities	Irwin Creek WWTP	Irwin Creek	NA	7.0	NA	10.5	10.9	10.9	12.0	12.0	12.0	12.0	12.0	12.0
55	NDF-3	Charlotte-Mecklenburg Utilities	Sugar Creek WWTP	Little Sugar Creek	NA	12.8	NA	12.7	14.4	14.4	15.0	20.0	25.0	30.0	35.0	40.0
56	NDF-4	Charlotte-Mecklenburg Utilities	McAlpine Creek WWTP	McAlpine Creek	NA	37.3	NA	40.6	50.3	50.3	50.3	58.7	66.6	72.3	75.7	78.2
209	NDF-5	Union County Public Works Department	Twelve Mile Creek WWTP	Twelve Mile Creek	NA	NA	NA	1.1	1.6	1.6	2.5	3.9	5.0	5.8	6.5	7.2
		PWS - Domestic														
20	NDF-6	Carolina Water Service, Inc	Forest Ridge WWTP	Irvins Creek	NA	NA	NA	NA	NA	0.0	0.2	0.2	0.2	0.2	0.2	0.2
		Industrial														
12	SDF-1	Bowater, Inc.	Pulp and Paper Mill	Catawba River	33.7	35.2	NA	24.3	NA	24.3	28.1	29.5	31.0	32.6	34.3	36.0
29	SDF-2	Celanese Acetate	Celriver	Catawba River	55.1	47.1	NA	38.8	NA	38.8	57.0	57.0	57.0	57.0	57.0	57.0

Catawba-Wateree River Basin Returns - Summary Sheet (in mgd)

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176	SDF-3	Nation Ford Chemical		Catawba River	0.7	0.5	NA	1.1	NA	1.1	1.0	1.3	1.8	2.4	3.2	4.3
196	SDF-4	Springs Industrial	Grace Complex	Fishing Creek Lake	8.5	10.6	NA	9.7	NA	9.7	9.8	10.3	10.8	11.4	12.0	12.6
		PWS														
74	SDF-5	Fort Mill	Fort Mill WWTP	Dye Branch	0.7	0.9	NA	1.1	NA	1.1	1.2	1.5	1.8	2.2	2.7	3.3
104	SDF-6	Lancaster	Lancaster WWTP	Fishing Creek Lake	NA	2.8	NA	2.4	NA	2.4	2.6	3.1	3.7	4.3	5.1	6.1
111	SDF-7	Lancaster County	Indianland WWTP	Catawba River	NA	NA	NA	0.2	NA	0.2	0.3	1.0	1.8	2.5	3.3	4.0
188	SDF-8	Rock Hill	Manchester Creek WWTP	Manchester Creek	7.6	9.0	NA	8.1	NA	8.1	10.0	12.2	14.8	18.1	22.0	26.9
		PWS - Domestic														
25	SDF-9	Carolina Water Service Inc.	Lamplighter Village Sewer District	McAlpine Creek	NA	0.2	NA	0.2	NA	0.2	0.3	0.3	0.4	0.5	0.5	0.5
26	SDF-10	Foxwood Sewer District	Foxwood Sewer District	Sugar Creek	NA	0.0	NA	0.0	NA	0.0	0.1	0.1	0.1	0.1	0.1	0.1
			FISHING CREEK RESERVOIR SUB-BASIN TOTAL FLOW		**106.2**	**164.9**	**0.0**	**152.4**	**77.3**	**164.6**	**191.9**	**213.0**	**233.9**	**253.6**	**271.9**	**290.9**
GREAT FALLS-DEARBORN RESERVOIR																
		PWS														
35	SDG-1	Chester Sewer District	Lando Manetta WWTP	Fishing Creek	0.1	0.1	NA	0.3	0.1	0.1	0.1	0.5	1.1	2.0	3.1	4.2
214	SDG-2	York	Fishing Creek WWTP	Fishing Creek	1.2	1.0	NA	0.9	NA	0.9	1.1	1.5	2.0	2.7	3.6	4.8
			GREAT FALLS-DEARBORN RESERVOIR SUB-BASIN TOTAL FLOW		**1.2**	**1.1**	**0.0**	**1.2**	**0.1**	**1.0**	**1.2**	**2.0**	**3.1**	**4.7**	**6.7**	**9.1**
CEDAR CREEK RESERVOIR																
		PWS														
36	SDC-1	Chester Sewer District	Rocky Creek	Rocky Creek	0.5	0.7	NA	0.6	0.6	0.6	0.7	0.9	1.2	1.7	2.3	2.9
87	SDC-2	Great Falls	Great Falls WWTP	Rocky Creek Lake	0.4	0.2	NA	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4
			CEDAR CREEK RESERVOIR SUB-BASIN TOTAL FLOW		**0.8**	**0.9**	**0.0**	**0.8**	**0.9**	**0.9**	**1.0**	**1.3**	**1.6**	**2.0**	**2.7**	**3.4**
LAKE WATEREE																
			LAKE WATEREE SUB-BASIN TOTAL FLOW													

Withdrawals and Returns Below Lake Wateree - Summary Sheet (in mgd)

PROJECTIONS FOR BELOW LAKE WATEREE

App D Page Ref	Proj ID	Entity	Facility	Receiving Water	1992	1997	1999	2002	2003	Current	2008	2018	2028	2038	2048	2058
		Industrial														
223	SWB-1	DuPont/Investa	May Plant		2.7	3.5	3.1	2.7	2.7	2.7	2.7	2.9	3.0	3.2	3.3	3.5
227	SWB-2	International Paper	Eastover Plant		24.8	29.0	27.7	28.9	28.2	28.2	28.9	30.3	31.9	33.5	35.2	37.0
		PWS														
238	SWB-3	SC Deparment of Corrections	Wateree River Corrections Institute		N/A	N/A	N/A	N/A	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0
		Power														
241	SWB-4	SCE&G	Wateree Station		N/A	N/A	N/A	N/A	N/A	463.8	502.9	555.5	613.6	677.8	748.7	827.0
				TOTAL WITHDRAWAL FLOW	**27.6**	**32.5**	**30.8**	**31.6**	**30.8**	**494.6**	**534.4**	**588.7**	**648.5**	**714.5**	**787.2**	**867.5**
		Industrial														
224	SDB-1	DuPont/Investa	May Plant		2.8	2.7	N/A	2.0	N/A	2.0	2.0	2.1	2.3	2.4	2.5	2.6
228	SDB-2	International Paper	Eastover Plant		24.2	31.0	N/A	29.8	N/A	29.8	28.3	29.7	31.3	32.9	34.5	36.3
221	SDB-3	Deroyal Textiles	Camden		0.1	0.2	N/A	0.1	N/A	0.1	0.1	0.2	0.2	0.2	0.2	0.2
218	SDB-4	Clariant LSM			0.4	0.5	N/A	0.3	N/A	0.3	0.4	0.5	0.6	0.9	1.2	1.6
231	SDB-5	Kawashima Textiles			0.4	0.3	N/A	0.3	N/A	0.3	0.3	0.3	0.4	0.4	0.4	0.5
230	SDB-6	Huron Tech Corporation			N/A	N/A	N/A	0.1	N/A	0.1	0.1	0.1	0.2	0.2	0.2	0.2
229	SDB-7	Hanson Aggregates	Hasskamp Plant		N/A	0.2	N/A	0.4	N/A	0.4	0.0	0.0	0.0	0.0	0.0	0.0
219	SDB-8	Cogsdill Tool			0.0	0.0	N/A	0.0	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
232	SDB-9	Kennecot Ridgeway Mining Company	Kennecot Ridgeway Gold Mine		0.3	N/A	N/A	0.2	N/A	0.2	0.0	0.0	0.0	0.0	0.0	0.0
234	SDB-10	New South, Inc.			N/A	N/A	N/A	N/A	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0
		PWS														
239	SDB-11	SC Deparment of Corrections	Wateree River Corrections Institute		N/A	0.1	N/A	0.1	N/A	0.1	0.1	0.1	0.2	0.2	0.2	0.2
217	SDB-12	City of Camden	WWTP		1.5	1.6	N/A	1.1	N/A	1.1	1.9	2.2	2.6	3.0	3.5	4.0
243	SDB-13	USAF	Shaw Base		0.8	0.7	N/A	0.7	N/A	0.7	0.7	0.8	0.9	1.0	1.1	1.2
220	SDB-14	Carolina Water Service	Oakland Plantation		N/A	0.1	N/A	0.1	N/A	0.1	0.1	0.1	0.2	0.2	0.2	0.2
233	SDB-15	Kershaw County-Lugoff	WWTP		0.3	0.3	N/A	0.3	N/A	0.3	0.3	0.5	0.6	0.7	0.8	0.9
235	SDB-16	Palmetto Utility, Inc	WWTP		N/A	N/A	N/A	N/A	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0
236	SDB-17	SC Army National Guard	McCrady Training Center		N/A	N/A	N/A	N/A	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0
244	SDB-18	USMC	Vehicle		0.0	0.0	N/A	0.0	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
225	SDB-19	Eastover Richland County			N/A	N/A	N/A	N/A	N/A	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		Power														
242	SDB-20	SCE&G	Wateree Station		417.6	398.9	N/A	432.1	N/A	432.1	467.7	516.6	570.6	630.3	696.3	769.1
				TOTAL RETURN FLOW	**448.3**	**436.5**	**0.0**	**467.5**	**0.0**	**467.5**	**502.2**	**553.3**	**609.8**	**672.1**	**740.9**	**816.9**

APPENDIX D
WITHDRAWAL AND RETURN DETAIL SHEETS

WATER USER INDEX

Beginning Page No.	Public Water System Users
3	Belmont, City of
7	Bessemer City
9	Blue Ridge C.C. Development LLC
17	Camden, City of
18	Carolina Water Service
47	Charlotte-Mecklenburg Utilities
30	Cherryville, City of
33	Chester Metro
34	Chester Sewer District
37	Claremont, City of
216	Concord/Kannapolis/Cabarrus Co.
61	Conover, City of
66	Cramerton, Town of
68	Dallas, Town of
225	Eastover Richland County
74	Fort Mill, City of
26	Foxwood Sewer District
75	Gastonia, City of
83	Granite Falls, Town of
87	Great Falls, Town of
94	Hickory, City of
101	Hideways WWTP
103	High Shoals, Town of
233	Kershaw County-Lugoff
111	Lancaster County
104	Lancaster, City of
112	Lenoir, City of
118	Lincoln County
123	Lincolnton, City of
128	Linville Harbor Pr. Owners Assoc.
129	Linville Resorts, Inc
130	Longview, Town of
132	Lowell, City of
134	Lugoff Elgin Water Authority
137	Maiden, Town of
139	Marion, City of
146	McAdenville, Town of
148	Mooresville, Town of
152	Morganton, City of
157	Mount Holly, City of
178	Newton, City of
182	Old Fort, Town of
235	Palmetto Utility, Inc
185	Rock Hill, City of
236	SC Army National Guard
237	SC Department of Corrections
197	Stanley, Town of
201	Statesville, City of
203	Taylorsville, Town of
209	Union County Public Works Department
106	Union County/Lancaster County
243	USAF
244	USMC
210	Valdese, Town of
214	York, City of

Beginning Page No.	Industrial Users
1	Aqua North Carolina
2	Baxter Healthcare Corporation
10	Bowater, Inc.
27	Celanese Acetate
44	Clariant Corporation
218	Clariant LSM
57	Coats American Inc.
219	Cogsdill Tool
60	Confidential Industry
65	Cramer Mountain Finishing LLC
72	Delta Apparel, Inc
221	Deroyal Textiles
222	DuPont/Investa
73	FMC Corporation
82	General Electric Company-Hickory
229	Hanson Aggregates
92	Heater Utilities, Inc.
93	Hedrich Industries
102	Huffman Finishing, Inc.
230	Huron Tech Corporation
226	International Paper
231	Kawashima Textiles
232	Kennecot Ridgeway Mining Company
136	Magellan Terminals Holdings LP
174	Nation Ford Chemical
177	National Fruit Product Company, Inc
234	New South, Inc.
184	Pharr Yarns, Inc
189	Schneider Mills, Inc.
190	SGL Carbon Corporation
191	Siemens Westinghouse
194	Springs Industrial
205	Textron, Inc
206	TransMontaigne Terminaling, Inc
215	Yorkshire Americas, Inc

Beginning Page No.	Agricultural/Irrigational Users
13	Buck Creek Trout Farm
89	Harris Creek Trout Farm
163	NC Wildlife Resources Commission

Beginning Page No.	Power Users
240	SCE&G

OWNER: Aqua North Carolina, Inc.

HDR ID	Facility	Type
NDN - 8	Aqua North Carolina	Discharge

CONTACT: Mike Myers

Proj. By: JCH

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Domestic WW
1.50

Monthly

Month	Ann Avg Coefficient
Jan	1.0
Feb	1.0
Mar	1.0
Apr	1.0
May	1.0
Jun	1.0
Jul	1.0
Aug	1.0
Sep	1.0
Oct	1.0
Nov	1.0
Dec	1.0

Yearly

Year	Avg. Q (mgd)
2008	0.11
2018	0.13
2028	0.15
2038	0.17
2048	0.20
2058	0.23

Analysis Notes

*Catawba County 1980s historical growth 1.19% AGR
*Catawba County 1990s historical growth 1.41% AGR
*Catawba County 2000-2030 pop. Projection 1.52% AGR
*Base future projections on 1.50% AGR

*No historical flow information available.
*Aqua North Carolina has purchased several domestic ww systems througout the State, including one near Newton. Will most likely continue to grow through acquisitions of these small systems.
*Assumed permit limit (0.1 mgd) as base flow.
*Projections take into account future acquisitions, or development for communities.
*No evidence of a CMUDCU projection.

OWNER: **Baxter Healthcare Corporation**

HDR ID	Facility	Type
NDJ - 1	Baxter Healthcare Corporation	Discharge

CONTACT: **Phillip Castro**

Proj. By: *JCH*

HISTORICAL SUMMARY DATA

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.87	1.03
Feb				0.91	0.98
Mar				0.92	0.93
Apr				0.85	0.90
May				0.89	0.93
Jun				0.90	0.87
Jul				0.83	0.94
Aug				0.94	1.03
Sep				0.94	1.03
Oct				0.99	1.03
Nov				1.04	0.99
Dec				0.91	1.02

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.78
1999	NA
2002	0.91
2003	0.97

PROJECTION SUMMARY

Monthly

Month	Annual Avg Coefficient
Jan	1.06
Feb	1.01
Mar	0.95
Apr	0.93
May	0.96
Jun	0.90
Jul	0.97
Aug	1.06
Sep	1.05
Oct	1.05
Nov	1.02
Dec	1.04

Yearly

Year	Avg. Q (mgd)
2008	1.11
2018	1.42
2028	1.72
2038	2.03
2048	2.34
2058	2.64

Analysis Notes

*Water Source: Well System

*Historical Data Source: DMRs from Division of Water Quality.

*Industry trend not available. Assumed straight line projection based on historical data.

OWNER: **City of Belmont**

HDR ID	Facility	Type
NWY - 6	Belmont WTP	Withdrawal
NDY -13	Belmont WTP	Discharge
NDY -14	Belmont WWTP	Discharge

CONTACT: **Chuck Flowers**

Proj. By: *JCH*

HDR ID: **NWY - 6**
FACILITY: **Belmont WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	2.34	NA
Feb				2.20	
Mar				2.24	
Apr				2.51	
May				2.55	
Jun				2.87	
Jul				2.79	
Aug				2.92	
Sep				2.62	
Oct				2.52	
Nov				2.29	
Dec				1.95	

Yearly

Year	Avg. Q (mgd)
1992	4.55
1997	4.38
1999	NA
2002	2.48
2003	NA

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.00	1.66

Monthly

Month	Ann Avg Coefficient
Jan	0.94
Feb	0.89
Mar	0.90
Apr	1.01
May	1.03
Jun	1.16
Jul	1.12
Aug	1.17
Sep	1.05
Oct	1.01
Nov	0.92
Dec	0.79

Yearly

Year	Avg. Q (mgd)
2008	3.33
2018	3.80
2028	4.35
2038	4.98
2048	5.71
2058	6.55

Type	2008	2018	2028	2038	2048	2058
Res. Cust	4,694	5,185	5,728	6,327	6,989	7,720
Demand	652,000	720,000	795,000	878,000	970,000	1,072,000
Com. Cust.	350	387	427	472	522	576
Demand	255,000	281,000	311,000	343,000	379,000	419,000
Ind. Cust	73	86	101	119	141	166
Demand	880,000	1,037,000	1,223,000	1,442,000	1,700,000	2,004,000
Inst. Cust	18	21	25	29	34	40
Demand	85,000	100,000	118,000	139,000	164,000	194,000
TOTALS	**5,135**	**5,658**	**6,256**	**6,918**	**7,651**	**8,462**
	3,325,000	**3,798,000**	**4,346,000**	**4,977,000**	**5,707,000**	**6,552,000**

Type	2002 LWSP	GPD/Cust
Res. Cust	4,422	139
Com. Cust.	330	727
Ind. Cust	66	12,076
Inst. Cust	16	4,813
TOTAL	**4,834**	**-**

1997 LWSP	2002 LWSP	AGR	AGR Ind.
8,200	8,705	1.00	1.66

Backwash & Unaccounted For 44%

Analysis Notes
*Historical Data Source: 1997 and 2002 LWSPs from NCDWR.
*Wastewater projections are based on the percentage of water usage by sector and the growth rate of those sectors.
*Use 1.00% based on AGR in Gastonia projection sheet; this will account for pop. growth projections and limited service area exp.
*Ind. AGR based on growth trends of surrounding industries, according to NC GSP.

HDR ID: **NDY - 13**
FACILITY: **Belmont WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.23
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.00
Apr	1.00
May	1.00
Jun	1.00
Jul	1.00
Aug	1.00
Sep	1.00
Oct	1.00
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	0.17
2018	0.19
2028	0.22
2038	0.25
2048	0.29
2058	0.33

Year	Total Water	Sys. Water	% of Total Water
1997	4.38	0.35	8.0%
2002	2.48	0.27	11.0%

Year	Total Water	Sys. Water	% of Total Water	Discharge
2008	3.33		5.0%	0.17
2018	3.80		5.0%	0.19
2028	4.35		5.0%	0.22
2038	4.98		5.0%	0.25
2048	5.71		5.0%	0.29
2058	6.55		5.0%	0.33

Analysis Notes
*0.35 mgd of system water reported in 1997 LWSP
*1997 DMR lists 0.23 return (66% of system water).
*0.272 mgd of system water reported in 2002 LWSP.
*Assume 5.0 of total water used is returned

HDR ID: NDY - 14
FACILITY: Belmont WWTP

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	1.77	1.86
Feb				1.62	2.21
Mar				1.74	2.21
Apr				1.67	2.37
May				1.64	2.24
Jun				1.66	1.86
Jul				1.56	1.70
Aug				1.91	1.75
Sep				1.84	1.73
Oct				2.00	1.68
Nov				1.98	1.72
Dec				1.92	1.54

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	3.33
1999	NA
2002	1.78
2003	1.91

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.00	1.66

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	0.91
Mar	0.98
Apr	0.94
May	0.92
Jun	0.93
Jul	0.87
Aug	1.07
Sep	1.03
Oct	1.13
Nov	1.11
Dec	1.08

Yearly

Year	Avg. Q (mgd)
2008	2.04
2018	2.33
2028	2.67
2038	3.06
2048	3.50
2058	4.02

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	854,000	49.4%	1.00	1.66	0.94
Ind/Inst	874,000	50.6%			0.97
Total	**1,728,000**	-	-	-	**1.91**

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.99	1.10	1.21	1.34	1.48	1.63
Ind/Inst Demand	1.05	1.24	1.46	1.72	2.03	2.39
Total	**2.04**	**2.33**	**2.67**	**3.06**	**3.50**	**4.02**

Analysis Notes
*Historical Data Source: DMRs from Division of Water Quality
*Wastewater projections are based on the percentage of water usage by sector and the growth rate of those sectors.

OWNER: **Bessemer City**

HDR ID	Facility	Type
NWY - 7	J.V. Tarpley WTP	Withdrawal
NWY - 8	J.V. Tarpley WTP	Withdrawal

CONTACT: **Lee Hayes**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	1.17	NA	2.34	NA
Feb		1.17		2.20	
Mar		1.08		2.24	
Apr		1.14		2.51	
May		1.39		2.55	
Jun		1.35		2.87	
Jul		1.44		2.79	
Aug		1.39		2.92	
Sep		0.71		2.62	
Oct		1.25		2.52	
Nov		1.78		2.29	
Dec		1.18		1.95	

Yearly

Year	Avg. Q (mgd)
1992	2.16
1997	1.25
1999	NA
2002	0.86
2003	NA

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.00	2.25

Monthly

Month	Ann Avg Coefficient
Jan	0.93
Feb	0.93
Mar	0.86
Apr	0.91
May	1.11
Jun	1.08
Jul	1.15
Aug	1.11
Sep	0.56
Oct	1.00
Nov	1.42
Dec	0.94

Yearly

Year	Avg. Q (mgd)
2008	1.53
2018	1.82
2028	2.19
2038	2.63
2048	3.18
2058	3.85

Analysis Notes

* NWY - 7 & NWY - 8 are used by 1 WTP - both will be treated as one withdrawal from Lake Wylie; 1 WTP: 3 mgd capacity
*Largest ind. user: FMC Corp. - Lithium Div. Used 0.543 mgd out of 0.657 mgd industrial water in 1997; 1997 more conservative
*Wastewater projections are based on the percentage of water usage by sector and the growth rate of those sectors.
*Assumed FMC consumption of 0.023 mgd and incr. water use for FMC based on their discharge projections and consumption.
*Used AGR as before for Gaston Co. at 1.00 AGR to account for pop. growth and limited service area exp.

Projection Analysis

Type	2008	2018	2028	2038	2048	2058
Res. Cust	2,449	2,705	2,988	3,301	3,646	4,028
Demand	441,000	487,000	538,000	594,000	656,000	725,000
Com. Cust.	195	216	238	263	291	321
Demand	64,000	70,000	78,000	86,000	95,000	105,000
Ind. Cust	4	5	6	7	9	12
Demand	839,000	1,048,000	1,310,000	1,636,000	2,044,000	2,553,000
Inst. Cust	1	2	2	2	3	4
Demand	14,000	18,000	22,000	27,000	34,000	43,000
TOTALS	**2,649**	**2,926**	**3,232**	**3,571**	**3,946**	**4,360**
	1,526,000	**1,824,000**	**2,189,000**	**2,633,000**	**3,179,000**	**3,849,000**

Type	1997 LWSP	GPD/Cust	1997 LWSP	2002 LWSP	AGR	AGR Ind.
Res. Cust	2,195	180	4,897	5,119	1.00	2.25
Com. Cust.	175	326				
Ind. Cust	3	219,000		Backwash & Unaccounted For		11%
Inst. Cust	1	11,000				
TOTAL	**2,374**	**-**				

OWNER: **Blue Ridge Country Club Development LLC**

HDR ID	Facility	Type
NDJ - 6	Blue Ridge Country Club Development LLC	Discharge

CONTACT: **Andy**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.0
Feb	1.0
Mar	1.0
Apr	1.0
May	1.0
Jun	1.0
Jul	1.0
Aug	1.0
Sep	1.0
Oct	1.0
Nov	1.0
Dec	1.0

Yearly

Year	Avg. Q (mgd)
2008	0.20
2018	0.20
2028	0.20
2038	0.20
2048	0.20
2058	0.20

Analysis Notes

*Assumed plant operates at permitted limit (0.20 mgd) with no plans to expand.
*Permitted limit (mgd) is:

OWNER: **Bowater, Inc.**

HDR ID	Facility	Type
SWF - 2	Pulp and Paper Mill	Withdrawal
SDF - 1	Pulp and Paper Mill	Discharge

CONTACT: Dale Herendeen

Proj. By: *PNB/LKM*

HDR ID: **SWF - 2**
FACILITY: **Pulp and Paper Mill**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	37.65	36.29	NA	24.52	24.32
Feb	36.66	34.48		24.00	24.48
Mar	37.71	36.29		25.19	29.55
Apr	38.30	37.50		25.00	29.90
May	38.19	37.39		24.84	29.87
Jun	38.40	35.60		25.87	30.80
Jul	38.19	37.19		26.55	31.26
Aug	38.39	38.39		26.68	31.48
Sep	38.20	37.20		25.57	31.43
Oct	40.55	35.52		25.23	31.10
Nov	34.57	36.10		24.73	31.83
Dec	39.35	36.29		25.32	32.52

Yearly

Year	Avg. Q (mgd)
1992	38.03
1997	36.53
1999	32.49
2002	25.30
2003	29.90

PROJECTION SUMMARY

AGR Industrial
0.50

Monthly

Month	Ann Avg Coefficient
Jan	0.97
Feb	0.95
Mar	1.00
Apr	0.99
May	0.98
Jun	1.02
Jul	1.05
Aug	1.05
Sep	1.01
Oct	1.00
Nov	0.98
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	30.00
2018	31.53
2028	33.15
2038	34.84
2048	36.62
2058	38.50

Analysis Notes

*Plant contact suggests a 30 MGD withdrawal for the next 10-20 years. Contact also verifies a consumptive use of 2 MGD. This is about 6.7% of total withdrawal.

*The current projections start in 2008 with a base flow of 30 MGD as reported and project to 2058 at 0.5% AGR

*The result gets the plant back to its highest capacity in the last 10 years (including the fact that they have recently optimized production).

*The highest recorded average monthly value withdrawal was 43.5 MGD

HDR ID: **SDF - 1**
FACILITY: **Pulp and Paper Mill - SC0001015**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	0.02	50.42	NA	26.78	NA
Feb	42.97	35.93		21.39	
Mar	39.38	34.19		22.01	
Apr	36.69	36.44		17.90	
May	34.69	30.35		17.28	
Jun	41.79	29.75		19.59	
Jul	30.29	32.17		23.28	
Aug	30.29	21.68		19.50	
Sep	33.69	17.62		17.50	
Oct	46.48	34.36		20.60	
Nov	37.40	50.79		32.02	
Dec	30.38	48.30		53.20	

Yearly

Year	Avg. Q (mgd)
1992	33.67
1997	35.17
1999	NA
2002	24.25
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.10
Feb	0.88
Mar	0.91
Apr	0.74
May	0.71
Jun	0.81
Jul	0.96
Aug	0.80
Sep	0.72
Oct	0.85
Nov	1.32
Dec	2.19

Yearly

Year	Avg. Q (mgd)
2008	28.07
2018	29.50
2028	31.01
2038	32.60
2048	34.26
2058	36.02

Type	Rate
Csmpt Use	6.4%

Analysis Notes

*Consumptive use is approx. 6.4%, based on historical data.
*Assumed that comsumptive use percentrage remains constant.
*The Plant has identified a 2 MGD consumptive use (evaporation of cooling water). Assuming a 0.5% annual growth in production, the withdrawal values also assume a 0.5% in evaporation, instead of a stagnant 2 MGD over the projection period.
*The discharge data will assume a consumptive use of 6.7%, which is approximately the 2 MGD of 30 MGD
*FYI - In 2002, Bowater conserved water usage by 20%. If this is the case, their 2002 value could be adjusted up to 30.31 MGD or 20% more than the reported 24.25 MGD.

OWNER: **Buck Creek Trout Farm**

HDR ID	Facility	Type
NWJ - 6	Buck Creek Trout Farm	Withdrawal
NDJ - 9	Buck Creek Trout Farm	Discharge

CONTACT: **Bill Ross**

Proj. By: *JCH*

HDR ID: **NWJ - 6**
FACILITY: **Buck Creek Trout Farm**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	1.30	NA	NA
Feb			1.30		
Mar			1.30		
Apr			1.30		
May			1.30		
Jun			1.30		
Jul			1.30		
Aug			1.30		
Sep			1.30		
Oct			1.30		
Nov			1.30		
Dec			1.30		

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	1.30
2002	NA
2003	NA

PROTECTION SUMMARY

AGR Industrial
0.00

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.00
Apr	1.00
May	1.00
Jun	1.00
Jul	1.00
Aug	1.00
Sep	1.00
Oct	1.00
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	1.30
2018	1.30
2028	1.30
2038	1.30
2048	1.30
2058	1.30

Analysis Notes
*Used 1999 withdrawal registration data from NCDWR to perform projections.
*Daily capacity of withdrawal in 1999 is 1.30 mgd.
*AGR not critical since all flow is assumed to return to system

HDR ID **NDJ - 9**
FACILITY: Buck Creek Trout Farm

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.0
Feb	1.0
Mar	1.0
Apr	1.0
May	1.0
Jun	1.0
Jul	1.0
Aug	1.0
Sep	1.0
Oct	1.0
Nov	1.0
Dec	1.0

Yearly

Year	Avg. Q (mgd)
2008	1.30
2018	1.30
2028	1.30
2038	1.30
2048	1.30
2058	1.30

Analysis Notes
*No listed NPDES permit.
*Assume that discharge equals withdrawal.

OWNER: **Camden**

HDR ID	Facility	Type
SWW - 1	Water Treatment Plant	Withdrawal

CONTACT: LKM discussion with Trueblood at meeting

Proj. By: *PNB/LKM*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	1.91	2.43	NA	2.58	2.55
Feb	1.88	2.40		2.48	2.58
Mar	1.96	2.41		2.42	2.42
Apr	2.10	2.31		2.73	2.24
May	2.41	2.49		2.83	2.31
Jun	2.30	2.45		3.02	2.37
Jul	2.82	2.70		3.21	2.56
Aug	2.30	2.92		3.15	2.83
Sep	2.21	2.61		2.75	2.55
Oct	1.97	2.44		2.63	2.96
Nov	1.98	2.33		2.87	2.51
Dec	1.97	2.41		2.42	2.34

Yearly

Year	Avg. Q (mgd)
1992	2.15
1997	2.49
1999	2.91
2002	2.76
2003	2.52

PROJECTION SUMMARY

AGR
1.50

Monthly

Month	Ann Avg Coefficient
Jan	0.94
Feb	0.90
Mar	0.88
Apr	0.99
May	1.02
Jun	1.10
Jul	1.16
Aug	1.14
Sep	1.00
Oct	0.95
Nov	1.04
Dec	0.88

Yearly

Year	Avg. Q (mgd)
2008	2.71
2018	3.15
2028	3.66
2038	4.24
2048	4.92
2058	5.72

Analysis Notes

*No classification on water use breakouts; assume overall 1.5 AGR for pop. growth and exp.

*Population data for Kershaw	AGR		
1980s	1.12	39,015	43,599
1990s	1.90	43,599	52,647
2000s proj. (by state)	1.13	52,647	58,880
2010s proj. (by state)	1.15	58,880	66,040
2020-25 proj (by state)	1.06	66,040	69,620

*Camden has experienced only a slight change in flow according to records.

AGR	2.08	2.49	2.76	1997:2002

*However 2003 was nearly the same as 1997; though it was a dry year.; use 2003 base year

*Future projections show modest growth for Kershaw

OWNER: **Carolina Water Service**

HDR ID	Facility	Type
NDY - 32	Queens Harbor WWTP	Discharge
NDY - 33	Riverpointe WWTP	Discharge
NDF - 6	Forest Ridge WWTP	Discharge

CONTACT: **James Highley**

Proj. By: *JCH*

HDR ID: **NDY - 32**
FACILITY: **Queens Harbor WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	NA
2002	0.1
2003	0.1

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.00
Apr	1.00
May	1.00
Jun	1.00
Jul	1.00
Aug	1.00
Sep	1.00
Oct	1.00
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	0.10
2018	0.10
2028	0.10
2038	0.10
2048	0.10
2058	0.10

Analysis Notes
*Plant likely runs at capacity with small neighborhood flow.
*Assumed plant operates at permitted limit (0.1 mgd) with no plans to expand.

HDR ID: **NDY - 33**
3/15/04 - Left message.
4/20/04 - Left another message. No response.

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	NA
2002	0.1
2003	0.1

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.00
Apr	1.00
May	1.00
Jun	1.00
Jul	1.00
Aug	1.00
Sep	1.00
Oct	1.00
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	0.10
2018	0.10
2028	0.10
2038	0.10
2048	0.10
2058	0.10

Analysis Notes
*Plant likely runs at capacity with small neighborhood flow.
*Assumed plant operates at permitted limit (0.1 mgd) with no plans to expand.

HDR ID: **NDF - 6**
OWNER: **Carolina Water Service**
FACILITY: **Forest Ridge WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.00
Apr	1.00
May	1.00
Jun	1.00
Jul	1.00
Aug	1.00
Sep	1.00
Oct	1.00
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	0.15
2018	0.15
2028	0.15
2038	0.15
2048	0.15
2058	0.15

Analysis Notes
*Assumed plant operates at permitted limit (0.15 mgd) with no plans to expand.

OWNER: **Carolina Water Service**

HDR ID	Facility	Type
SWY - 2	NOT USED	Withdrawal
SDY - 1	Tega Cay 2	Discharge
SDY - 2	Tega Cay 3	Discharge
SDF - 9	Lamplighter Village Sewer District	Discharge
SDF - 10	Foxwood Sewer District	Discharge

CONTACT: Bruce T Haas

Proj. By: *PNB*

HDR ID: **SWY - 2**
FACILITY: **NOT USED**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.0
Feb	1.0
Mar	1.0
Apr	1.0
May	1.0
Jun	1.0
Jul	1.0
Aug	1.0
Sep	1.0
Oct	1.0
Nov	1.0
Dec	1.0

Yearly

Year	Avg. Q (mgd)
2008	0.00
2018	0.00
2028	0.00
2038	0.00
2048	0.00
2058	0.00

Analysis Notes

HDR ID: **SDY - 1**
FACILITY: **Tega Cay 2**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan		0.20	NA	0.24	NA
Feb		0.23		0.27	
Mar		0.25		0.23	
Apr		0.26		0.17	
May		0.25		0.16	
Jun		0.23		0.14	
Jul	0.19	0.25		0.14	
Aug	0.21	0.21		0.15	
Sep	0.19	0.21		0.19	
Oct	0.26	0.21		0.19	
Nov	0.31	0.25		0.22	
Dec	0.24	0.29		0.29	

Yearly

Year	Avg. Q (mgd)
1992	0.23
1997	0.24
1999	NA
2002	0.20
2003	NA

PROJECTION SUMMARY

AGR Residential
2.00

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.15
Mar	0.99
Apr	0.74
May	0.69
Jun	0.61
Jul	0.69
Aug	0.62
Sep	0.82
Oct	0.79
Nov	0.95
Dec	1.22

Yearly

Year	Avg. Q (mgd)
2008	0.23
2018	0.26
2028	0.26
2038	0.26
2048	0.26
2058	0.26

Analysis Notes
*Assumed water demand will grow according to 2.0% AGR until plant has reached capacity of 0.26 mgd (80% of .32)
*Any increase in County water demand beyond plant capacity is assumed to be met by other providers.

HDR ID: **SDY - 2**
FACILITY: **Tega Cay 3**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	2003 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	0.11	0.15	NA	0.15	NA
Feb	0.12	0.16		0.15	
Mar	0.13	0.14		0.17	
Apr	0.12	0.11		0.16	
May	0.12	0.09		0.15	
Jun	0.13	0.09		0.14	
Jul	0.10	0.11		0.13	
Aug	0.11	0.08		0.14	
Sep	0.11	0.09		0.14	
Oct	0.13	0.09		0.70	
Nov	0.16	0.10		0.16	
Dec	0.12	0.12		0.15	

Yearly

Year	Avg. Q (mgd)
1992	0.12
1997	0.11
1999	NA
2002	0.20
2003	NA

PROJECTION SUMMARY

AGR Residential
5.00

Monthly

Month	Ann Avg Coefficient
Jan	0.77
Feb	0.76
Mar	0.86
Apr	0.81
May	0.78
Jun	0.73
Jul	0.67
Aug	0.72
Sep	0.73
Oct	3.57
Nov	0.84
Dec	0.76

Yearly

Year	Avg. Q (mgd)
2008	0.26
2018	0.43
2028	0.70
2038	1.00
2048	1.00
2058	1.00

Analysis Notes

*Permitted capacity is 1.3 MGD….assume that plant reaches approx. 80% of rated capacity (1.0) and flow is limited.
remainder of York Co. growth will occur in other providers.
(e.g. Fort Mill, Rock Hill)
*Assume growth at 5% AGR until capacity is reached
*Per KMB

HDR ID: **SDF - 9**
FACILITY: **Lamplighter Village Sewer District**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	0.15	NA	0.23	NA
Feb		0.16		0.23	
Mar		0.18		0.24	
Apr		0.17		0.23	
May		0.15		0.27	
Jun		0.15		0.24	
Jul		0.18		0.21	
Aug		0.15		0.21	
Sep		0.14		0.22	
Oct		0.15		0.22	
Nov		0.16		0.23	
Dec		0.18		0.22	

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.16
1999	NA
2002	0.23
2003	NA

PROJECTION SUMMARY

AGR Residential
2.00

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.04
Apr	0.98
May	1.17
Jun	1.06
Jul	0.92
Aug	0.91
Sep	0.97
Oct	0.96
Nov	1.02
Dec	0.97

Yearly

Year	Avg. Q (mgd)
2008	0.26
2018	0.32
2028	0.39
2038	0.47
2048	0.50
2058	0.50

Analysis Notes
*Assumed water demand will grow at 2.0 AGR until plant has reachedapprox. 80% of rated capacity (0.5 mgd.)
*Any increase in County water demand beyond plant capacity is assumed to be met by other providers.
*Rated capacity is 6.3 mgd

HDR ID: **SDF - 10**
FACILITY: **Foxwood Sewer District**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	0.04	NA	0.05	NA
Feb		0.05		0.04	
Mar		0.04		0.05	
Apr		0.04		0.05	
May		0.04		0.05	
Jun		0.04		0.04	
Jul		0.04		0.04	
Aug		0.03		0.04	
Sep		0.04		0.04	
Oct		0.04		0.04	
Nov		0.05		0.04	
Dec		0.04		0.04	

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.04
1999	NA
2002	0.04
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.04
Feb	1.01
Mar	1.04
Apr	1.04
May	1.08
Jun	0.89
Jul	0.99
Aug	0.97
Sep	0.99
Oct	0.99
Nov	0.99
Dec	0.97

Yearly

Year	Avg. Q (mgd)
2008	0.10
2018	0.10
2028	0.10
2038	0.10
2048	0.10
2058	0.10

Analysis Notes
*Flows not likely to increase because the plant probably serves "built-out" subdivision.
*Flows now currently less than 0.1 mgd, assume with rounding flat-line 0.1 mgd for projections.
*Assumed flows will reach 0.1 mgd and remain there throughout study period.

OWNER: **Celanese Acetate**

HDR ID	Facility	Type
SWF - 1	Celriver Plant	Withdrawal
SDF - 2	Celriver Plant	Discharge

CONTACT: Danny McCaskill

Proj. By: *PNB/LKM*

HDR ID: **SWF - 1**
FACILITY: **Celriver Plant**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	47.75	41.19	NA	35.74	36.97
Feb	47.89	39.19		34.59	38.72
Mar	50.87	37.87		36.06	37.84
Apr	53.92	38.84		35.43	36.80
May	52.11	42.90		35.77	36.61
Jun	77.12	47.75		38.10	37.20
Jul	58.53	49.44		38.45	40.55
Aug	57.43	48.98		36.29	48.68
Sep	52.53	48.32		37.40	45.17
Oct	50.07	47.35		35.90	40.19
Nov	45.44	46.70		34.57	39.10
Dec	43.00	41.21		34.94	35.61

Yearly

Year	Avg. Q (mgd)
1992	53.04
1997	44.16
1999	45.32
2002	36.11
2003	39.46

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.99
Feb	0.96
Mar	1.00
Apr	0.98
May	0.99
Jun	1.06
Jul	1.06
Aug	1.01
Sep	1.04
Oct	0.99
Nov	0.96
Dec	0.97

Yearly

Year	Avg. Q (mgd)
2008	60.00
2018	60.00
2028	60.00
2038	60.00
2048	60.00
2058	60.00

Analysis Notes

*This assumes no major new intake modifications or extensive plant expansions.

*While rapid expansion of flow back to peak is unlikely, the past decade trend shows possible

*The Celriver Plant is currently in a time of low production. Water withdrawals are directly linked to production rates. The plant contact forecast that production will increase in the upcoming years but is unsure of a foreseeable range. The plant contact also mentioned that the 50 - 55 MGD is a max withdrawal range. However the Plant withdrew a maximum of 76 MGD in June of 1992 and has exceeded the 50-55 MGD several times. Withdrawal data is reported back to 1983.

*The first cut at projections used data from 1992 on and the resulting flows decreased to zero. A second cut uses the full range of data (1983-2003) and shows a more meager decrease.

*The Plant Contact suspects that the withdrawal meter is not accurate and reports values less than actual. The discharge meter is accurate for regulatory reasons and therefore withdrawals.

* Estimates should be increased 10% (3-4% for evaporative loss and 7% for reading inaccuracy). There is no loss of water in the system other than evaporation out of the cooling systems, which was about 3-4% of the withdrawal flows.

*Assume for conservatism that the future is flat-lined at 60 MGD withdrawal and a 5% consumptive use.

*Data is not availabe for finer projections and with a 5% consumptive use, the difference of 60 MGD and 40 MGD is only 1.0 MGD for consumptive use.

HDR ID: **SDF - 2**
FACILITY: **Celriver Plant**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	50.90	41.09	NA	40.22	NA
Feb	50.80	42.70		38.40	
Mar	53.50	42.05		39.98	
Apr	54.40	41.97		36.85	
May	56.00	44.87		37.96	
Jun	61.60	51.08		39.63	
Jul	63.30	55.22		40.05	
Aug	61.50	53.22		39.67	
Sep	59.30	53.14		40.88	
Oct	54.54	50.70		38.86	
Nov	49.69	44.59		36.62	
Dec	45.74	44.96		35.94	

Yearly

Year	Avg. Q (mgd)
1992	55.11
1997	47.13
1999	NA
2002	38.75
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.99
Feb	0.96
Mar	1.00
Apr	0.98
May	0.99
Jun	1.06
Jul	1.06
Aug	1.01
Sep	1.04
Oct	0.99
Nov	0.96
Dec	0.97

Yearly

Year	Avg. Q (mgd)
2008	57.00
2018	57.00
2028	57.00
2038	57.00
2048	57.00
2058	57.00

Analysis Notes
*Assumed that evaporative and other minor losses contribute to a consumption rate of approx. 5% of withdrawn water.

OWNER: **City of Cherryville**

HDR ID	Facility	Type
NWY - 9	Cherryville WTP	Withdrawal
NDY - 15	Cherryville WWTP	Discharge

CONTACT: **Patty Hall**

Proj. By: *JCH*

HDR ID: **NWY - 9**
FACILITY: **Cherryville WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.92	NA
Feb				0.84	
Mar				0.82	
Apr				0.92	
May				0.96	
Jun				1.01	
Jul				0.75	
Aug				0.63	
Sep				0.58	
Oct				0.76	
Nov				0.76	
Dec				0.77	

Yearly

Year	Avg. Q (mgd)
1992	1.66
1997	1.60
1999	NA
2002	0.82
2003	NA

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.00	1.66

Monthly

Month	Ann Avg Coefficients
Jan	1.13
Feb	1.03
Mar	1.01
Apr	1.13
May	1.18
Jun	1.23
Jul	0.92
Aug	0.77
Sep	0.71
Oct	0.94
Nov	0.93
Dec	0.95

Yearly

Year	Avg. Q (mgd)
2008	0.91
2018	1.02
2028	1.15
2038	1.30
2048	1.46
2058	1.65

Projection Analysis

Type	2008	2018	2028	2038	2048	2058
Res. Cust	2,740	3,026	3,343	3,693	4,079	4,506
Demand	446,000	492,000	544,000	601,000	664,000	733,000
Com. Cust.	258	285	315	348	384	424
Demand	96,000	106,000	117,000	129,000	142,000	157,000
Ind. Cust	31	36	43	51	60	70
Demand	188,000	221,000	261,000	308,000	363,000	427,000
Inst. Cust	0	0	0	0	0	0
Demand	0	0	0	0	0	0
TOTALS	**3,029**	**3,348**	**3,701**	**4,091**	**4,523**	**5,001**
	913,000	**1,024,000**	**1,153,000**	**1,298,000**	**1,461,000**	**1,646,000**

Type	2002 LWSP	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	2,581	163	4,756	5,361	1.00	1.66
Com. Cust.	243	370				
Ind. Cust	28	6,071				
Inst. Cust	0	0				
TOTAL	**2,852**	-				

Backwash & Unaccounted For 20%

Analysis Notes

*Data Source: 1997 and 2002 LWSP
*Projections based on annual growth rate (residential and commercial) and gpd/customer. Lost 1 major indusry between 1992 and 2002. Assumed small amount of growth during study period.
*Res./Comm. AGR based on projected population growth in Gaston County, according to NC OSP.
*Ind. AGR based on growth trends of surrounding industries, according to NC GSP.
*AGR assumed based on Gastonia sheet info. for Gaston Co. and approach used in Belmont

HDR ID: **NDY - 15**
FACILITY: **Cherryville WWTP**

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.55	0.35
Feb				0.45	0.49
Mar				0.60	0.68
Apr				0.43	0.98
May				0.38	1.01
Jun				0.38	0.87
Jul				0.34	0.85
Aug				0.38	1.09
Sep				0.39	0.97
Oct				0.43	0.74
Nov				0.55	0.63
Dec				0.65	0.58

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	1.16
1999	NA
2002	0.46
2003	0.77

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.00	1.66

Monthly

Month	Ann Avg Coefficient
Jan	1.20
Feb	0.98
Mar	1.31
Apr	0.93
May	0.83
Jun	0.83
Jul	0.74
Aug	0.82
Sep	0.85
Oct	0.94
Nov	1.21
Dec	1.42

Yearly

Year	Avg. Q (mgd)
2008	0.82
2018	0.92
2028	1.03
2038	1.16
2048	1.31
2058	1.47

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	510,000	75.0%	1.00	1.66	0.58
Ind/Inst	170,000	25.0%			0.19
Total	**680,000**	-	-	-	**0.77**

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.61	0.67	0.74	0.82	0.90	1.00
Ind/Inst Demand	0.21	0.25	0.29	0.34	0.40	0.48
Total	**0.82**	**0.92**	**1.03**	**1.16**	**1.31**	**1.47**

Analysis Notes
*Data source: DMRs from DWQ
*Wastewater projections are based on the percentage of water usage by sector and the growth rate of those sectors.

Owner: **Chester Metro**

HDR ID	Facility	Type
SWF - 7	12WS002S01	Withdrawal

Contacts: Mike Medlin

Proj. By: *LKM*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1997 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	2.62	3.55	NA	3.26	3.14
Feb	2.58	3.39		3.22	3.31
Mar	2.51	3.37		3.42	3.24
Apr	2.53	3.32		3.42	2.94
May	2.37	3.69		3.45	2.95
Jun	2.65	3.70		3.69	3.14
Jul	2.69	3.94		3.79	3.05
Aug	2.79	3.81		4.22	3.21
Sep	2.56	3.56		3.95	3.12
Oct	2.45	3.72		3.26	3.14
Nov	2.45	3.25		3.25	2.81
Dec	2.47	3.36		2.85	2.86

Yearly

Year	Avg. Q (mgd)
1992	2.56
1997	3.55
1999	3.67
2002	3.47
2003	3.08

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.94
Feb	0.93
Mar	0.98
Apr	0.98
May	0.99
Jun	1.06
Jul	1.09
Aug	1.21
Sep	1.14
Oct	0.94
Nov	0.93
Dec	0.82

Yearly

Year	Avg. Q (mgd)
2008	3.97
2018	6.98
2028	10.23
2038	13.75
2048	17.18
2058	19.94

Staggered AGR	
2002 - 2008	2.22%
2008 - 2018	5.80%
2018 - 2028	3.90%
2028 - 2038	3.00%
2038 - 2048	2.25%
2048 - 2058	1.50%

Analysis Notes

*Short-term AGR based on 2004 IBT Permit Application, which projects aggressive service area expansion.

*Longer term AGR based on information provided by Chester regarding potential industrial mega-site and pop. growth

OWNER: **Chester Sewer District**

HDR ID	Facility	Type
SDG - 1	Lando Manetta WWTP	Discharge
SDC - 1	Rocky Creek	Discharge

Contacts: Mike Medlin

Proj. By: *LKM*

HDR ID: **SDG - 1**
FACILITY: **Lando Manetta WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	0.03	0.10	NA	0.09	0.13
Feb	0.07	0.10		0.13	0.10
Mar	0.10	0.10		0.10	0.07
Apr	0.02	0.10		0.11	0.09
May	0.02	0.10		0.12	0.08
Jun	0.10	0.10		2.82	0.08
Jul	0.10	0.10		0.10	0.08
Aug	0.10	0.10		0.10	0.12
Sep	0.10	0.10		0.10	0.17
Oct	0.10	0.10		0.12	0.16
Nov	0.10	0.10		0.10	0.10
Dec	0.20	0.10		0.09	0.09

Yearly

Year	Avg. Q (mgd)
1992	0.09
1997	0.10
1999	NA
2002	0.33
2003	0.11

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.27
Feb	0.39
Mar	0.30
Apr	0.33
May	0.36
Jun	8.50
Jul	0.30
Aug	0.30
Sep	0.30
Oct	0.36
Nov	0.30
Dec	0.27

Yearly

Year	Avg. Q (mgd)
2008	0.11
2018	0.47
2028	1.12
2038	2.01
2048	3.12
2058	4.23

Staggered AGR	
2003 - 2008	0.30%
2008 - 2018	16.00%
2018 - 2028	9.00%
2028 - 2038	6.00%
2038 - 2048	4.50%
2048 - 2058	3.10%

Analysis Notes
*AGR based, in part, on water projections prepared for the Chester IBT application.
*Longer term AGR based on information provided by Chester regarding potential industrial mega-site and pop. growth

HDR ID: **SDC - 1**
FACILITY: **Rocky Creek**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	0.70	0.80	NA	0.50	0.60
Feb	0.60	0.60		0.54	0.70
Mar	0.50	0.60		0.50	0.50
Apr	0.40	0.60		0.70	0.50
May	0.40	0.50		0.60	0.50
Jun	0.40	0.70		0.60	0.50
Jul	0.40	0.70		0.60	0.50
Aug	0.50	0.90		0.50	0.80
Sep	0.40	0.80		0.60	1.00
Oct	0.40	0.70		0.60	0.90
Nov	0.60	0.70		0.50	0.70
Dec	0.40	0.60		0.50	0.50

Yearly

Year	Avg. Q (mgd)
1992	0.48
1997	0.68
1999	NA
2002	0.56
2003	0.64

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.89
Feb	0.96
Mar	0.89
Apr	1.25
May	1.07
Jun	1.07
Jul	1.07
Aug	0.89
Sep	1.07
Oct	1.07
Nov	0.89
Dec	0.89

Yearly

Year	Avg. Q (mgd)
2008	0.74
2018	0.94
2028	1.24
2038	1.67
2048	2.31
2058	2.93

Staggered AGR	
2003 - 2008	3.00%
2008 - 2018	2.40%
2018 - 2028	2.80%
2028 - 2038	3.00%
2038 - 2048	3.30%
2048 - 2058	2.40%

Analysis Notes
*AGR based, in part, on water projections prepared for the Chester IBT application.
*Longer term AGR based on information provided by Chester regarding potential industrial mega-site and pop. growth

OWNER: **City of Claremont**

HDR ID	Facility	Type
NDN - 1	McLin Creek WWTP	Discharge
NDN - 2	North WWTP	Discharge
NDN - 3	South WWTP	Discharge

CONTACT: **Dean McGinnis**

Proj. By: *JCH*

HDR ID: **NDN - 1**
FACILITY: **McLin Creek WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.18	0.14
Feb				0.15	0.13
Mar				0.17	0.18
Apr				0.19	0.21
May				0.19	0.23
Jun				0.19	0.20
Jul				0.18	0.19
Aug				0.19	0.19
Sep				0.18	0.16
Oct				0.17	0.15
Nov				0.20	0.15
Dec				0.20	0.16

Yearly

Year	Avg. Q (mgd)
1992	0.06
1997	0.17
1999	NA
2002	0.18
2003	0.18

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.40	1.66

Monthly

Month	Ann Avg Coefficient
Jan	1.02
Feb	0.83
Mar	0.92
Apr	1.03
May	1.05
Jun	1.06
Jul	0.99
Aug	1.06
Sep	1.02
Oct	0.97
Nov	1.10
Dec	1.09

Yearly

Year	Avg. Q (mgd)
2008	0.18
2018	0.21
2028	0.24
2038	0.28
2048	0.33
2058	0.38

Analysis Notes
Analysis Notes
*Historical Flow Data Source: DMRs from Division of Water Quality
*Wastewater projections are based on the percentage of water usage by sector and the growth rate of those sectors.
*Assume AGR of 1.40 based on Catawba Co. growth rate (see Hickory)….
*This AGR will accommodate future pop. growth with minimal service area expansion. That expansion was assumed in Hickory projections.
*AGR of 1.66 is assumed for industrial - 1990s manufacturing NC GSP less inflation
*Note that Claremont's usage has a large industrial component

Analysis Notes

Type	2002 LWSP	GPD/Cust	1997 LWSP	2002 LWSP	AGR	AGR Ind.
Res. Cust	687	141	1,026	1,450	1.40	1.66

Res. Cust	687	141	1,036	1,450	1.40	1.66
Com. Cust.	50	300				
Ind. Cust	51	2,255				
Inst. Cust	10	1,500				
TOTAL	**788**	**-**				

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	112,000	46.3%	1.40	1.66	0.08
Ind/Inst	130,000	53.7%			0.10
Total	**242,000**	**-**	**-**	**-**	**0.18**

Wastewater Projections

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.09	0.10	0.12	0.14	0.16	0.18
Ind/Inst Demand	0.09	0.11	0.13	0.15	0.17	0.21
Total	**0.18**	**0.21**	**0.24**	**0.28**	**0.33**	**0.38**

HDR ID: NDN - 2
FACILITY: North WWTP

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.05	0.06
Feb				0.05	0.06
Mar				0.06	0.07
Apr				0.05	0.09
May				0.05	0.09
Jun				0.05	0.08
Jul				0.04	0.08
Aug				0.05	0.07
Sep				0.04	0.06
Oct				0.04	0.06
Nov				0.05	0.06
Dec				0.06	0.05

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.09
1999	NA
2002	0.05
2003	0.07

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.40	1.66

Monthly

Month	Ann Avg Coefficient
Jan	1.03
Feb	1.04
Mar	1.12
Apr	0.99
May	0.93
Jun	0.91
Jul	0.90
Aug	0.92
Sep	0.86
Oct	0.89
Nov	1.05
Dec	1.18

Yearly

Year	Avg. Q (mgd)
2008	0.08
2018	0.09
2028	0.10
2038	0.12
2048	0.14
2058	0.16

Analysis Notes
*Historical Flow Data Source: DMRs from Division of Water Quality
*Wastewater projections are based on the percentage of water usage by sector and the growth rate of those sectors.

Analysis Notes

Type	2002 LWSP	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	687	141	1,036	1,450	3.42	0.50
Com. Cust.	50	300				
Ind. Cust	51	2,255				
Inst. Cust	10	1,500				
TOTAL	**788**	**-**				

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	112,000	46.3%	1.40	1.66	0.03
Ind/Inst	130,000	53.7%			0.04
Total	**242,000**	**-**	**-**	**-**	**0.07**

Wastewater Projections

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.03	0.04	0.05	0.05	0.06	0.07
Ind/Inst Demand	0.04	0.05	0.06	0.07	0.08	0.09
Total	**0.08**	**0.09**	**0.10**	**0.12**	**0.14**	**0.16**

HDR ID: **NDN - 3**
FACILITY: **South WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.075
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.40	1.66

Monthly

Month	Ann Avg Coefficient
Jan	1.03
Feb	1.04
Mar	1.12
Apr	0.99
May	0.93
Jun	0.91
Jul	0.90
Aug	0.92
Sep	0.86
Oct	0.89
Nov	1.05
Dec	1.18

Yearly

Year	Avg. Q (mgd)
2008	0.09
2018	0.10
2028	0.12
2038	0.14
2048	0.16
2058	0.19

Analysis Notes

*Historical Flow Data Source: DMRs from Division of Water Quality

*Wastewater projections are based on the percentage of water usage by sector and the growth rate of those sectors.

Analysis Notes

Type	2002 LWSP	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	687	141	1,036	1,450	3.42	0.50
Com. Cust.	50	300				
Ind. Cust	51	2,255				

Ind. Cust	51	2,255
Inst. Cust	10	1,500
TOTAL	**788**	**-**

Type	Flow	Percentage	Res AGR	Ind AGR	1997 Base
Res/Com	112,000	46.3%	1.40	1.66	0.03
Ind/Inst	130,000	53.7%			0.04
Total	**242,000**	**-**	**-**	**-**	**0.08**

Wastewater Projections

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.04	0.05	0.05	0.06	0.07	0.08
Ind/Inst Demand	0.05	0.06	0.07	0.08	0.09	0.11
Total	**0.09**	**0.10**	**0.12**	**0.14**	**0.16**	**0.19**

OWNER: **Clariant Corporation**

HDR ID	Facility	Type
NWY - 2	Mt. Holly Plant	Withdrawal
NDY - 1	Mount Holly East (MHE) Facility	Discharge

CONTACT: **Gary Sanderson**

Proj. By: *JCH*

HDR ID: **NWY - 2**
FACILITY: **Mt. Holly Plant**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	0.81	NA	NA
Feb			0.99		
Mar			1.12		
Apr			1.02		
May			1.10		
Jun			1.11		
Jul			0.99		
Aug			1.00		
Sep			1.00		
Oct			1.08		
Nov			0.99		
Dec			0.87		

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	1.01
2002	NA
2003	0.27

PROJECTION SUMMARY

AGR Industrial
4.35

Monthly

Month	Ann Avg Coefficient
Jan	0.81
Feb	0.98
Mar	1.11
Apr	1.01
May	1.09
Jun	1.10
Jul	0.98
Aug	0.99
Sep	0.99
Oct	1.07
Nov	0.98
Dec	0.87

Yearly

Year	Avg. Q (mgd)
2008	0.33
2018	0.51
2028	0.78
2038	1.20
2048	1.83
2058	2.81

Analysis Notes
*Daily capacity of withdrawal is 1.008 mgd.
*Used 1999 withdrawal registration data from NCDWR to perform projections.
*AGR based on NC GSP data for chemicals, textile, and paper industries.

HDR ID: **NDY - 1**
FACILITY: **Mount Holly East (MHE) Facility**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.61	0.81
Feb				0.33	0.56
Mar				0.49	0.52
Apr				0.59	1.01
May				0.55	1.18
Jun				0.88	1.26
Jul				0.82	1.40
Aug				0.64	1.10
Sep				0.62	1.06
Oct				0.62	0.67
Nov				0.75	0.42
Dec				0.84	0.20

Yearly

Year	Avg. Q (mgd)
1992	1.20
1997	1.24
1999	1.21
2002	0.58
2003	0.88

PROJECTION SUMMARY

AGR Industrial
2.55

Monthly

Month	Ann Avg Coefficient
Jan	0.92
Feb	0.64
Mar	0.59
Apr	1.15
May	1.35
Jun	1.44
Jul	1.60
Aug	1.26
Sep	1.21
Oct	0.76
Nov	0.48
Dec	0.23

Yearly

Year	Avg. Q (mgd)
2008	0.99
2018	1.28
2028	1.64
2038	2.11
2048	2.72
2058	3.50

Analysis Notes
*Historical Flow Data Source: DMRs from Division of Water Quality
*Permit limit is 3.9 MGD
*AGR based on an assumed discharge rate of 3.5 MGD by the year 2058 (approx. 80% of plant capacity)

OWNER: **Charlotte Mecklenburg Utilities**

HDR ID	Facility	Type
NWN - 1	North Mecklenburg WTP	Withdrawal
NWM - 1	Franklin and Vest WTP	Withdrawal
NDM - 1	North Mecklenburg WTP	Discharge
NDM - 2	McDowell WWTP	Discharge
NDF - 1	Franklin WTP	Discharge
NDF - 2	Irwin Creek WWTP	Discharge
NDF - 3	Sugar Creek WWTP	Discharge
NDF - 4	McApline Creek WWTP	Discharge
NIBT - 2	Mallard Creek WWTP	Transfer

CONTACT: Meeting with Gullet, Klein, Mosteller, Cooke, Bruce

Proj. By: *LKM*

Population Data/Information

NC - Office of Planning			AGR		Population Density (persons/sq. mi)
1980s	404,270	511,433	2.38%	***ver. w/Chamber***	970
1990s	511,433	695,454	3.12%	***ver. w/Chamber***	1,320
Proj. - 2000 to 2030	695,454	1,317,738	2.15%		2,500
Mecklenburg Planning					
Hammer Projs. - 2000 to 2035	695,454	1,316,114	1.84%		2,497
Chamber - 2000 to 2010	695,454	990,525	3.60%	***ver. w/Chamber***	1,880
Hammer Projs - by decade					
2000s	695,454	860,469	2.15%		1,633
2010s	860,469	1,058,047	2.09%		2,008
2020s	1,058,047	1,242,130	1.62%		2,357
2030s to 2035	1,242,130	1,316,114	1.16%		2,497
Water Supply Study	695,454	773,299			1,467
Water Supply Study Projections					
2000	695,454	957,567	3.25%		1,817
2010	957,567	1,167,268	2.00%		2,215
2020	1,167,268	1,354,663	1.50%		2,571
2030	1,354,663	1,496,390	1.00%		2,839
2040	1,496,390	1,612,484	0.75%		3,060
2050	1,612,484	1,694,947	0.50%		3,216
2060	1,694,947				-
Average AGR 2000-2060	695,454	1,694,947	1.50%		
2000-2003	695,454	773,299	3.60%		1,467

Projection Analysis

Type	2010	2020	2030	2040	2050	2060
Res. Cust	235,089	286,572	332,579	367,374	395,876	416,121
Demand	79,251,000	95,926,000	108,262,000	118,939,000	127,685,000	133,897,000
Com. Cust.	22,654	27,615	32,049	35,402	38,148	40,099
Demand	39,561,000	48,225,000	55,967,000	61,822,000	66,618,000	70,025,000
Ind. Cust	2,598	2,730	2,870	3,017	3,171	3,333
Demand	582,000	612,000	643,000	676,000	710,000	747,000
Inst. Cust	1,639	1,723	1,811	1,904	2,001	2,104
Demand	367,000	386,000	406,000	426,000	448,000	471,000
Wholesale	3	3	3	3	3	3
Cust. Demand	1,970,000	1,970,000	1,970,000	1,970,000	1,970,000	1,970,000
TOTALS	**261,983**	**318,644**	**369,312**	**407,699**	**439,199**	**461,660**
	132,451,000	**160,075,000**	**181,977,000**	**200,022,000**	**214,818,000**	**225,349,000**

Type	2002 LWSP	Q (MGD)	GPD/Cust	1997 LWSP	2002 LWSP	AGR	AGR Ind.	
Res. Cust	182,017	62.06	341	450,777	584,000	3.25%	1.66%	2000 to 2010
Com. Cust.	17,540	30.63	1,746		5.31%	2.00%	0.50%	2010 to 2020
Ind. Cust	2,277	0.51	224			1.50%	0.50%	2020 to 2030
Inst. Cust	1,437	4.53	3,152			1.00%	0.50%	2030 to 2040
TOTAL	**203,271**	**97.73**	**-**			0.75%	0.50%	2040 to 2050
Sales to Other Systems						0.50%	0.50%	2050 to 2060
Concord		1.60						
York Co.		0.34						
Union County		0.03						
subtotal wholesale		1.97						
System Process Water		1.59						
subtotal		101.29						
Unaccounted For Water		8.92	8.09%					
Total		110.21						

HDR ID: **NWN - 1** and **NWM - 1**
FACILITY: **North Mecklenburg WTP**
Franklin and Vest WTP

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	91.90	89.90
Feb				89.43	85.59
Mar				89.95	84.83
Apr				110.41	89.38
May				131.25	97.12
Jun				144.24	100.92
Jul				138.29	107.49
Aug				129.20	107.37
Sep				111.79	118.39
Oct				104.54	110.86
Nov				93.68	98.49
Dec				89.00	87.12

Yearly

Year	Avg. Q (mgd)
1992	71.24
1997	95.52
1999	NA
2002	110.21
2003	98.12

Assume	Vest+Frank.	N. Meck
2002	93.5	16.7
2003	83.4	14.7

Monthly

Month	Ann Avg Coefficient
Jan	0.83
Feb	0.81
Mar	0.82
Apr	1.00
May	1.19
Jun	1.31
Jul	1.25
Aug	1.17
Sep	1.01
Oct	0.95
Nov	0.85
Dec	0.81

Yearly

North Meck WTP

Year	Avg. Q (mgd)
2008	18.00
2018	29.55
2028	37.60
2038	41.41
2048	46.86
2058	48.24

Franklin and Vest WTP

Year	Avg. Q (mgd)
2008	110.00
2018	125.00
2028	140.00
2038	155.00
2048	165.00
2058	175.00

Year	Franklin	Vest	North Meck	Total
2002 RC	**181**	**36**	**25**	**242**
2004 IC	**330**		**108**	**438**
2008	90	20	18.0	128.0
2018	105	20	29.6	154.6
2028	120	20	37.6	177.6
2038	135	20	41.4	196.4
2048	145	20	46.9	211.9
2058	155	20	48.2	223.2

Analysis Notes

*Historical Data is total withdrawal for North Mecklenburg WTP, Franklin WTP, and Vest WTP.
*Assume GPD/Customer stays the same for existing customers; drops 10% for new customers
*Assume primary service providers for Mecklenburg Co. - little supply outside the County - these projections included with others
*The linear interpolation between even years to get to '08s not accurate, but reasonable
*This analysis also uses as a baseline water flow the 2002 usage which was during the period of severe drought
*The above analysis shows meeting the needs of new growth in Mecklenburg related to population,
assuming the population estimates are correct, not current residents, who are not yet customers
*Vest and Franklin WTPs treated as one withdrawal.

HDR ID: **NDM - 1**
FACILITY: **North Mecklenburg WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	NA
2002	0.2
2003	0.2

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.83
Feb	0.81
Mar	0.82
Apr	1.00
May	1.19
Jun	1.31
Jul	1.25
Aug	1.17
Sep	1.01
Oct	0.95
Nov	0.85
Dec	0.81

Yearly

Year	Avg. Q (mgd)
2008	0.27
2018	0.44
2028	0.56
2038	0.62
2048	0.70
2058	0.72

Analysis Notes
*DMR Data from State Does Not Appear Useable for Monthly Averages on WTP Discharge
*1997 Backwash as % of Total Water Demand 1.70%
*2002 Backwash as % of Total Water Demand 1.44%

*Use 1.50% as backwash waste

General Wastewater Projections for CMUD

Water

	McDowell	Sugar	Irwin	McAlpine	Mallard	Total	Water Demand	Wastewater as % of Water Provided
1992	2.0	13.3	12.9	30.4	2.7	61.2	71.2	86.0%
1993	2.1	10.9	12.7	30.6	3.6	59.9		
1994	1.9	10.2	11.5	27.7	3.9	55.2		
1995	2.2	10.4	8.7	32.5	4.3	58.1		
1996						-		
1997	2.5	12.8	10.4	37.2	5.0	67.9	95.5	71.1%
1998	2.9	14.7	10.3	37.5	5.5	70.9		
1999	4.2	14.8	10.8	38.3		68.1		
2000	4.5	14.2	11.0	43.6		73.3		
2001	4.5	13.9	11.5	39.4		69.3		
2002	4.9	12.7	11.7	40.6		69.9	110.2	63.4% drought conditions
2003	5.7	14.4	12.7	50.3	8.0	91.1	98.1	92.9% heavily wet year
								78.4% average
						Assume		75.0% of water treated is returned

Total Water	Total Wastewater	McAlpine	Sugar	Irwin	Mallard	McDowell	to WSACC	Year	Avg. Q (mgd)
128.0	96.0	50.3	15.0	12.0	9.5	7.4	1.8	2008	96.0
154.6	115.9	58.7	20.0	12.0	11.5	11.6	2.2	2018	115.9
177.6	133.2	66.6	25.0	12.0	13.2	13.9	2.5	2028	133.2
196.4	147.3	72.3	30.0	12.0	14.6	15.7	2.8	2038	147.3
211.9	158.9	75.7	35.0	12.0	15.7	17.5	3.0	2048	158.9
223.2	167.4	78.2	40.0	12.0	16.6	17.5	3.1	2058	167.4

Analysis Notes

*McDowell Projections are based on Study Report

*Assumes Clear, Goose, Crooked Creek come back to McAlpine

*Since McAlpine, Sugar, and Irwin are into Fishing Creek Reservoir, then allocations are less important for these as individual sys.

*Assume 9.5 MGD to start for Mallard in 2008 and escalating at same rate as total wastewater

*Assumes Rocky River, Clarke, Lower Clarke, Reedy, McKee discharge to WSACC into the Rocky River Basin - projections based on growth rate and IBT balance provided by CMUD

*The general wastewater projections above analysis to arrive at 75% does not account for any wastewater to WSACC facilities.- good assumption

HDR ID: **NDM - 2**
FACILITY: **McDowell WWTP**

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	4.80	5.01
Feb				4.74	5.65
Mar				5.03	6.14
Apr				4.88	6.88
May				4.63	6.95
Jun				4.56	6.45
Jul				4.67	5.95
Aug				4.66	5.44
Sep				4.83	5.35
Oct				5.10	5.25
Nov				5.25	4.88
Dec				5.56	4.85

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	2.45
1999	NA
2002	4.89
2003	5.73

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.98
Feb	0.97
Mar	1.03
Apr	1.00
May	0.95
Jun	0.93
Jul	0.95
Aug	0.95
Sep	0.99
Oct	1.04
Nov	1.07
Dec	1.14

Yearly

Year	Avg. Q (mgd)
2008	7.40
2018	11.60
2028	13.90
2038	15.70
2048	17.50
2058	17.50

HDR ID: **NDF - 1**
FACILITY: **Franklin WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	1.40
1999	NA
2002	1.60
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	
Feb	
Mar	
Apr	
May	
Jun	
Jul	
Aug	
Sep	
Oct	
Nov	
Dec	

Yearly

Year	Avg. Q (mgd)
2008	1.65
2018	1.88
2028	2.10
2038	2.33
2048	2.48
2058	2.63

Analysis Notes
*Use 1.50% as backwash waste

HDR ID: **NDF - 2**
FACILITY: **Irwin Creek WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	11.70	9.45
Feb				11.08	10.89
Mar				11.74	12.45
Apr				11.15	12.68
May				9.42	12.70
Jun				9.11	11.83
Jul				9.62	10.78
Aug				9.39	11.74
Sep				10.59	9.94
Oct				11.33	9.59
Nov				10.44	9.40
Dec				10.89	9.81

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	6.98
1999	NA
2002	10.54
2003	10.94

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.11
Feb	1.05
Mar	1.11
Apr	1.06
May	0.89
Jun	0.86
Jul	0.91
Aug	0.89
Sep	1.00
Oct	1.08
Nov	0.99
Dec	1.03

Yearly

Year	Avg. Q (mgd)
2008	12.00
2018	12.00
2028	12.00
2038	12.00
2048	12.00
2058	12.00

Analysis Notes
*see above

HDR ID: **NDF - 3**
FACILITY: **Sugar Creek WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	11.77	13.58
Feb				11.39	13.89
Mar				11.82	15.94
Apr				12.59	15.92
May				12.66	16.76
Jun				12.91	15.93
Jul				12.80	14.03
Aug				12.19	13.73
Sep				12.68	13.90
Oct				13.56	13.25
Nov				13.86	13.06
Dec				14.48	13.29

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	12.81
1999	NA
2002	12.73
2003	14.44

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.92
Feb	0.89
Mar	0.93
Apr	0.99
May	0.99
Jun	1.01
Jul	1.01
Aug	0.96
Sep	1.00
Oct	1.06
Nov	1.09
Dec	1.14

Yearly

Year	Avg. Q (mgd)
2008	15.00
2018	20.00
2028	25.00
2038	30.00
2048	35.00
2058	40.00

Analysis Notes
*see above

HDR ID: **NDF - 4**
Facility: **McApline Creek WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	37.93	40.21
Feb				38.10	49.07
Mar				41.97	57.37
Apr				39.85	62.85
May				39.08	62.84
Jun				38.95	63.35
Jul				39.67	55.48
Aug				39.65	53.21
Sep				40.94	42.16
Oct				41.58	40.42
Nov				43.00	38.53
Dec				46.35	38.62

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	37.31
1999	NA
2002	40.59
2003	50.34

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.93
Feb	0.94
Mar	1.03
Apr	0.98
May	0.96
Jun	0.96
Jul	0.98
Aug	0.98
Sep	1.01
Oct	1.02
Nov	1.06
Dec	1.14

Yearly

Year	Avg. Q (mgd)
2008	50.30
2018	58.70
2028	66.60
2038	72.30
2048	75.70
2058	78.20

Analysis Notes
*see above

OWNER: **Coats American**

HDR ID	Facility	Type
NWJ - 1	Sevier Finishing Plant	Withdrawal
NDJ - 2	Sevier Finishing Plant	Discharge

CONTACT: **Jerry McKinney**

Proj. By: *JCH*

HDR ID: **NWJ - 1**
FACILITY: **Sevier Finishing Plant**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	1.00	NA	NA
Feb			1.00		
Mar			1.00		
Apr			1.10		
May			1.20		
Jun			1.30		
Jul			1.10		
Aug			1.20		
Sep			1.00		
Oct			0.87		
Nov			0.78		
Dec			0.83		

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	1.03
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
1.66

Monthly

Month	Avg Month Ann Avg
Jan	0.97
Feb	0.97
Mar	0.97
Apr	1.07
May	1.16
Jun	1.26
Jul	1.07
Aug	1.16
Sep	0.97
Oct	0.84
Nov	0.76
Dec	0.80

Yearly

Year	Avg. Q (mgd)
2008	1.20
2018	1.41
2028	1.66
2038	1.96
2048	2.31
2058	2.73

Analysis Notes
*Daily capacity of withdrawal in 1999 is 2.7 mgd.
*Used 1999 withdrawal registration data from NCDWR to perform projections.
*Ind. AGR based on 4.66% annual growth in textile industry, adjusted down 3% for inflation.

HDR ID: **NDJ - 2**
FACILITY: **Sevier Finishing Plant**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.41	0.62
Feb				0.47	0.65
Mar				0.46	0.64
Apr				0.59	0.68
May				0.57	0.81
Jun				0.65	0.83
Jul				0.69	0.77
Aug				0.65	0.83
Sep				0.63	0.80
Oct				0.64	0.85
Nov				0.59	0.80
Dec				0.51	0.60

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	1.16
1999	0.91
2002	0.57
2003	0.74

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.71
Feb	0.82
Mar	0.81
Apr	1.04
May	1.00
Jun	1.14
Jul	1.22
Aug	1.14
Sep	1.10
Oct	1.13
Nov	1.03
Dec	0.90

Yearly

Year	Avg. Q (mgd)
2008	1.06
2018	1.25
2028	1.47
2038	1.73
2048	2.04
2058	2.41

Analysis Notes
*Historical Flow Data Source: DMRs from Division of Water Quality
*Assumed plant consumptive use is 11.7%, based on 1999 flow data, and would remain constant into the future.

OWNER: **Confidential**

HDR ID	Facility	Type
NWY - 1	Confidential	Withdrawal

CONTACT: **John Bowyer**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	1.65	NA	NA
Feb			1.56		
Mar			1.45		
Apr			1.88		
May			1.79		
Jun			1.68		
Jul			2.47		
Aug			1.88		
Sep			2.16		
Oct			2.18		
Nov			1.75		
Dec			1.43		

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	1.82
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
0.00

Monthly

Month	Ann Avg Coefficient
Jan	0.90
Feb	0.85
Mar	0.80
Apr	1.03
May	0.98
Jun	0.92
Jul	1.36
Aug	1.03
Sep	1.18
Oct	1.19
Nov	0.96
Dec	0.78

Yearly

Year	Avg. Q (mgd)
2008	1.82
2018	1.82
2028	1.82
2038	1.82
2048	1.82
2058	1.82

Analysis Notes

*Daily capacity of withdrawal is 3.456 mgd.

*AGR based on assumption of no growth or decline, according to a negative texitile Industry trend, according to NC GSP.

*Discharge goes to another system; info not listed in withdrawal registration.

OWNER: **City of Conover**

HDR ID	Facility	Type
NDN - 4	Northeast WWTP	Discharge
NDN - 5	Southeast WWTP	Discharge

CONTACT: **Jimmy Clark**

Proj. By: *JCH*

HDR ID: **NDN - 4**
FACILITY: **Northeast WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.99	0.61
Feb				0.70	0.79
Mar				0.70	0.91
Apr				0.61	1.05
May				0.60	1.11
Jun				0.49	0.98
Jul				0.49	0.76
Aug				0.53	0.88
Sep				0.53	0.55
Oct				0.61	0.60
Nov				0.79	0.67
Dec				0.86	0.78

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.65
1999	NA
2002	0.66
2003	0.81

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.40	1.66

Monthly

Month	Ann Avg Coefficient
Jan	1.50
Feb	1.05
Mar	1.07
Apr	0.92
May	0.91
Jun	0.74
Jul	0.75
Aug	0.80
Sep	0.81
Oct	0.93
Nov	1.19
Dec	1.30

Yearly

Year	Avg. Q (mgd)
2008	0.87
2018	1.01
2028	1.16
2038	1.34
2048	1.55
2058	1.79

Analysis Notes
*Historical Flow Data Source: DMRs from Division of Water Quality
*Wastewater projections are based on the percentage of water usage by sector and the growth rate of those sectors.
*Assume AGR of 1.40 based on Catawba Co. growth rate (see Hickory)….
*This AGR will accommodate future population growth with minimal service area expansion….that expansion was assumed in Hickory projections.
*AGR of 1.66 is assumed for industrial - 1990s manufacturing NC GSP less inflation
*Note that Conover's usage has a large industrial component

Analysis Notes

Type	2002 LWSP	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	4,483	153	5,465	6,604	1.91	
Com. Cust	307	539				

Res. Cust	4,485	193	3,485	6,664	1.91	
Com. Cust.	397	539				
Ind. Cust	108	1,759				
Inst. Cust	42	738				
TOTAL	**4,988**	**-**				

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	900,000	80.3%	1.40	1.66	0.65
Ind/Inst	221,000	19.7%			0.16
Total	**1,121,000**	**-**	**-**	**-**	**0.81**

Wastewater Projections

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.70	0.80	0.92	1.06	1.22	1.40
Ind/Inst Demand	0.17	0.20	0.24	0.28	0.33	0.39
Total	**0.87**	**1.01**	**1.16**	**1.34**	**1.55**	**1.79**

HDR ID: **NDN - 5**
FACILITY: **Southeast WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.34	0.32
Feb				0.31	0.40
Mar				0.34	0.48
Apr				0.27	N/A
May				0.28	N/A
Jun				0.26	N/A
Jul				0.25	N/A
Aug				0.28	0.36
Sep				0.28	0.40
Oct				0.28	0.27
Nov				0.36	0.27
Dec				0.43	0.34

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.32
1999	NA
2002	0.31
2003	0.36

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.40	1.66

Monthly

Month	Ann Avg Coefficient
Jan	1.10
Feb	0.99
Mar	1.10
Apr	0.88
May	0.89
Jun	0.84
Jul	0.82
Aug	0.91
Sep	0.91
Oct	0.91
Nov	1.17
Dec	1.38

Yearly

Year	Avg. Q (mgd)
2008	0.39
2018	0.45
2028	0.52
2038	0.60
2048	0.69
2058	0.80

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	900,000	80.3%	1.40	1.66	0.29
Ind/Inst	221,000	19.7%			0.07
Total	**1,121,000**	-	-	-	**0.36**

Wastewater Projections

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.31	0.36	0.41	0.47	0.54	0.62
Ind/Inst Demand	0.08	0.09	0.11	0.13	0.15	0.18
Total	**0.39**	**0.45**	**0.52**	**0.60**	**0.69**	**0.80**

OWNER: **Cramer Mountain Finishing, LLC**

HDR ID	Facility	Type
NWY - 3	Cramer Mountain Finishing	Withdrawal

CONTACT: **Bob Kaufman**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	1.50	NA	NA
Feb			1.50		
Mar			1.00		
Apr			1.00		
May			1.00		
Jun			1.50		
Jul			1.50		
Aug			1.50		
Sep			1.00		
Oct			1.00		
Nov			1.00		
Dec			1.00		

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	1.21
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
1.68

Monthly

Month	Ann Avg Coefficient
Jan	1.24
Feb	1.24
Mar	0.83
Apr	0.83
May	0.83
Jun	1.24
Jul	1.24
Aug	1.24
Sep	0.83
Oct	0.83
Nov	0.83
Dec	0.83

Yearly

Year	Avg. Q (mgd)
2008	1.40
2018	1.66
2028	1.96
2038	2.31
2048	2.73
2058	3.23

Analysis Notes

*Used 1999 withdrawal registration data from NCDWR to perform projections.
*Daily capacity of withdrawal is 8.00 mgd.
*Ind. AGR based on 4.68% annual growth in furniture industry, adjusted down 3% for inflation.
*Discharge goes to another system not listed in withdrwal registration.

OWNER: **Town of Cramerton**

HDR ID	Facility	Type
NDY - 27	Eagle Road WWTP	Discharge

CONTACT: **David Young**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	1.03	1.12
Feb				1.04	1.33
Mar				1.18	1.64
Apr				1.01	1.60
May				1.08	1.34
Jun				0.95	1.16
Jul				0.83	1.24
Aug				1.02	1.49
Sep				1.14	1.36
Oct				1.07	1.27
Nov				1.07	1.06
Dec				0.96	0.99

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	1.62
1999	NA
2002	1.03
2003	1.30

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
0.75	1.66

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.14
Apr	0.98
May	1.05
Jun	0.92
Jul	0.80
Aug	0.99
Sep	1.10
Oct	1.04
Nov	1.04
Dec	0.93

Yearly

Year	Avg. Q (mgd)
2008	1.38
2018	1.55
2028	1.75
2038	1.97
2048	2.23
2058	2.53

Type	2002 LWSP	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	1,381	158	2,371	2,976	0.75	1.66
Com. Cust.	55	600				
Ind. Cust.	3	75,000				

Com. Cust.	55	600
Ind. Cust	2	75,000
Inst. Cust	2	29,000
TOTAL	**1,438**	**-**

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	251,000	54.7%	0.75	1.66	0.71
Ind/Inst	208,000	45.3%			0.59
Total	**459,000**	**-**	**-**	**-**	**1.30**

Wastewater Projections

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.74	0.80	0.86	0.92	1.00	1.07
Ind/Inst Demand	0.64	0.75	0.89	1.05	1.24	1.46
Total	**1.38**	**1.55**	**1.75**	**1.97**	**2.23**	**2.53**

Analysis Notes

*See Gastonia projections for Gaston Co. population info.
*Gastonia and Mt. Holly have been aggressively projected for the region.
*Assume an AGR of 0.75 for commercial and industrial
*Assume an AGR of 1.66 for industrial flow
*Historical Flow Data Source: DMRs from Division of Water Quality
*Wastewater projections are based on the percentage of water usage by sector and the growth rate of those sectors.

OWNER: **Town of Dallas**

HDR ID	Facility	Type
NWY - 10	Dallas WTP	Withdrawal
NDY - 28	Dallas WWTP	Discharge

CONTACT: **George Hughes**

Proj. By: *JCH*

HDR ID: **NWY - 10**
FACILITY: **Dallas WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	0.42	0.48	NA	NA	NA
Feb	0.42	0.47			
Mar	0.41	0.51			
Apr	0.43	0.48			
May	0.47	0.52			
Jun	0.50	0.52			
Jul	0.50	0.57			
Aug	0.49	0.63			
Sep	0.48	0.58			
Oct	0.46	0.50			
Nov	0.42	0.50			
Dec	0.45	0.48			

Yearly

Year	Avg. Q (mgd)
1992	0.45
1997	0.52
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.92
Feb	0.90
Mar	0.98
Apr	0.91
May	1.00
Jun	0.99
Jul	1.09
Aug	1.22
Sep	1.11
Oct	0.96
Nov	0.95
Dec	0.93

Yearly

Year	Avg. Q (mgd)
2008	0.56
2018	0.56
2028	0.56
2038	0.56
2048	0.56
2058	0.56

Analysis Notes
*Historical Flow Data Source: 1992 and 1997 LWSPs from NCDWR.
*Assumed Dallas water withdrawal remains unchanged since future demand will likely be satisfied by City of Gastonia.
*Gastonia 2002 LWSP indicates a connection with Dallas to begin in 2003 for 0.14 MGD average, and contract of 0.5 MGD, & Gastonia Water Master Plan accomodates nearly 1 MGD for Dallas by 2020.

Type	2008	2018	2028	2038	2048	2058
Res. Cust	1,775	1,775	1,775	1,775	1,775	1,775

Type	2005	2010	2020	2030	2040	2050
Res. Cust	1,775	1,775	1,775	1,775	1,775	1,775
Demand	280,000	280,000	280,000	280,000	280,000	280,000
Com. Cust.	211	211	211	211	211	211
Demand	87,000	87,000	87,000	87,000	87,000	87,000
Ind. Cust	2	2	2	2	2	2
Demand	14,000	14,000	14,000	14,000	14,000	14,000
Inst. Cust	3	3	3	3	3	3
Demand	35,000	35,000	35,000	35,000	35,000	35,000
Wholesale	0	0	0	0	0	0
TOTALS	**1,991**	**1,988**	**1,988**	**1,988**	**1,988**	**1,988**
	555,000	**555,000**	**555,000**	**555,000**	**555,000**	**555,000**

Type	1997 LWSP	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	1,775	158	3,012	3,402	0.00	0.00
Com. Cust.	211	412				
Ind. Cust	2	7,000			Backwash & Unaccounted For	25%
Inst. Cust	3	11,667			2002 Wholesale	0
TOTAL	**1,991**	**-**				

HDR ID: **NDY - 28**
FACILITY: **Dallas WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.40	0.43
Feb				0.35	0.39
Mar				0.43	0.46
Apr				0.34	0.48
May				0.34	0.45
Jun				0.31	0.39
Jul				0.32	0.37
Aug				0.32	0.37
Sep				0.35	0.33
Oct				0.37	0.34
Nov				0.40	0.35
Dec				0.43	0.35

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.22
1999	NA
2002	0.36
2003	0.39

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.11
Feb	0.98
Mar	1.18
Apr	0.96
May	0.93
Jun	0.86
Jul	0.88
Aug	0.89
Sep	0.96
Oct	1.02
Nov	1.12
Dec	1.20

Yearly

Year	Avg. Q (mgd)
2008	0.39
2018	0.39
2028	0.39
2038	0.39
2048	0.39
2058	0.39

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	367,000	88.2%	0.00	0.00	0.34
Ind/Inst	49,000	11.8%			0.05
Total	**416,000**	-	-	-	**0.39**

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.34	0.34	0.34	0.34	0.34	0.34
Ind/Inst Demand	0.05	0.05	0.05	0.05	0.05	0.05
Total	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**	**0.39**

Analysis Notes
*Historical Flow Data Source: DMRs from Division of Water Quality
*Assumed future Dallas wastewater will be handled by City of Gastonia.

OWNER: **Delta Apparel, Inc.**

HDR ID	Facility	Type
NDY - 2	Delta Apparel	Discharge

CONTACT: Alan McRee

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.87	0.83
Feb				0.92	0.81
Mar				0.89	0.89
Apr				0.91	0.82
May				0.90	0.65
Jun				0.84	0.71
Jul				0.89	0.66
Aug				0.88	0.82
Sep				0.85	0.89
Oct				0.84	0.94
Nov				0.76	0.87
Dec				0.60	0.68

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.76
1999	NA
2002	0.85
2003	0.80

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.02
Feb	1.09
Mar	1.05
Apr	1.07
May	1.06
Jun	0.99
Jul	1.05
Aug	1.04
Sep	1.00
Oct	0.99
Nov	0.90
Dec	0.70

Yearly

Year	Avg. Q (mgd)
2008	0.85
2018	0.85
2028	0.85
2038	0.85
2048	0.85
2058	0.85

Analysis Notes

*Historical Flow Data Source: DMRs from Division of Water Quality

*NC GSP for textiles shows a decrease of -1.9% for apparels 1990 to 2000; although flows have increased slightly

*Assumed discharge rate to remain at maximum annual average to date, although decreasing industry trend, according to NC GSP.

OWNER: **FMC Corporation**

HDR ID	Facility	Type
NDY - 3	Lithium Division Plant	Discharge

CONTACT: **Kimberly Weathers**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.39	0.89
Feb				0.63	1.03
Mar				0.53	0.99
Apr				0.64	1.21
May				0.25	3.48
Jun				0.16	1.69
Jul				0.01	4.38
Aug				0.00	2.06
Sep				0.05	1.49
Oct				0.00	1.10
Nov				2.73	0.70
Dec				0.71	0.79

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.52
1999	NA
2002	0.51
2003	1.65

PROJECTION SUMMARY

AGR Industrial
2.25

Monthly

Month	Ann Avg Coefficient
Jan	0.54
Feb	0.62
Mar	0.60
Apr	0.74
May	2.11
Jun	1.03
Jul	2.66
Aug	1.25
Sep	0.90
Oct	0.67
Nov	0.43
Dec	0.48

Yearly

Year	Avg. Q (mgd)
2008	0.58
2018	0.73
2028	0.91
2038	1.13
2048	1.42
2058	1.77

Analysis Notes

*Historical Flow Data Source: DMRs from Division of Water Quality

Purchase 0.543 mgd from Bessemer City in 1997. Consumed 0.023 mgd.

*Industrial AGR based on 7.34% annual growth for chemicals industry, per NC GSP, adjusted down for inflation; other factors

OWNER: **Fort Mill**

HDR ID	Facility	Type
SDF - 5	WWTP	Discharge

Contacts: Chris Richardson

Proj. By: *LKM*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	0.53	0.88	NA	1.20	NA
Feb	0.66	1.06		1.30	
Mar	0.80	1.14		1.12	
Apr	0.63	0.92		1.02	
May	0.68	0.90		0.96	
Jun	0.84	0.86		0.97	
Jul	0.56	0.84		0.95	
Aug	0.55	0.77		0.95	
Sep	0.53	0.78		1.07	
Oct	0.65	0.77		1.09	
Nov	0.86	0.87		1.15	
Dec	0.76	1.01		1.14	

Yearly

Year	Avg. Q (mgd)
1992	0.67
1997	0.90
1999	NA
2002	1.08
2003	NA

PROJECTION SUMMARY

AGR
2.00

Monthly

Month	Ann Avg Coefficient
Jan	1.11
Feb	1.21
Mar	1.04
Apr	0.95
May	0.89
Jun	0.90
Jul	0.88
Aug	0.88
Sep	0.99
Oct	1.01
Nov	1.07
Dec	1.06

Yearly

Year	Avg. Q (mgd)
2008	1.21
2018	1.48
2028	1.80
2038	2.20
2048	2.68
2058	3.26

Analysis Notes

*AGR based on historical water discharges, with 2002 flow serving as base; and current growth patterns of York Co.

Owner: **City of Gastonia**

HDR ID	Facility	Type
NWM - 2	City of Gastonia WTP	Withdrawal
NDY - 16	City of Gastonia WTP	Discharge
NDY - 17	Crowders Creek WWTP	Discharge
NDY - 18	Long Creek WWTP	Discharge

CONTACT: LKM visit with Gastonia Staff

Proj. By: *LKM*

HDR ID: **NWM - 2**
FACILITY: **City of Gastonia WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	12.00	12.10
Feb				11.50	11.68
Mar				11.39	11.36
Apr				12.62	11.60
May				13.30	12.44
Jun				15.17	12.79
Jul				15.32	12.73
Aug				15.17	13.02
Sep				12.95	13.30
Oct				12.21	13.14
Nov				11.21	12.45
Dec				11.12	11.99

Yearly

Year	Avg. Q (mgd)
1992	15.99
1997	15.92
1999	NA
2002	12.83
2003	12.39

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.94
Feb	0.90
Mar	0.89
Apr	0.98
May	1.04
Jun	1.18
Jul	1.19
Aug	1.18
Sep	1.01
Oct	0.95
Nov	0.87
Dec	0.87

Yearly

Year	Avg. Q (mgd)
2008	15.41
2018	22.16
2028	25.72
2038	29.84
2048	34.63
2058	40.20

Staggered AGR	
Years	AGR
2003 - 2018	3.7
2019 - 2058	1.5

LWSP

25.5	2020
29.2	2030
32.9	2040
38.1	2050

Analysis Notes

*Staggered AGR used to balance very aggressive growth projections from the City's Master Plan (2003 - 2018) and a more modest growth over the long term.
*AGRs account for population growth and service area expansion.
*Intake Amount - 18.5

Population Data

Data from Office of State Planning

*Gaston County 1980s historical growth	0.74%	AGR
*Gaston County 1990s historical growth	0.62%	AGR
*Gaston County 2000s population projections	0.92%	AGR
*Gaston County 2010s population projections	0.60%	AGR
*Gaston County 2020s population projections	0.51%	AGR

Future Population Projections (Gaston Co.)

Use AGR	1.0%	People/Square Mile	
2000	186,328	393	
2010	205,822	434	
2020	227,356	479	
2030	251,142	529	
2040	277,417	585	
2050	306,441	646	no limiting factor on density

*Clearly, Gastonia is and will, in the future, be serving other communities within Gaston Co. as a regional service provider.

*Consideration is being given to regional consolidation of utilities.

Proposed Population Served (Table 4-3) for Gastonia and all other wholesale users and others:

2002	79,930	42.9%	percent of county served based on 2000 census
2020	165,005	76.1%	percent of county served based on Office of Planning projections

this is quite aggressive

Average Water Demand Projections		AGR	
2002	12.8		*these projections account for a lower per capita consumption for resid.*
2010	17.5	3.99%	*160 down to 140 gpcd including combined flow*
2020	23.1	3.53%	*due to pumping from Mt. Island to Rankin Lake where most*

this is very aggressive *water is evaporated, seeps, or flows to S. Fork of Catawba*

the growth is shown for Gastonia, Ranlo, Dallas, some of York Co., New Development

232,794	acres	363.62	square miles
Population	Population		
162,568	175,093	482	
175,093	186,328	512	
186,328	204,156	561	
204,156	216,822	596	
216,822	228,066	627	

2002 LWSP	Q (MGD)	GPD/Cust	1997 LWSP	2002 LWSP	AGR	AGR Ind.	AGR YR
21,042	4.01	191	65,343	67,919	3.70		to 2018
2,579	3.05	1,182			1.50		to 2058
110	0.92	8,391					
55	0.02						
23,786	**8.00**	**-**					

Lowell	0.43	
McAdenville	0.42	
Ranlo	0.34	
Cramerton	0.30	
Clover	0.51	
Dallas	0.21	emergency - don't include in total
Bessemmer City	0.87	emergency - don't include in total
	1.99	
Subtotal	**9.99**	
System Process Water	0.33	2.55%
Subtotal	10.32	
Average Annual Daily Use	12.83	
Unaccounted For Water	2.52	19.60%

Intake Capacity

Mt. Island Lake	75 MGD
South Fork Catawba	15.5 MGD

*Base future projections to 2018 based on 3.70% AGR total flow to simulate recent master planning efforts
This approach accounts for residential and commercial usage at the above population growth + significant expansion of the sys.
1.50% AGR this should still count for pop. growth and service area exp.
and 1.50% AGR as before for GSP of manufacturing; similar to 1.66

HDR ID: **NDY - 16**
FACILITY: **City of Gastonia WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	0.40
1997	0.50
1999	NA
2002	0.60
2003	0.77

WTP prod.	% backwas
15.99	2.5%
15.92	3.1%
12.83	4.7%
12.39	6.2%

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.94
Feb	0.90
Mar	0.89
Apr	0.98
May	1.04
Jun	1.18
Jul	1.19
Aug	1.18
Sep	1.01
Oct	0.95
Nov	0.87
Dec	0.87

Yearly

Year	Avg. Q (mgd)
2008	0.54
2018	0.78
2028	0.90
2038	1.04
2048	1.21
2058	1.41

Analysis Notes
*Assumed 3.5% of withdrawn water is discharged back into lake.

HDR ID: **NDY - 17**
FACILITY: **Crowders Creek WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	2.95	2.53
Feb				2.96	3.25
Mar				3.09	3.64
Apr				3.16	4.20
May				2.98	3.82
Jun				2.90	3.42
Jul				2.90	2.94
Aug				2.95	3.41
Sep				2.77	2.54
Oct				2.43	2.25
Nov				2.85	2.07
Dec				3.12	1.93

Yearly

Year	Avg. Q (mgd)
1992	3.16
1997	2.75
1999	NA
2002	2.92
2003	3.00

PROJECTION SUMMARY

AGR
1.71

Monthly

Month	Ann Avg Coefficient
Jan	1.01
Feb	1.01
Mar	1.06
Apr	1.08
May	1.02
Jun	0.99
Jul	0.99
Aug	1.01
Sep	0.95
Oct	0.83
Nov	0.97
Dec	1.07

Yearly

Year	Avg. Q (mgd)
2008	3.27
2018	3.87
2028	4.58
2038	5.43
2048	6.43
2058	7.62

Analysis Notes
*AGR based on future flow projections in 2004 Wastewater Master Plan Report.

Crowders Creek Flow		AGR	AGR over 20 years
2000	2.65		
2010	2.94	1.04%	
2020	3.72	2.38%	1.71%

1.7% AGR for projections…this will account for population increases
service area expansion to keep pace with projections above
and industrial flow increases

HDR ID: **NDY - 18**
FACILITY: **Long Creek WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	6.39	5.83
Feb				5.65	6.65
Mar				6.04	8.17
Apr				5.56	9.22
May				5.53	8.69
Jun				5.39	7.43
Jul				5.45	6.98
Aug				5.81	6.78
Sep				5.85	5.86
Oct				6.10	5.67
Nov				6.24	5.53
Dec				6.85	5.66

Yearly

Year	Avg. Q (mgd)
1992	5.91
1997	5.13
1999	NA
2002	5.90
2003	6.87

PROJECTION SUMMARY

AGR
1.61

Monthly

Month	Ann Avg Coefficient
Jan	1.08
Feb	0.96
Mar	1.02
Apr	0.94
May	0.94
Jun	0.91
Jul	0.92
Aug	0.98
Sep	0.99
Oct	1.03
Nov	1.06
Dec	1.16

Yearly

Year	Avg. Q (mgd)
2008	7.44
2018	8.72
2028	10.22
2038	11.97
2048	14.03
2058	16.45

Analysis Notes

*AGR based on future flow projections in 2004 Wastewater Master Plan Report.

Long Creek Flow			AGR over 20 years
2000	7.5		
2010	8.7	1.47%	
2020	10.3	1.76%	1.61%

1.6% AGR for projections…this will account for population increases
service area expansion to keep pace with projections above
and industrial flow increases

OWNER: **General Electric Company - Hickory**

HDR ID	Facility	Type
NDY - 11	General Electric Company - Hickory	Discharge

CONTACTS: **John Edwards**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.10
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
1.00

Monthly

Month	Ann Avg Coefficient
Jan	1.0
Feb	1.0
Mar	1.0
Apr	1.0
May	1.0
Jun	1.0
Jul	1.0
Aug	1.0
Sep	1.0
Oct	1.0
Nov	1.0
Dec	1.0

Yearly

Year	Avg. Q (mgd)
2008	0.11
2018	0.12
2028	0.14
2038	0.15
2048	0.15
2058	0.17

Analysis Notes

*Assumed permit limit as base (0.12 mgd)

*Industrial AGR based on 4.0% annual growth in electronic equipment and machinery sector in 1990s, according to NC GSP.

*AGR adjusted down for 3% inflation.

*Assumed annual average flow from 1997 as base.

OWNER: **Town of Granite Falls**

HDR ID	Facility	Type
NWR - 1	Granite Falls WTP	Withdrawal
NDH - 5	Granite Falls WWTP	Discharge

CONTACT: **Shuford Wise**

Proj. By: *JCH*

HDR ID: **NWR - 1**
FACILITY: **Granite Falls WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	1.11	NA
Feb				1.07	
Mar				1.09	
Apr				1.24	
May				1.46	
Jun				1.65	
Jul				1.57	
Aug				1.53	
Sep				1.29	
Oct				1.18	
Nov				1.29	
Dec				1.20	

Yearly

Year	Avg. Q (mgd)
1992	0.98
1997	1.15
1999	NA
2002	1.31
2003	NA

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.36	1.66

Monthly

Month	Ann Avg Coefficient
Jan	0.85
Feb	0.82
Mar	0.83
Apr	0.95
May	1.12
Jun	1.26
Jul	1.20
Aug	1.17
Sep	0.98
Oct	0.90
Nov	0.99
Dec	0.92

Yearly

Year	Avg. Q (mgd)
2008	1.46
2018	1.67
2028	1.92
2038	2.20
2048	2.53
2058	2.91

Analysis Notes

Type	2008	2018	2028	2038	2048	2058
Res. Cust	2,267	2,595	2,970	3,400	3,891	4,454
Demand	352,000	403,000	462,000	528,000	605,000	692,000

Demand	352,000	403,000	462,000	528,000	605,000	692,000
Com. Cust.	271	310	355	406	465	532
Demand	63,000	72,000	82,000	94,000	108,000	124,000
Ind. Cust	12	14	17	20	23	28
Demand	387,500	442,100	506,000	581,300	668,800	771,700
Inst. Cust	34	40	48	56	66	78
Demand	108,000	128,000	150,000	177,000	209,000	246,000
Wholesale	436,000	499,000	571,000	654,000	748,000	856,000
TOTALS	**2,585**	**2,920**	**3,342**	**3,826**	**4,380**	**5,014**
	1,456,000	**1,669,000**	**1,915,000**	**2,199,000**	**2,528,000**	**2,908,000**

Type	2002 LWSP	GPD/Cust	1997 LWSP	2002 LWSP	AGR	AGR Ind.
Res. Cust	2,091	155	4,310	4,611	1.36	1.66
Com. Cust.	250	232				
Ind. Cust	11	22,780			Backwash & Unaccounted For	8%
Inst. Cust	31	3,161			2002 Wholesale	402,000
TOTAL	**2,383**	**-**				

*Projections based on annual growth rate (residential and commercial) and gpd/customer.
*Trend for Granite Falls has been up thru 3 LWSPs

*1980's AGR =	1.16	based on Caldwell Co. and OSP
*1990's AGR =	1.24	
*2000's AGR (predicted) =	1.23	7.8%
*2010's AGR (predicted) =	1.19	5.9%
*2020's AGR (predicted) =	1.17	5.0%

*Assume AGR of 1.36 to 2058 since AGR of 1.36 exists on LWSPS (92 to 97) and slightly higher than pop. projs. and to account for service area expansion
*Likely that Industrial usage may decrease, result of textiles/furniture trend; assume 1.66 based on NCGSP

HDR ID: **NDH - 5**
FACILITY: **Granite Falls WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.47	0.40
Feb				0.41	0.48
Mar				0.45	0.56
Apr				0.38	0.59
May				0.38	0.57
Jun				0.36	0.47
Jul				0.35	0.46
Aug				0.37	0.46
Sep				0.44	0.40
Oct				0.46	0.40
Nov				0.53	0.41
Dec				0.56	0.47

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.49
1999	NA
2002	0.43
2003	0.47

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.36	1.66

Monthly

Month	Ann Avg Coefficient
Jan	1.08
Feb	0.95
Mar	1.04
Apr	0.89
May	0.89
Jun	0.84
Jul	0.82
Aug	0.87
Sep	1.03
Oct	1.08
Nov	1.22
Dec	1.30

Yearly

Year	Avg. Q (mgd)
2008	0.51
2018	0.59
2028	0.68
2038	0.79
2048	0.92
2058	1.07

Analysis Notes
*Historical Flow Data Source: DMRs from Division of Water Quality
*Wastewater projs are based on the % of water usage by sector and growth rate of those sectors.

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	383,000	52.4%	1.36	1.66	0.25
Ind/Inst	348,580	47.6%			0.22
Total	**731,580**	-	-	-	**0.47**

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.26	0.30	0.34	0.39	0.45	0.52
Ind/Inst Demand	0.24	0.29	0.34	0.40	0.47	0.55
Total	**0.51**	**0.59**	**0.68**	**0.79**	**0.92**	**1.07**

OWNER: **Great Falls**

HDR ID	Facility	Type
SDC - 2	Great Falls WWTP	Discharge

Contacts: Sammy Bell

Proj. By: *PNB/LKM*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	0.30	0.21	NA	0.27	0.27
Feb	0.37	0.28		0.23	0.30
Mar	0.44	0.18		0.24	0.28
Apr	0.41	0.21		0.23	0.34
May	0.34	0.21		0.21	0.34
Jun	0.41	0.16		0.18	0.29
Jul	0.30	0.12		0.18	0.32
Aug	0.33	0.73		0.19	0.23
Sep	0.26	0.09		0.19	0.22
Oct	0.35	0.12		0.27	0.22
Nov	0.50	0.14		0.35	0.20
Dec	0.40	0.15		0.27	0.23

Yearly

Year	Avg. Q (mgd)
1992	0.37
1997	0.22
1999	NA
2002	0.23
2003	0.27

PROJECTION SUMMARY

AGR
2.00

Monthly

Month	Ann Avg Coefficient
Jan	1.14
Feb	0.98
Mar	1.02
Apr	1.00
May	0.90
Jun	0.76
Jul	0.78
Aug	0.80
Sep	0.82
Oct	1.14
Nov	1.50
Dec	1.15

Yearly

Year	Avg. Q (mgd)
2008	0.28
2018	0.31
2028	0.33
2038	0.36
2048	0.40
2058	0.43

Analysis Notes

*Great Falls gets water from Chester Metro.

*Flow dropped from 1992 to 1997
*Since 1997 the flow has stabilized
*Projections assume that growth rate is similar to population trends

The 1990s growth rate in Great Falls	-4.9%
The 1980s growth rate in Chester Co./Fairfield Co.	6.7%, 7.7%
The 1990s growth rate in Chester Co/Fairfield Co.	10.2%, 1.8%
The 2000/2025 projection for Chester Co.	6.9%
The 2000/2025 projection for Fairfield Co.	14.7%
The AGR for Chester 2000/2025	0.3%
The AGR for Chester 2000/2025	0.6% ?
The highest historical growth of 10.2% equals annualized	1.0%

*The Chester IBT application makes a detailed account for future wastewater in 2025 for the region.
The plan for Great Falls WWTP indicates a 0.29 MGD flow in 2025.
*This implies a relatively low growth for Great Falls 0.29 0.24 This flow increase in AGR is 0.86 from 2003 to 2025
*Based on information provided by Chester based on commercial activity, population growth, and availability of a mega-site for industrial development,
Assume 2.00 AGR
*Reflecting back on population projections, these numbers are very conservative with population forecasts for the area; and allows for considerable expansion of the system.

OWNER: **Harris Creek Trout Farm**

HDR ID	Facility	Type
NWJ - 7	Harris Creek Trout Farm	Withdrawal
NDJ - 10	Harris Creek Trout Farm	Discharge

CONTACT: J.D. Stockton, Carl Kittel

Proj. By: *JCH*

HDR ID: NWJ - 7
FACILITY: Harris Creek Trout Farm
CONTACT: J.D. Stockton

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	0.86	NA	NA
Feb			0.86		
Mar			0.86		
Apr			0.86		
May			0.86		
Jun			0.86		
Jul			0.86		
Aug			0.86		
Sep			0.86		
Oct			0.86		
Nov			0.86		
Dec			0.86		

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	0.86
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
0.00

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.00
Apr	1.00
May	1.00
Jun	1.00
Jul	1.00
Aug	1.00
Sep	1.00
Oct	1.00
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	0.86
2018	0.86
2028	0.86
2038	0.86
2048	0.86
2058	0.86

Analysis Notes
*Used 1999 withdrawal registration data from NCDWR to perform projections.
*AGR used for projections is not critical since all flow is assumed to return to system; flow is pass-thru.

HDR ID: NDJ - 10
FACILITY: Harris Creek Trout Farm
CONTACT: Carl Kittel

HISTORICAL DATA SUMMARY

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.00
Apr	1.00
May	1.00
Jun	1.00
Jul	1.00
Aug	1.00
Sep	1.00
Oct	1.00
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	0.86
2018	0.86
2028	0.86
2038	0.86
2048	0.86
2058	0.86

Analysis Notes
*No listed NPDES permit.
*Assumed that discharge equals withdrawal.

OWNER: **Heater Utilities, Inc.**

HDR ID	Facility	Type
NDN - 9	Diamond Head WWTP	Discharge

CONTACT: **Jerry Tweed**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.00
Apr	1.00
May	1.00
Jun	1.00
Jul	1.00
Aug	1.00
Sep	1.00
Oct	1.00
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	0.08
2018	0.08
2028	0.08
2038	0.08
2048	0.08
2058	0.08

Analysis Notes

*Water source is community well system.

*Plant capacity is 0.1 mgd and there are no plans to expand.

*Assumed that discharge will be 80% of plant capacity (0.1 mgd):

OWNER: **Hedrich Industries**

HDR ID	Facility	Type
NWY - 4	Lake Norman Quarry	Withdrawal

CONTACT: **Jeff Lamm, Manager of Land Resources**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	0.27	NA	NA
Feb			0.27		
Mar			0.22		
Apr			0.46		
May			0.54		
Jun			0.87		
Jul			1.05		
Aug			1.05		
Sep			0.94		
Oct			0.54		
Nov			0.25		
Dec			0.27		

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	0.60
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
1.66

Monthly

Month	Ann Avg Coefficient
Jan	0.45
Feb	0.45
Mar	0.37
Apr	0.77
May	0.90
Jun	1.44
Jul	1.74
Aug	1.74
Sep	1.55
Oct	0.90
Nov	0.41
Dec	0.45

Yearly

Year	Avg. Q (mgd)
2008	0.70
2018	0.82
2028	0.97
2038	1.15
2048	1.35
2058	1.59

Analysis Notes

*Used 1999 withdrawal registration data from NCDWR to perform projections.

*AGR based on 4.66% annual growth for manufacturing sector, according to NC GSP, adjusting down for 3% inflation.

Owner: **City of Hickory**

HDR ID	Facility	Type
NWH - 1	City of Hickory Water Treatment Plant	Withdrawal
NDH - 2	City of Hickory WTP	Discharge
NDH - 3	Northeast WWTP	Discharge
NDN - 6	Hickory WWTP	Discharge
NDY - 19	Henry Fork WWTP	Discharge

CONTACT: Gene Haynes

Proj. By: *LKM*

HDR ID: NWH - 1
FACILITY: City of Hickory Water Treatment Plant

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	11.80	NA
Feb				10.60	
Mar				10.40	
Apr				11.90	
May				13.20	
Jun				15.30	
Jul				15.00	
Aug				15.00	
Sep				13.10	
Oct				11.90	
Nov				11.60	
Dec				11.20	

Yearly

Year	Avg. Q (mgd)
1992	10.20
1997	10.80
1999	NA
2002	12.60
2003	15.90

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
2.00	1.66

Monthly

Month	Ann Avg Coefficient
Jan	0.94
Feb	0.84
Mar	0.83
Apr	0.94
May	1.05
Jun	1.21
Jul	1.19
Aug	1.19
Sep	1.04
Oct	0.94
Nov	0.92
Dec	0.89

Yearly

Year	Avg. Q (mgd)
2008	14.26
2018	17.36
2028	21.12
2038	25.71
2048	31.30
2058	38.10

LWSP Projections

18.5	2010
22.5	2020
23.8	2030
29.0	2040
30.5	2050

Analysis Notes
*Plant capacity - 32 mgd
*Contract with Town of Maiden for 1.5 mgd
*Projections based on annual growth rate (residential and commercial) and gpd/customer.
*The residential gp/d/customer seems high, but could be hige since there are no institutional or industrial breakdowns shown.
*We will use 193 for projections.
*Clearly, Hickory is and will, in the future, be serving other communities outside Catawba Co. with an aggressive marketing plan

Analysis Notes

Type	2008	2018	2028	2038	2048	2058
Res. Cust	17,825	21,728	26,487	32,287	39,358	47,977

Type	2000	2010	2020	2030	2040	2050
Res. Cust	17,825	21,728	26,487	32,287	39,358	47,977
Demand	3,435,000	4,187,000	5,104,000	6,222,000	7,584,000	9,245,000
Com. Cust.	2,681	3,269	3,984	4,857	5,921	7,217
Demand	3,041,000	3,707,000	4,518,000	5,508,000	6,714,000	8,184,000
Ind. Cust	6	7	8	9	11	13
Demand	552,000	651,000	767,000	904,000	1,066,000	1,257,000
Inst. Cust	0	0	0	0	0	0
Demand	0	0	0	0	0	0
Wholesale Cust. Demand	4,623,000	5,635,000	6,869,000	8,374,000	10,208,000	12,443,000
TOTALS	**20,512**	**25,004**	**30,479**	**37,153**	**45,289**	**55,207**
	14,261,000	**17,356,000**	**21,124,000**	**25,714,000**	**31,300,000**	**38,102,000**

Type	2002 LWSP	Q (MGD)	GPD/Cust	1997 LWSP	2002 LWSP	AGR	AGR Ind.
Res. Cust	15,828	3.05	193	35,300	37,975	2.00	1.66
Com. Cust.	2,381	2.70	1,134				
Ind. Cust	5	0.50	100,000				
Inst. Cust							
TOTAL	**18,214**	**6.25**	**-**				

Unaccounted For Water	15.9%	2.00
Backwash Water	2.4%	0.30
	18.3%	**2.31**

Sales to Other Systems

Alex. Co. - Hwy 16	0.34	*the 2.7, 5 and 0.5 values above were separated as noted belc*
Bethlehem Water District	0.41	
Conover	1.84	
Icard	0.40	
Longview	0.54	
Newton	-	
SE - Catawba Co.	0.08	
Taylorsville	0.42	
Energy United	0.07	*also stated in interview that they had recruited Town of Maiden and Town*
Subtotal Wholesale	4.11	*also stated they sold water to Sherrills Ford, Startown, and Mt. View*
Total	**10.36**	

12.66

Population Data

Data from State Office of Planning

*Catawba County 1980s historical growth 1.19% AGR
*Catawba County 1990s historical growth 1.41% AGR
*Catawba County 2000-2030 pop. Projection 1.52% AGR
Since Hickory serves beyond City limits, using Catawba projections seems reasonable

From LWSP

*AGR between 1997 and 2002 LWSP indicates a 1.47% AGR

WPCOG information for Catawba County

*1990s historical growth 1.81% AGR *OSP discrepancy, use*
*2000 - 2010 projections 1.59% AGR *WPCOG*
*2010 - 2020 projections 1.37% AGR *result is similar to OSP*

Future Population Projections (Catawba County)

Use AGR 2.0% People/Square Mile

2000	141,685	299	
2010	172,713	364	
2020	210,536	444	
2030	256,643	541	
2040	312,846	659	
2050	381,358	804	no limiting factor on density

*Base future projections for Hickory and wholesale customers on 2.00% AGR
*This approach accounts for residential and commercial usage at the above population growth + the expansion of the system
*Hickory indicates in 2003 that they have roughly half a dozen industries that use a total of 0.6-0.8 MGD of water;
*Thus, reduce comm. Baseline from 3.2 to 2.7 and baseline ind. at 0.5 mgd 1.66% AGR

HDR ID: **NDH - 2**
FACILITY: **City of Hickory WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.32
1999	NA
2002	0.30
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.94
Feb	0.84
Mar	0.83
Apr	0.94
May	1.05
Jun	1.21
Jul	1.19
Aug	1.19
Sep	1.04
Oct	0.94
Nov	0.92
Dec	0.89

Yearly

Year	Avg. Q (mgd)
2008	0.34
2018	0.42
2028	0.51
2038	0.62
2048	0.75
2058	0.91

Analysis Notes
Assumed 2.4% of withdrawn water returned to lake from WTP.

HDR ID: **NDH - 3**
FACILITY: **Northeast WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	3.66	3.47
Feb				3.45	3.79
Mar				3.55	4.18
Apr				3.28	4.58
May				3.22	4.57
Jun				3.19	4.14
Jul				3.23	3.80
Aug				3.25	4.43
Sep				3.37	3.72
Oct				3.51	3.39
Nov				3.80	3.56
Dec				3.94	3.76

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	3.23
1999	NA
2002	3.45
2003	3.95

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.06
Feb	1.00
Mar	1.03
Apr	0.95
May	0.93
Jun	0.92
Jul	0.94
Aug	0.94
Sep	0.98
Oct	1.02
Nov	1.10
Dec	1.14

Yearly

Year	Avg. Q (mgd)
2008	4.71
2018	5.73
2028	6.97
2038	8.49
2048	10.33
2058	12.57

Analysis Notes

*Flows based on projected flows at the Hickory WTP.
*Assumed 55% of future growth of water demand to be discharged via one of the two WWTPs.
*This should account for greater % for new water customers connecting to sewer, not septic.
*Northeast WWTP currently treats approx. 60% of system's collected wastewater.
Assumed this portion to remain constant.
*Assume future growth to be within the service area, and for those areas outside of the City that are served, flows will be discharged via other facilites, or septic.

General Wastewater Treatment Projection Analysis

	Water Demand	NE WWTP	Henry Fork WWTP	Total	Wastewater as % of Water
1992	10.20			6.9	
1997	10.80	3.3	3.1	6.4	59.3%
2002	12.60	3.5	2.2	5.7	45.2% drought
2003	15.90	4.0	2.6	6.6	41.5% wet

*These basins are relatively evenly split in Catawba County and growth from US 321 and Gaston Co., may begin to impact the southern area sooner.

Year	Avg. Q (mgd)
2008	7.8
2018	9.5
2028	11.6
2038	14.1
2048	17.2
2058	21.0

HDR ID: **NDN - 6**
FACILITY: **Hickory WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.05	N/A
Feb				0.04	0.04
Mar				0.05	0.05
Apr				0.06	0.04
May				0.04	0.06
Jun				0.05	0.07
Jul				0.03	0.08
Aug				0.03	0.08
Sep				0.03	0.07
Oct				0.03	0.05
Nov				0.03	0.08
Dec				0.03	0.05

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.05
1999	NA
2002	0.04
2003	0.06

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.25
Feb	0.95
Mar	1.31
Apr	1.41
May	0.98
Jun	1.14
Jul	0.84
Aug	0.79
Sep	0.68
Oct	0.87
Nov	0.81
Dec	0.83

Yearly

Year	Avg. Q (mgd)
2008	0.10
2018	0.10
2028	0.10
2038	0.10
2048	0.10
2058	0.10

Analysis Notes
*Assumed plant will discharge similarly to historical record, approx. 0.1 mgd.
*Assumed no increase in discharge rate.

HDR ID: **NDY - 19**
FACILITY: **Henry Fork WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	2.31	2.34
Feb				2.20	2.71
Mar				2.20	2.99
Apr				2.06	3.22
May				2.02	2.68
Jun				2.01	2.53
Jul				1.79	2.35
Aug				2.20	3.55
Sep				2.23	2.17
Oct				2.51	2.19
Nov				2.68	2.17
Dec				2.48	2.25

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	3.07
1999	NA
2002	2.22
2003	2.60

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.04
Feb	0.99
Mar	0.99
Apr	0.93
May	0.91
Jun	0.90
Jul	0.81
Aug	0.99
Sep	1.00
Oct	1.13
Nov	1.21
Dec	1.12

Yearly

Year	Avg. Q (mgd)
2008	3.14
2018	3.82
2028	4.65
2038	5.66
2048	6.89
2058	8.38

Analysis Notes
*Flows based on projected flows at the Hickory WTP.
*See notes above

OWNER: **Hideways WWTP**

HDR ID	Facility	Type
NDY - 34	Hideways WWTP	Withdrawal

CONTACT: **Wendell Smith**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.00
Apr	1.00
May	1.00
Jun	1.00
Jul	1.00
Aug	1.00
Sep	1.00
Oct	1.00
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	0.10
2018	0.10
2028	0.10
2038	0.10
2048	0.10
2058	0.10

Analysis Notes

*Permitted limit is 0.120 mgd, round to 0.1

*Assumed that plant operates at permitted limit with no plans to expand.

OWNER: **Huffman Finishing, Inc.**

HDR ID	Facility	Type
NDH - 1	Huffman Finishing	Discharge

CONTACT: **Lee Huffman**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.09	0.11
Feb				0.14	0.10
Mar				0.11	0.10
Apr				0.10	0.13
May				0.11	-
Jun				0.14	0.11
Jul				0.15	0.11
Aug				0.14	0.10
Sep				0.11	0.10
Oct				0.11	0.11
Nov				0.08	0.13
Dec				0.10	0.14

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.17
1999	NA
2002	0.12
2003	0.11

PROJECTION SUMMARY

AGR Industrial
1.68

Monthly

Month	Ann Avg Coefficient
Jan	0.79
Feb	1.17
Mar	0.88
Apr	0.83
May	0.90
Jun	1.19
Jul	1.26
Aug	1.13
Sep	0.95
Oct	0.94
Nov	0.64
Dec	0.84

Yearly

Year	Avg. Q (mgd)
2008	0.13
2018	0.16
2028	0.19
2038	0.22
2048	0.26
2058	0.31

Analysis Notes

*Historical Flow Data Source: DMRs from Division of Water Quality

*AGR based on 4.68% annual growth in furniture sector in 1990s, according to NC GSP, adjusted 3% for inflation.

OWNER: **Town of High Shoals**

HDR ID	Facility	Type
NWY - 11	High Shoals WTP	Withdrawal

CONTACT:

Proj. By: *LKM*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	0.07	NA	NA	NA
Feb		0.07			
Mar		0.07			
Apr		0.06			
May		0.06			
Jun		0.06			
Jul		0.07			
Aug		0.07			
Sep		0.07			
Oct		0.07			
Nov		0.06			
Dec		0.06			

Yearly

Year	Avg. Q (mgd)
1992	0.09
1997	0.06
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

AGR
0.75

Projection Analysis

Monthly

Month	Ann Avg Coefficient
Jan	1.16
Feb	1.09
Mar	1.09
Apr	0.97
May	0.98
Jun	0.91
Jul	1.08
Aug	1.03
Sep	1.06
Oct	1.03
Nov	0.89
Dec	0.86

Yearly

Year	Avg. Q (mgd)
2008	0.07
2018	0.07
2028	0.08
2038	0.09
2048	0.09
2058	0.10

Analysis Notes

*Relatively small flow.
*WTP capacity of 0.22 MGD
*Much of Gaston growth projected in City of Gastonia
*See Gastonia projections for historical and future population growth
*AGR based on population growth in current service area.
*Assumed service area expansion unnecessary due to Gastonia system expansion.
*Annual average flow in 1997 used as based flow for projections.

OWNER: **Lancaster**

HDR ID	Facility	Type
SDF - 6	WWTP	Discharge

Contacts: Mack McDonald

Proj. By: *PNB/LKM*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	2.85	NA	2.70	NA
Feb		3.20		2.43	
Mar		3.00		2.86	
Apr		2.82		2.38	
May		2.66		2.11	
Jun		2.50		2.01	
Jul		2.31		1.98	
Aug		1.76		1.95	
Sep		2.74		2.16	
Oct		2.88		2.26	
Nov		3.33		2.63	
Dec		3.27		2.94	

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	2.78
1999	NA
2002	2.37
2003	NA

PROJECTION SUMMARY

AGR
1.70

Monthly

Month	Ann Avg Coefficient
Jan	1.14
Feb	1.03
Mar	1.21
Apr	1.00
May	0.89
Jun	0.85
Jul	0.84
Aug	0.82
Sep	0.91
Oct	0.95
Nov	1.11
Dec	1.24

Yearly

Year	Avg. Q (mgd)
2008	2.62
2018	3.10
2028	3.67
2038	4.35
2048	5.15
2058	6.09

Analysis Notes

*One textile industry over 50,000 GPD; could be jeopardized in the future….gives grounds for starting w/ 2002 flows

**from Catawba Regional Council of Govts.*

Lancaster Co. 1980s Growth	2.2%
City of Lancaster - 1980s	1.3%
Lancaster Co. 1990s Growth	12.5%
City of Lancaster - 1990s	7.5%

Plant Capacity 5.75 MGD

Lancaster Growth Projs (20)		AGR
State Projections	12.0%	0.6%
Growth Trend	29.0%	1.3%
Growth Trend (Cat. Ridge)	40.0%	1.7%
Building Permit Trend	55.0%	2.2%
CR-COG Projections approx		1.7% use this value

OWNER: **Lancaster County/Union County**

HDR ID	Facility	Type
SWF - 6	Catawba River Plant	Withdrawal
SDF - 7	Indianland WWTP	Discharge

CONTACT:

Proj. By:

HDR ID: **SWF - 6**
FACILITY: **Catawba River Plant**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	10.49	11.19
Feb				10.10	10.43
Mar				10.39	10.43
Apr				13.18	10.73
May				14.35	11.61
Jun				17.23	11.66
Jul				15.27	12.44
Aug				13.99	12.36
Sep				12.06	14.42
Oct				11.80	13.53
Nov				10.65	12.65
Dec				10.58	11.68

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	NA
2002	12.51
2003	11.93

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.84
Feb	0.81
Mar	0.83
Apr	1.05
May	1.15
Jun	1.38
Jul	1.22
Aug	1.12
Sep	0.96
Oct	0.94
Nov	0.85
Dec	0.85

Yearly

Year	Avg. Q (mgd)
2008	17.4
2018	25.8
2028	32.0
2038	37.5
2048	41.7
2058	46.4

Lancaster Co. Staggered AGR	
2000s	2.20
2010s	2.00
2020s	1.50
2030s	1.50
2040s	1.00
2050s	1.00

Analysis Notes
*Future flows based on contributions from Union County and Lancaster County.
*Overall Union Co. projections based on Water System Master Plan population projections extended out to 2060.
*Projections for UC out of the CRWTP are based on service areas outline in the 2000 Water System Master Plan.
includes a reduced service area for Anson County purchased water

for Union County

NC - Office of Planning			AGR	Population Density (persons/sq. mi)	640
1980s	70,436	84,211	1.80%	132	square miles
1990s	84,211	119,842	3.59%	187	25% is in the
Proj. - 2000 to 2030	119,842	262,441	2.65%	410	Basin
Water Master Planning Projections					
2000 to 2020	119,842	325,069	5.12%	508	

Water Supply Study				AGR for Q to approx. 2000 Water System Master Plan	
Water Supply Study Projections					
2000	119,842	199,908	5.25%	9.50%	379
2010	199,908	295,913	4.00%	5.00%	562
2020	295,913	369,655	2.25%	2.50%	701
2030	369,655	429,000	1.50%	1.50%	814
2040	429,000	473,883	1.00%	1.10%	899
2050	473,883	523,461	1.00%	1.00%	993
2060	523,461				
Average AGR 2000-2060	119,842	523,461	2.49%		

Union County Flows

Year	Avg. Q (mgd)			
1992	3.5			
1997	4.7	6.1%		17%
2002	7.3	9.2%	6.23 mgd from CRWTP &	13%
2003	6.0		0.903 from Anson Co (Yadkin)	11%
				9%
				9%
				9%
				9%
				9%

CRWTP	
Year	**Avg. Q (mgd)**
2008	10.2
2018	17.1
2028	21.8
2038	25.8
2048	28.7
2058	32.0

Overall UC Projs.	
Year	**Avg. Q (mgd)**
2008	12.4
2018	19.7
2028	24.8
2038	29.1
2048	32.4
2058	36.0

for Lancaster County

**from Catawba Regional Council of Govts.* AGR

Lancaster Co. 1980s Growth	2.2%
Lancaster Co. 1990s Growth	12.5%

**from SC OSPL*

1980s	53,361	54,516	0.2%
1990s	54,516	60,424	1.0%
2000 to 2020	60,242	68,740	0.7%

**from Catawba Regional Council of Govts.*

Lancaster Co. 1980s Growth	2.2%
City of Lancaster - 1980s	1.3%
Lancaster Co. 1990s Growth	12.5%
City of Lancaster - 1990s	7.5%

Water Supply Study Projections

2000	60,242	74,887	2.20%
2010	74,887	91,287	2.00%
2020	91,287	105,943	1.50%
2030	105,943	122,951	1.50%
2040	122,951	135,814	1.00%
2050	135,814	150,023	1.00%
2060	150,023		

Lancaster Co. Flows

Year	Avg. Q (mgd)
1992	-
1997	-
2002	6.3
2003	6.0

Total CRWTP withdrawal minus water sold to Union Co
(as reported in their 2002 LWSP)

Simple Projections

Year	Avg. Q (mgd)
2008	7.2
2018	8.7
2028	10.1
2038	11.7
2048	13.0
2058	14.3

Table 6
Union County Water Master Plan - 2000
Potable Water Demand Projections By Service Area

Provider/Year	Service Area Population	Number of Customers	Avg Day (mgd)	Peak Day (mgd)

	Population	Customers	(mgd)	(mgd)
CRWTP				
1999	81,126	16,029	4.1	4.1
2005	129,222	33,518	8.5	16.1
2010	176,509	50,714	12.8	24.3
2020	270,946	85,054	21.4	40.6
2030	336,386	108,851	27.3	51.9
2040	390,390	128,489	32.2	61.2
2050	431,234	143,341	35.9	68.3
2060	476,350	159,747	40.0	76.1
Anson County				
1999	16,482	410	0.8	1.0
2005	19,237	1,412	2.5	3.0
2010	22,074	2,443	2.7	3.3
2020	27,885	4,557	3.2	4.3
2030	33,269	6,514	3.7	5.3
2040	38,610	8,457	4.2	6.2
2050	42,649	9,925	4.6	6.9
2060	47,111	11,548	5.0	7.7

Table 5
Union County Water Master Plan - 2000
Potable Water Demand Projections

Year	County Service Area Population	Number of Customers	Average Daily Demand (mgd)	Peak Daily Demand(mgd)
1999	97,608	16,439	4.9	8.6
2000	106,083	19,521	5.7	10.2
2005	148,459	34,930	10.9	19.0
2010	198,583	53,157	15.5	27.6
2020	298,831	89,611	24.6	44.9
2030	369,655	115,365	31.0	57.2
2040	429,000	136,945	36.4	67.4
2050	473,883	153,266	40.5	75.2
2060	523,461	171,295	45.0	83.7

CH2MHILL PROJECTIONS
Rocky River Water Supply Feasibility Study
Potable Water Demand Projections - Peak Demand

Region	Year				
	2005	2010	2020	2030	2035
NW	4.0	5.1	8.3	11.2	13.0
Catawba	8.6	11.5	20.6	27.7	32.2
NE	1.8	1.9	2.7	3.7	4.2
Anson	0.8	1.0	1.1	1.4	1.6

Anson	0.8	1.0	1.1	1.4	1.6
SE	2.1	2.4	3.4	4.5	5.3
Monroe	13.8	16.0	23.4	29.8	33.6
UC near Monroe	1.1	1.3	1.1	1.4	1.8

Potable Water Demand Projections - Avg Demand					
Region	Year				
	2005	2010	2020	2030	2035
NW	2.1	2.7	4.4	5.9	6.8
Catawba	4.5	6.1	10.8	14.6	16.9
NE	0.9	1.0	1.4	1.9	2.2
Anson	0.4	0.5	0.6	0.7	0.8
SE	1.1	1.3	1.8	2.4	2.8
Monroe	7.3	8.4	12.3	15.7	17.7
UC near Monroe	0.6	0.7	0.6	0.7	0.9

Projections for Catawba Service Area (excludes Monroe and Anson area)

	2005	2010	2020	2030	2035
CH2MHill	9.3	11.7	19.0	25.5	29.7
HDR	8.5	12.8	21.4	27.3	

HDR ID: **SDF - 7**
FACILITY: **Indianland WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.24	NA
Feb				0.15	
Mar				0.21	

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	NA

Apr				0.21	
May				0.19	
Jun				0.20	
Jul				0.24	
Aug				0.25	
Sep				0.28	
Oct				0.26	
Nov				0.27	
Dec				0.24	

2002	0.23
2003	NA

PROJECTION SUMMARY

AGR
1.70

Monthly

Month	Ann Avg Coefficient
Jan	1.07
Feb	0.64
Mar	0.93
Apr	0.93
May	0.84
Jun	0.87
Jul	1.05
Aug	1.11
Sep	1.21
Oct	1.13
Nov	1.19
Dec	1.04

Yearly

Year	Avg. Q (mgd)
2008	0.23
2018	0.98
2028	1.74
2038	2.49
2048	3.25
2058	4.00

Analysis Notes

**from Catawba Regional Council of Govts.*

Lancaster Co. 1980s Growth	2.2%
City of Lancaster - 1980s	1.3%
Lancaster Co. 1990s Growth	12.5%
City of Lancaster - 1990s	7.5%

*Plant Capacity 1.2 mgd

*Expansion to 4.0 MGD proposed in the next decade

*Lancaster Growth Projs (20)

		AGR
State Projections	12.0%	0.6%
Growth Trend	29.0%	1.3%
Growth Trend (Cat. Ridge)	40.0%	1.7%
Building Permit Trend	55.0%	2.2%
CR-COG Projs. Approx.		1.7%

*These projections indicate a 2058 flow of only 0.59 MGD

*Future 2058 pop. Proj. for Lancaster Co. indicate 158,000. Approx. 2/3 of that is in Cat. Basin; thus a pop. Of 105,000 at a rate of 4 mgd for Indianland WWTP and 6 mgd for City of Lancaster, the resulting 10 mgd flow represents a near 100% coverage of population at a rate of 100 gpcd (incl. Res/comm/ind.). In addition, it is possible flow moved into the Yadkin basin may be brought back by pumping into the Catawaba to avoid future IBT….which Lancaster coverage only 2/3 of pop.

Owner: **City of Lenoir**

HDR ID	Facility	Type
NWR - 2	Lenoir Water Treatment Plant	Discharge
NDR - 2	Lenoir WTP	Withdrawal
NDR - 3	Lower Creek WWTP	Discharge
NDH - 4	Gunpowder Creek WWTP	Discharge

CONTACT: **Mack 'Buddy' Edmisten**

Proj. By: *LKM*

HDR ID: **NWR - 2**
FACILITY: **Lenoir Water Treatment Plant**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	6.10	NA
Feb				6.08	
Mar				6.03	
Apr				6.30	
May				6.63	
Jun				7.21	
Jul				7.30	
Aug				7.22	
Sep				6.59	
Oct				6.53	
Nov				6.05	
Dec				5.88	

Yearly

Year	Avg. Q (mgd)
1992	4.89
1997	6.26
1999	NA
2002	6.47
2003	NA

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
0.75	0.50

Monthly

Month	Ann Avg Coefficient
Jan	0.94
Feb	0.94
Mar	0.93
Apr	0.97
May	1.02
Jun	1.11
Jul	1.13
Aug	1.12
Sep	1.02
Oct	1.01
Nov	0.93
Dec	0.91

Yearly

Year	Avg. Q (mgd)
2008	6.72
2018	7.19
2028	7.69
2038	8.22
2048	8.80
2058	9.41

Analysis Notes

Type	2008	2018	2028	2038	2048	2058

Type	2006	2016	2026	2036	2046	2056
Res. Cust	8,499	9,158	9,868	10,634	11,459	12,348
Demand	1,121,000	1,208,000	1,302,000	1,403,000	1,512,000	1,629,000
Com. Cust.	1,805	1,945	2,096	2,259	2,434	2,623
Demand	236,000	255,000	274,000	296,000	319,000	343,000
Ind. Cust	1,236	1,300	1,366	1,436	1,509	1,587
Demand	1,096,000	1,152,000	1,211,000	1,273,000	1,338,000	1,407,000
Inst. Cust	36	38	40	42	44	46
Demand	335,000	346,000	358,000	370,000	383,000	396,000
Wholesale Demand	2,521,000	2,716,000	2,927,000	3,154,000	3,399,000	3,662,000
TOTALS	**11,576**	**12,441**	**13,371**	**14,371**	**15,447**	**16,604**
	6,720,000	**7,186,000**	**7,686,000**	**8,223,000**	**8,799,000**	**9,414,000**

Type	2002 LWSP	GPD/Cust	1997 LWSP	2002 LWSP	AGR	AGR Ind.
Res. Cust	8,126	132	15,881	16,793	0.75	0.50
Com. Cust.	1,726	131				
Ind. Cust	1200	887				
Inst. Cust	35	5,971				
TOTAL	**11,087**	**-**				

2002 Wholesale (MGD):

Caldwell Co.	1.49
Baton WC	0.55
Sawmills	0.27
Joyceton WC	0.10
Total	2.41
System Process Water	0.13
Total Water Used	6.47
Unaccounted For Water %	21.0%

*Reported to have lost some industry in the past few years.
*Lenoir has plans for a new intake or modifications, and are planning to look at plant's ability to deliver 12 MGD.
(cannot do reliably now)...Future project may look at expansion to 18 MGD
*They have some IBT into Caldwell County; with the line up to Happy Valley Elem School via 321 and Hwy 268 to serve Omni
*Caldwell is developing a project in NE Caldwell to serve that area….future interbasin transfer may not be required.
*Projections based on annual growth rate (residential and commercial) and gpd/customer.

*1980's AGR =	0.43%	67746	70709
*1990's AGR =	0.86%	70709	77016
Office of Planning			
*2000's AGR (predicted) =	0.76%	77016	83035
*2010's AGR (predicted) =	0.58%	83035	87948
*2020's AGR (predicted) =	0.49%	87948	92336
WPCOG			
*2000s AGR (predicted) =	0.72%	77415	83143
*2010s AGR (predicted) =	0.57%	83143	88044

*Assume AGR of 0.75% to 2058 for residential/commercial, this will allow accomodation of proposed population growth, allow some service area expansion, and be slightly conservative
*Assume AGR of 0.5% growth for industrial
*Assume AGR of 0.75% for wholesale growth rate

*It is important to note that Caldwell County plans for new water source on the Yadkin could impact Lenoir projections… those above are likely conservative estimates.

HDR ID: **NDR - 2**
FACILITY: **Lenoir WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.12
1999	NA
2002	0.13
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.00
Apr	1.00
May	1.00
Jun	1.00
Jul	1.00
Aug	1.00
Sep	1.00
Oct	1.00
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	0.14
2018	0.14
2028	0.15
2038	0.17
2048	0.18
2058	0.19

Analysis Notes

*Assumed 2.01% of withdrawn water is returned back to lake from WTP, as suggested by historical flow data.

HDR ID: **NDR - 3**
FACILITY: **Lower Creek WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	2.27	2.09
Feb				2.14	2.84
Mar				2.31	3.19
Apr				1.95	3.01
May				1.88	2.74
Jun				1.64	2.79
Jul				1.85	2.56
Aug				2.04	3.00
Sep				2.08	2.03
Oct				2.18	2.00
Nov				2.42	2.06
Dec				2.59	2.20

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	2.44
1999	NA
2002	2.11
2003	2.54

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.08
Feb	1.01
Mar	1.10
Apr	0.93
May	0.89
Jun	0.78
Jul	0.88
Aug	0.97
Sep	0.99
Oct	1.03
Nov	1.15
Dec	1.23

Yearly

Year	Avg. Q (mgd)
2008	2.7
2018	2.9
2028	3.1
2038	3.3
2048	3.5
2058	3.8

Lower Creek Wastewater Flow as % of Water Demand

WTP		
6.26	39.0%	
6.47	32.6%	dry year

Analysis Notes

*Historical Flow Data Source: DMRs from Division of Water Quality
*Future flows based on projected withdrawal rates from Lenoir WTP.
*Wastewater projections are based on the percentage of water usage and the growth rate according to historical data
*Base Lower Creek WWTP from 40% of WTP output

HDR ID: **NDH - 4**
FACILITY: **Gunpowder Creek WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	1.01	0.82
Feb				0.75	1.06
Mar				0.88	1.38
Apr				0.75	1.65
May				0.73	1.33
Jun				0.72	1.28
Jul				0.66	1.34
Aug				0.75	1.20
Sep				0.87	0.99
Oct				1.01	0.91
Nov				1.24	0.87
Dec				1.14	0.90

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.96
1999	NA
2002	0.87
2003	1.14

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.16
Feb	0.86
Mar	1.01
Apr	0.86
May	0.84
Jun	0.82
Jul	0.76
Aug	0.86
Sep	1.00
Oct	1.16
Nov	1.43
Dec	1.31

Yearly

Year	Avg. Q (mgd)
2008	1.0
2018	1.1
2028	1.2
2038	1.2
2048	1.3
2058	1.4

Gunpowder Creek
Wastewater Flow as % of Water Demand

	WTP		
	6.26	15.3%	
	6.47	13.4%	dry year

Analysis Notes
*Historical Flow Data Source: DMRs from Division of Water Quality
*Future flows based on projected withdrawal rates from Lenoir WTP.
*Assumed Lower Creek WWTP treats approx. 15% of Lenoir WTP output, according to historical data.

OWNER: **Lincoln County**

HDR ID	Facility	Type
NWN - 2	Lincoln County WTP	Withdrawal
NDN - 7	Lincoln County WTP	Discharge
NDY - 26	Forney Creek WWTP	Discharge

CONTACT: **Stephen Gilbert**

Proj. By: *JCH*

HDR ID: NWN - 2
FACILITY: **Lincoln County WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	1.87	NA
Feb				1.84	
Mar				1.81	
Apr				2.08	
May				2.40	
Jun				2.67	
Jul				2.58	
Aug				2.55	
Sep				2.18	
Oct				1.81	
Nov				1.71	
Dec				1.76	

Yearly

Year	Avg. Q (mgd)
1992	1.02
1997	2.33
1999	NA
2002	2.11
2003	NA

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
2.50	1.66

Projection Analysis

Monthly

Month	Ann Avg Coefficient
Jan	0.80
Feb	0.79
Mar	0.78
Apr	0.89
May	1.03
Jun	1.15
Jul	1.11
Aug	1.09
Sep	0.93
Oct	0.78
Nov	0.74
Dec	0.76

Yearly

Year	Avg. Q (mgd)
2008	2.30
2018	2.91
2028	3.69
2038	4.68
2048	6.12
2058	7.74

LWSP

2.5	2010
3.3	2020
4.1	2030
5.1	2040
6.4	2050

Analysis Notes
*Historical Flow Data Source: 1997 and 2002 LWSPs from NCDWR.
*Wastewater projections are based on the percentage of water usage by sector and the growth of those sectors.
*Res./Comm. AGR based on growing by approx. 350 customers/year by the year 2058.
*Ind. AGR based on growth trends of surrounding industries, according to NC GSP.

Analysis Notes

Type	2008	2018	2028	2038	2048	2058
Res. Cust	7,528	9,636	12,335	15,790	20,212	25,873

Res. Cust	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Demand	1,279,000	1,637,000	2,096,000	2,683,000	3,435,000	4,397,000
Com. Cust.	459	588	753	963	1,233	1,578
Demand	197,000	252,000	323,000	414,000	529,000	678,000
Ind. Cust	46	55	64	76	90	106
Demand	135,000	159,000	187,000	221,000	394,800	448,700
Inst. Cust	105	124	146	172	203	239
Demand	84,000	99,000	117,000	137,000	162,000	191,000
Wholesale	6,000	6,000	8,000	9,000	10,000	12,000
TOTALS	**8,138**	**10,278**	**13,152**	**16,829**	**21,535**	**27,557**
	2,299,000	**2,909,000**	**3,691,000**	**4,681,000**	**6,123,000**	**7,739,000**

Type	2002 LWSP	GPD/Cust	1997 LWSP	2002 LWSP	AGR	AGR Ind.
Res. Cust	6,491	170	11,808	17,167	2.50	1.66
Com. Cust.	396	429				
Ind. Cust	42	2,905				
Inst. Cust	95	800				
TOTAL	**7,024**	**-**				

Backwash & Unaccounted For	26%
2002 Wholesale	5,000
Process Water	0.09

*Pop AGR from 1997 and 2002 LWSP is 7.77. Seems too high to use; could be based on service area expansion
*Based on an interview with the Utility Dir. used 350 customers/yr

Population Information

*State - Office of Planning		AGR	*Check 2.5% approach*		
	1980s	1.70%	2000 population	59,764	
	1990s	1.70%	at 1.7% AGR	158,875	2058 pop.
	2000s proj.	2.60%	2002 served	17,167	
	2010s proj.	1.70%	at 2.5% AGR served	68,428	2058 served
	2020s proj.	1.40%	*this increases % of county served from approx. 28% to 43% by the County assume OK*		

*Assume growth in demand and residential/commercial customers to follow a 2.50% AGR, to account for both population growth and service area expansion into other parts of Lincoln County.
*Assume growth in demand for ind. To be at 1.66%; per NCGSP
*Lincoln County has proposed expansion to 6 MGD at WTP
*Lincoln County has withdrawal permit of 15 MGD
*2002 LWSP says they may buy 2 MGD from Hickory…..this will not be assumed in the analysis; while it may be an emergency connect…assume Lincoln County takes care of own needs in future.

HDR ID: NDN - 7
FACILITY: Lincoln County WTP

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.07
1999	NA
2002	0.09
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.00
Apr	1.00
May	1.00
Jun	1.00
Jul	1.00
Aug	1.00
Sep	1.00
Oct	1.00
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	0.08
2018	0.11
2028	0.13
2038	0.17
2048	0.26
2058	0.28

Analysis Notes

*0.07 mgd of system water reported in 1997 LWSP
*1997 DMR lists 0.09 mgd discharge.
*0.09 mgd of system water reported in 2002 LWSP.
*use 3.6%....average of the results, likely will be reduced as plant is expanded

Year	Total Water	Sys. Water	% of Total Water
1997	2.33	0.07	3.0%
2002	2.11	0.09	4.3%

3.6%

Year	Total Water	Sys. Water	% of Total Water	Discharge
2008	2.30	0.08	3.6%	0.08
2018	2.91	0.11	3.6%	0.11
2028	3.69	0.13	3.6%	0.13
2038	4.68	0.17	3.6%	0.17
2048	6.12	0.26	4.3%	0.26
2058	7.74	0.28	3.6%	0.28

Percentage of System Water Discharged
100%

HDR ID: NDY - 26
FACILITY: Forney Creek WWTP

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.25	0.35
Feb				0.25	0.38
Mar				0.33	0.43
Apr				0.33	0.39
May				0.28	0.46
Jun				0.23	0.45
Jul				0.26	0.43
Aug				0.29	0.46
Sep				0.28	0.43
Oct				0.30	0.42
Nov				0.32	0.42
Dec				0.33	0.43

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.09
1999	NA
2002	0.29
2003	0.42

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
2.50	1.66

Monthly

Month	Ann Avg Coefficient
Jan	0.86
Feb	0.86
Mar	1.12
Apr	1.13
May	0.95
Jun	0.80
Jul	0.89
Aug	0.99
Sep	0.98
Oct	1.02
Nov	1.10
Dec	1.12

Yearly

Year	Avg. Q (mgd)
2008	0.47
2018	0.60
2028	0.76
2038	0.96
2048	1.22
2058	1.55

Analysis Notes
*Historical Flow Data Source: DMRs from Division of Water Quality
*Wastewater projs are based on the % of water usage by sector and the growth of those sectors.
*Ind. AGR based on growth trends of surrounding industries, according to NC GSP.

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	1,273,000	86.5%	2.50	1.66	0.36
Ind/Inst	198,000	13.5%			0.06
Total	**1,471,000**	**-**	**-**	**-**	**0.42**

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.41	0.53	0.67	0.86	1.10	1.41
Ind/Inst Demand	0.06	0.07	0.09	0.10	0.12	0.14
Total	**0.47**	**0.60**	**0.76**	**0.96**	**1.22**	**1.55**

OWNER: **City of Lincolnton**

HDR ID	Facility	Type
NWY - 12	Lincolnton WTP	Withdrawal
NDY - 20	Lincolnton WTP	Discharge
NDY - 21	Lincolnton WWTP	Discharge

CONTACT: **Steve Peeler**

Proj. By: *JCH*

HDR ID: **NWY - 12**
FACILITY: **Lincolnton WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	4.83	4.07	NA	NA	NA
Feb	4.79	4.13			
Mar	5.05	3.93			
Apr	5.19	4.12			
May	5.30	4.27			
Jun	5.08	4.34			
Jul	5.09	4.30			
Aug	5.17	4.46			
Sep	4.48	4.74			
Oct	4.41	4.35			
Nov	4.57	4.06			
Dec	4.53	4.03			

Yearly

Year	Avg. Q (mgd)
1992	4.71
1997	4.24
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.50	1.66

Monthly

Month	Ann Avg Coefficient
Jan	0.96
Feb	0.97
Mar	0.93
Apr	0.97
May	1.01
Jun	1.02
Jul	1.01
Aug	1.05
Sep	1.12
Oct	1.03
Nov	0.96
Dec	0.95

Yearly

Year	Avg. Q (mgd)
2008	4.87
2018	5.70
2028	6.66
2038	7.80
2048	9.12
2058	10.69

Analysis Notes
*Historical Flow Data Source: 1992 and 1997 LWSPs from NCDWR.
*Wastewater projections are based on the percentage of water usage by sector and the growth of those sectors.
*Res./Comm. AGR based on historical and projected AGRs for the County, according to the NC State Office of Planning.
*Ind. AGR based on growth trends of surrounding industries, according to NC GSP.

Analysis Notes

Type	2008	2018	2028	2038	2048	2058
Res. Cust	4,484	5,204	6,040	7,009	8,134	9,440
Demand	596,000	692,000	803,000	931,000	1,081,000	1,255,000

Com. Cust.	763	886	1,028	1,193	1,385	1,607
Demand	234,000	272,000	315,000	366,000	424,000	493,000
Ind. Cust	88	104	123	145	171	201
Demand	1,410,500	1,649,100	1,929,000	2,259,300	2,646,800	3,103,700
Inst. Cust	10	12	14	16	19	23
Demand	684,000	807,000	951,000	1,121,000	1,322,000	1,559,000
Wholesale	0	0	0	0	0	0
TOTALS	**5,346**	**6,194**	**7,190**	**8,347**	**9,690**	**11,248**
	4,874,000	**5,700,000**	**6,663,000**	**7,796,000**	**9,123,000**	**10,685,000**

Type	1997 LWSP	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	4,101	133	6,955	9,965	1.50	1.66
Com. Cust.	698	307				
Ind. Cust	80	14,725			Backwash & Unaccounted For	40%
Inst. Cust	9	68,889			1997 Wholesale	0
TOTAL	**4,888**	**-**				

*2002 LWSP not submitted. 2003 data not submitted. Projections based on 1992 and 1997 data from LWSP.

Population Information - Lincoln County

*State - Office of Planning	AGR
1980s	1.70%
1990s	1.70%
2000s proj.	2.60%
2010s proj.	1.70%
2020s proj.	1.40%

*Assume growth in demand and residential/commercial customers to follow a 1.5% AGR, to account for both population growth and limited service area expansion into other parts of Lincoln County.

*The Lincoln County WTP projections were assumed on the higher side of 2.5 AGR

*Assume growth in demand for ind. to be at 1.66% per NC GSP

*Unaccouted for Water seems very high

HDR ID: **NDY - 20**
FACILITY: **Lincolnton WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.56	0.82
Feb				0.63	0.93
Mar				0.60	0.80
Apr				0.56	0.69
May				0.76	0.80
Jun				0.60	0.63
Jul				0.70	0.85
Aug				0.63	0.85
Sep				0.69	1.21
Oct				0.60	1.20
Nov				0.54	1.07
Dec				0.78	1.17

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	NA
2002	0.64
2003	0.92

no WTP data for 2002, 2003
*Assume 4.5 mgd
Discharge
Water
14.2%
20.4%
While these seem high,
we need to assume
15%
unless other data presented

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.88
Feb	0.99
Mar	0.94
Apr	0.87
May	1.19
Jun	0.93
Jul	1.10
Aug	0.98
Sep	1.08
Oct	0.94
Nov	0.84
Dec	1.21

Yearly

Year	Avg. Q (mgd)
2008	0.73
2018	0.86
2028	1.00
2038	1.17
2048	1.37
2058	1.60

Year	Total Water	Sys. Water	% of Total Water
1997	4.243	0.121	2.9%
2002	NA	0.64	NA

Year	Total Water	Sys. Water	% of Total Water	Discharge
2008	4.87			0.73
2018	5.70			0.86
2028	6.66			1.00
2038	7.80			1.17
2048	9.12			1.37
2058	10.69			1.60

Analysis Notes
*Assumed Lincolnton WTP will discharge 15% of what it withdraws, as suggested by historical flow data.

HDR ID: **NDY - 21**
FACILITY: **Lincolnton WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	3.88	2.41
Feb				2.58	2.86
Mar				2.49	3.19
Apr				2.58	3.88
May				2.43	3.47
Jun				2.51	3.59
Jul				1.85	2.66
Aug				2.80	2.98
Sep				2.69	2.88
Oct				2.62	2.95
Nov				2.60	2.73
Dec				2.63	2.33

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	3.49
1999	NA
2002	2.64
2003	2.99

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.50	1.66

Monthly

Month	Ann Avg Coefficient
Jan	1.47
Feb	0.98
Mar	0.94
Apr	0.98
May	0.92
Jun	0.95
Jul	0.70
Aug	1.06
Sep	1.02
Oct	0.99
Nov	0.99
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	3.24
2018	3.80
2028	4.46
2038	5.24
2048	6.14
2058	7.21

Analysis Notes
*Historical Flow Data Source: DMRs from Division of Water Quality
*Wastewater projs. are based on the % of water usage by sector and the growth of those sectors.
*Res./Comm. AGR based on historical and projected AGRs for the County.
*Ind. AGR based on growth trends of surrounding industries, according to NC GSP.

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	759,000	29.7%	1.50	1.66	0.89
Ind/Inst	1,798,000	70.3%			2.10
Total	**2,557,000**	**-**	**-**	**-**	**2.99**

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.96	1.11	1.29	1.49	1.73	2.01
Ind/Inst Demand	2.28	2.69	3.17	3.74	4.41	5.20
Total	**3.24**	**3.80**	**4.46**	**5.24**	**6.14**	**7.21**

OWNER: **Linville Land Harbor Property Owners Association**

HDR ID	Facility	Type
NDJ - 7	Linville Land Harbor Property Owners Association	Discharge

CONTACT: **Kevin McCracken**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.12	NA
Feb				0.08	
Mar				0.10	
Apr				0.08	
May				0.10	
Jun				0.13	
Jul				0.15	
Aug				0.15	
Sep				0.15	
Oct				0.14	
Nov				0.14	
Dec				0.15	

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.08
1999	NA
2002	0.12
2003	NA

PROJECTION SUMMARY

AGR Residential
1.42

Monthly

Month	Ann Avg Coefficient
Jan	0.96
Feb	0.66
Mar	0.80
Apr	0.62
May	0.80
Jun	1.05
Jul	1.22
Aug	1.18
Sep	1.22
Oct	1.16
Nov	1.14
Dec	1.18

Yearly

Year	Avg. Q (mgd)
2008	0.13
2018	0.15
2028	0.18
2038	0.21
2048	0.24
2058	0.27

Analysis Notes

*Permitted limit currently is 0.225 mgd, but a PER has been submitted to incr. capacity to 0.30 mgd.
*Water source is community well system with capacity of 0.927
*Assume that this type of development will continue in this area…and to account for that growth we increase projections for discharge at the rate of Burke County population projections

*Burke County growth in 1980s	4.5%	10 year growth	AGR	0.44%
*Burke County growth in 1990s	10.8%	10 year growth	AGR	1.03%
*OSPL B.C. projected growth 2000-2030	52.8%	30 year growth	AGR	1.42%

*Use 1.42% annually

OWNER: **Linville Resorts, Inc.**

HDR ID	Facility	Type
NDJ - 8	Linville Resorts Incoporated	Discharge

CONTACT: **Bentley Parlier**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.03
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.0
Feb	1.0
Mar	1.0
Apr	1.0
May	1.0
Jun	1.0
Jul	1.0
Aug	1.0
Sep	1.0
Oct	1.0
Nov	1.0
Dec	1.0

Yearly

Year	Avg. Q (mgd)
2008	0.15
2018	0.15
2028	0.15
2038	0.15
2048	0.15
2058	0.15

Analysis Notes

*Assumed plant will operate at permitted limit (0.15 mgd) with no plans for expansion.

*Water source is community well system.

OWNER: **Town of Longview**

HDR ID	Facility	Type
NWH - 2	Longview WTP	Withdrawal

CONTACT: **Randi Holland**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	1.08	0.97
Feb				1.08	0.97
Mar				0.99	0.88
Apr				1.10	0.99
May				1.22	1.11
Jun				1.15	1.04
Jul				1.04	0.93
Aug				1.11	1.00
Sep				0.98	0.87
Oct				0.98	0.87
Nov				0.95	0.84
Dec				0.84	0.73

Yearly

Year	Avg. Q (mgd)
1992	1.25
1997	1.64
1999	NA
2002	1.04
2003	NA

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.50	1.66

Monthly

Month	Ann Avg Coefficient
Jan	1.03
Feb	1.04
Mar	0.94
Apr	1.06
May	1.17
Jun	1.10
Jul	1.00
Aug	1.06
Sep	0.94
Oct	0.94
Nov	0.91
Dec	0.81

Yearly

Year	Avg. Q (mgd)
2008	1.48
2018	1.74
2028	2.04
2038	2.39
2048	2.80
2058	3.28

Type	2008	2018	2028	2038	2048	2058
Res. Cust	2,537	2,944	3,417	3,965	4,602	5,341

Type	2005	2010	2020	2030	2040	2050
Res. Cust	2,537	2,944	3,417	3,965	4,602	5,341
Demand	419,000	486,000	564,000	654,000	759,000	881,000
Com. Cust.	180	209	243	282	327	380
Demand	758,000	879,000	1,021,000	1,184,000	1,375,000	1,595,000
Ind. Cust	22	26	31	36	43	50
Demand	221,000	260,000	307,000	362,000	427,000	503,000
Inst. Cust	0	0	0	0	0	0
Demand	0	0	0	0	0	0
TOTALS	**2,739**	**3,179**	**3,690**	**4,283**	**4,972**	**5,771**
	1,589,000	**1,847,000**	**2,150,000**	**2,500,000**	**2,910,000**	**3,385,000**

Type	2002 LWSP	GPD/Cust	1997 LWSP	2002 LWSP	AGR	AGR Ind.
Res. Cust	2,320	165	4,500	4,909	1.50	1.66
Com. Cust.	165	4,200				
Ind. Cust	20	10,000				
Inst. Cust	0	0				
TOTAL	**2,505**	**-**				

Backwash & Unaccounted For 12%

*Projections based on annual growth rate (residential and commercial) and gpd/customer.
*Both the 1997 and 2002 LWSPs show that Longview purchased 0.35 mgd for 114 days.
*Assumed that 0.11 mgd (over 1 year) is purchased from Hickory. To avoid double counting, this number was subtracted from the overall yearly projections.
*2002 LWSP data for GPD/customer incorrect. Estimates based on previous LWSPs.
*Catawba County 1980s historical growth 1.19% AGR
*Catawba County 1990s historical growth 1.41% AGR
*Catawba County 2000-2030 pop. Projection 1.52% AGR
*AGR between 1997 and 2002 LWSP indicates a 1.76% AGR
*Longview population grew rapidly during the 1990s - roughtly 3% AGR, annexation?
*This area may ultimately be served by the City of Hickory or others, but will include withdrawal projections as part of Longview
*Base future projections on 1.50% AGR
*CMUDCU projections in 2030 for 2020 was 2.35, likely based on 1997 higher flows
*The industrial per user rate is high, but LWSP says largest user is 15,000 gpd, so it seems rather equally spread
*AGR ind. Is 4.66 - 3.00 per NC GSP

LWSP Projections

1.1	2010	
1.2	2020	
1.2	2030	
1.5	2040	
1.6	2050	expect to serve 6600 people

OWNER: **City of Lowell**

HDR ID	Facility	Type
NDY - 22	Lowell WWTP	Discharge

CONTACT: **Ben Blackburn**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.21	0.23
Feb				0.20	0.30
Mar				0.27	0.40
Apr				0.23	0.53
May				0.28	0.46
Jun				0.22	0.36
Jul				0.29	0.34
Aug				0.36	0.32
Sep				0.19	0.29
Oct				0.25	0.25
Nov				0.25	0.25
Dec				0.29	0.29

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.35
1999	NA
2002	0.25
2003	0.33

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.68
Feb	0.88
Mar	1.20
Apr	1.59
May	1.37
Jun	1.07
Jul	1.02
Aug	0.96
Sep	0.85
Oct	0.76
Nov	0.75
Dec	0.88

Yearly

Year	Avg. Q (mgd)
2008	0.35
2018	0.38
2028	0.41
2038	0.45
2048	0.49
2058	0.53

Analysis Notes

Type	2002 LWSP	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	1,282	292	2,710	2,662	0.75	1.66

Type	2002 LWSI	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	1,282	292	2,710	2,662	0.75	1.66
Com. Cust.	98	194	AGR of 1.66 as before			
Ind. Cust	1	30,000				
Inst. Cust	1	3,000				
TOTAL	**1,381**	**-**				

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	393,000	92.3%	0.75	1.66	0.31
Ind/Inst	33,000	7.7%			0.03
Total	**426,000**	**-**	**-**	**-**	**0.33**

Wastewater Projections

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.32	0.35	0.37	0.40	0.43	0.47
Ind/Inst Demand	0.03	0.03	0.04	0.05	0.05	0.06
Total	**0.35**	**0.38**	**0.41**	**0.45**	**0.49**	**0.53**

*Wastewater projections are based on the percentage of water usage by sector and the growth of those sectors.
*Historical Flow Data Source: DMRs from Division of Water Quality
*Ind. AGR based on growth trends of general industries, according to NC GSP.
*Wastewater projections are based on the percentage of water usage and the growth rate of that usage.
*Lowell purchases water from the City of Gastonia.
*Assume AGR of 0.75 for res/comm based on future Gaston pop. Projections (see Gastonia)

OWNER: **Lugoff Elgin Water Authority**

HDR ID	Facility	Type
SWW - 2	28WS004	Withdrawal

CONTACT:

Proj. By: *LKM*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	1.79	NA	2.12	2.08
Feb		1.78		2.16	1.91
Mar		1.74		2.38	1.86
Apr		1.90		2.45	1.90
May		2.07		2.38	2.07
Jun		2.16		2.56	2.27
Jul		2.41		2.53	2.08
Aug		2.41		2.50	2.10
Sep		2.31		2.46	2.16
Oct		1.97		2.08	2.00
Nov		1.89		1.93	1.87
Dec		1.77		1.93	1.92

Yearly

Year	Avg. Q (mgd)
1992	0.74
1997	2.01
1999	NA
2002	2.29
2003	2.01

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.03
Feb	0.95
Mar	0.93
Apr	0.95
May	1.03
Jun	1.13
Jul	1.03
Aug	1.04
Sep	1.07
Oct	0.99
Nov	0.93
Dec	0.95

Yearly

Year	Avg. Q (mgd)
2008	3.62
2018	4.82
2028	5.97
2038	6.81
2048	7.80
2058	8.69

Staggered AGRs	
2002-2008	4.12%
2008-2018	3.50%
2018-2028	2.50%
2028-2038	1.50%
2038-2048	1.50%
2048-2058	1.20%

Analysis Notes

*WTP is rated at 3.1 MGD; is being expanded to 6.0 MGD with ultimate cap. of 8 MGD

*They have a FERC allocation of 10 MGD, supplement with well systems
*They may pick up DuPont as a water customer; they currently pull out of the Wateree River
*90% of their customer base is on septic systems; this will likely change in the future.
*Lugoff completed a Water System Master Plan in March of 2004…..some relevant findings include:

*growth occuring primarily around Elgin
*growth in number of customers

1999	3.77%	
2000	8.04%	
2001	5.60%	
2002	3.01%	
2003	3.07%	
over 5 yrs	4.70%	AGR in customers

*report a 4.00% growth in water demand in the past 5 years…slight discrepancy; depends on which 5 years and real impact of drought.
*report a 4.12% growth in number of customers in the next 5 years

*Kershaw county data (copied from Camden projections)

*Population data for Kershaw	AGR		
1980s	1.12	39,015	43,599
1990s	1.90	43,599	52,647
2000s proj. (by state)	1.13	52,647	58,880
2010s proj. (by state)	1.15	58,880	66,040
2020-25 proj (by state)	1.06	66,040	69,620

*The growth plans appear aggressive; the capital improvements plan also seems aggressive; thus we will assume a staggered growth approach thru the period, in line with current plans and future population projections; use 2002 as a basis.
*This approach will seem aggressive, but considering recent industrial successes (e.g. Target) and potential future Dupont; and proximity to Columbia, this approach should be adequate.

OWNER: **Magellan Terminals Holdings LP**

HDR ID	Facility	Type
NDY - 4	Charlotte II Terminal	Discharge

CONTACT: **Paul Potts**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.06
2002	NA
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.0
Feb	1.0
Mar	1.0
Apr	1.0
May	1.0
Jun	1.0
Jul	1.0
Aug	1.0
Sep	1.0
Oct	1.0
Nov	1.0
Dec	1.0

Yearly

Year	Avg. Q (mgd)
2008	0.00
2018	0.00
2028	0.00
2038	0.00
2048	0.00
2058	0.00

Analysis Notes

*Talking with Transmontaigne and others, these facilities are washdown areas and tank containment. That discharges are intermittent (e.g. 1/year) and that flows are not significant.

*Permitted limit currently is 0.259 mgd.

*Discharges are infrequent (e.g. 1 per year), which yield insignificant annual discharge volumes.

*Projection is assumed to be 0.0 mgd on an annual average basis with no expected increase.

OWNER: **Town of Maiden**

HDR ID	Facility	Type
NDY - 29	Maiden WWTP	Discharge

CONTACT: **Eddie Faulkner**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.42	0.33
Feb				0.33	0.46
Mar				0.37	0.65
Apr				0.37	0.84
May				0.32	0.76
Jun				0.25	0.70
Jul				0.27	0.41
Aug				0.27	0.44
Sep				0.26	0.31
Oct				0.33	0.29
Nov				0.42	0.30
Dec				0.61	0.37

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.40
1999	NA
2002	0.35
2003	0.49

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.40	1.66

Monthly

Month	Ann Avg Coefficient
Jan	0.68
Feb	0.95
Mar	1.33
Apr	1.72
May	1.55
Jun	1.43
Jul	0.84
Aug	0.90
Sep	0.63
Oct	0.59
Nov	0.61
Dec	0.76

Yearly

Year	Avg. Q (mgd)
2008	0.51
2018	0.54
2028	0.58
2038	0.63
2048	0.68
2058	0.74

Analysis Notes

Type	2002 LWSP	GPD/Cust	1997 LWSP	2002 LWSP	AGR	AGR Ind.

Type	2002 LWSP	GPD/Cust	1997 LWSP	2002 LWSP	AGR	AGR Ind.
Res. Cust	1,368	157	2,900	3,262	1.40	0.50
Com. Cust.	124	548				
Ind. Cust	53	18,189				
Inst. Cust	0	0				
TOTAL	**1,545**	**-**				

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	283,000	22.7%	1.40	0.50	0.11
Ind/Inst	964,000	77.3%			0.38
Total	**1,247,000**	**-**	**-**	**-**	**0.49**

Wastewater Projections

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.12	0.14	0.16	0.18	0.21	0.24
Ind/Inst Demand	0.39	0.41	0.43	0.45	0.47	0.50
Total	**0.51**	**0.54**	**0.58**	**0.63**	**0.68**	**0.74**

*Historical Flow Data Source: DMRs from Division of Water Quality
*Wastewater projections are based on the percentage of water usage by sector and the growth of those sectors.

Population Data

Data from State Office of Planning

*Catawba County 1980s historical growth	1.19% AGR	
*Catawba County 1990s historical growth	1.41% AGR	
*Catawba County 2000-2030 pop. Projection	1.52% AGR	

From LWSP

*AGR between 1997 and 2002 LWSP indicates a	2.38% AGR	

WPCOG information for Catawba County

*1990s historical growth	1.81% AGR	small discrepancy;
*2000 - 2010 projections	1.59% AGR	use WPCOG
*2010 - 2020 projections	1.37% AGR	

Future Projections

*Maiden has seen little growth according to DMRs in the last decade
*Hickory will likely be regional provider; Maiden will be assumed limited within relatively the current boundaries.
*Use AGR as below to reflect normal growth within the existing system; and slower growth due to heavy textiles

*Base future projections for Maiden on	1.40% AGR
and	0.50% AGR

OWNER: **City of Marion**

HDR ID	Facility	Type
NWJ - 2	Marion WTP	Withdrawal
NWJ - 3	Marion WTP	Withdrawal
NWJ - 4	Marion WTP	Withdrawal
NDJ - 3	Marion WTP	Discharge
NDJ - 4	Catawba WWTP	Discharge
NDR - 4	Corpening WWTP	Discharge

CONTACT: **Steve Basney**

Proj. By: *JCH*

HDR ID: **NWJ - 2, NWJ - 3, NWJ - 4**
FACILITY: **Marion WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	1.41	NA
Feb				1.42	
Mar				1.40	
Apr				1.48	
May				1.44	
Jun				1.64	
Jul				1.67	
Aug				1.70	
Sep				1.59	
Oct				1.50	
Nov				1.43	
Dec				1.41	

Yearly

Year	Avg. Q (mgd)
1992	1.73
1997	1.90
1999	NA
2002	1.51
2003	NA

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.30	1.66

Monthly

Month	Ann Avg Coefficient
Jan	0.93
Feb	0.94
Mar	0.93
Apr	0.98
May	0.96
Jun	1.09
Jul	1.11
Aug	1.13
Sep	1.05
Oct	1.00
Nov	0.95
Dec	0.93

Yearly

Year	Avg. Q (mgd)
2008	1.91
2018	2.18
2028	2.50
2038	2.87
2048	3.29
2058	3.78

Analysis Notes:

Type	2008	2018	2028	2038	2048	2058
Res. Cust	3,793	4,316	4,911	5,588	6,358	7,235
Demand	510,000	580,000	660,000	751,000	855,000	973,000
Com. Cust.	483	550	625	712	810	921
Demand	242,000	275,000	313,000	357,000	406,000	462,000
Ind. Cust	33	39	46	54	64	75
Demand	270,000	319,000	376,000	443,000	522,000	616,000
Inst. Cust	166	195	230	271	320	377
Demand	411,000	464,000	525,000	598,000	683,000	784,000
TOTALS	**4,475**	**5,100**	**5,812**	**6,625**	**7,552**	**8,609**
	1,911,000	**2,184,000**	**2,499,000**	**2,865,000**	**3,288,000**	**3,780,000**

Type	2002 LWSP	GPD/Cust	1997 LWSP	2002 LWSP	AGR	AGR Ind.
Res. Cust	3,510	134	3,339	3,510	1.30	1.66
Com. Cust.	447	501				
Ind. Cust	30	8,167		Backwash & Unaccounted For		25%
Inst. Cust	150	1,760				
TOTAL	**4,137**	**-**				

*NWJ - 2 is associated with withdrawals from Buck Creek; NWJ - 3 for Clear Creek, NWJ - 4 for Mackey Creek
*Data is not individually available for each withdrawal.

*Projections based on annual growth rate (residential and commercial) and gpd/customer.

*All 3 withdrawals are out of tribu	1.05		based on McDowell Co. and OSP
*1980's AGR =	1.31		
*1990's AGR =	1.34	18.4%	
*2000's AGR (predicted) =	1.29	12.9%	
*2010's AGR (predicted) =	1.27	11.1%	
*2020's AGR (predicted) =			

*Assume AGR of 1.3 to 2058

HDR ID: **NDJ - 3**
FACILITY: **Marion WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.21
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.0
Feb	1.0
Mar	1.0
Apr	1.0
May	1.0
Jun	1.0
Jul	1.0
Aug	1.0
Sep	1.0
Oct	1.0
Nov	1.0
Dec	1.0

Yearly

Year	Avg. Q (mgd)
2008	0.21
2018	0.24
2028	0.28
2038	0.32
2048	0.36
2058	0.42

Analysis Notes

Year	Total Water	Sys. Water	% of Total Water
1997	1.90	0.21	11.1%
2002	1.51	NA	-

Year	Total Water	Sys. Water	% of Total Water	Discharge
2008	1.91	0.21	11.1%	0.21
2018	2.18	0.24	11.1%	0.24
2028	2.50	0.28	11.1%	0.28
2038	2.87	0.32	11.1%	0.32
2048	3.29	0.36	11.1%	0.36
2058	3.78	0.42	11.1%	0.42

Percentage of System Water Discharged
100%

HDR ID: NDJ - 4
FACILITY: Catawba WTP

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.07
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.30	1.66

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.0
Mar	1.0
Apr	1.0
May	1.0
Jun	1.0
Jul	1.0
Aug	1.0
Sep	1.0
Oct	1.0
Nov	1.0
Dec	1.0

Yearly

Year	Avg. Q (mgd)
2008	0.08
2018	0.09
2028	0.11
2038	0.13
2048	0.15
2058	0.17

Analysis Notes

Type	Flow	Percentage	Res AGR	Ind AGR	1997 Base
Res/Com	696,000	57.8%	1.30	1.66	0.04
Ind/Inst	509,000	42.2%			0.03
Total	**1,205,000**	**-**	**-**	**-**	**0.07**

Wastewater Projections

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.05	0.05	0.06	0.07	0.08	0.09
Ind/Inst Demand	0.04	0.04	0.05	0.06	0.07	0.08
Total	**0.08**	**0.09**	**0.11**	**0.13**	**0.15**	**0.17**

*Historical Data Source: DMRs from Division of Water Quality

*Wastewater projections are based on the percentage of water usage by sector and the growth of those sectors.

*Res./Comm. AGR based on City and McDowell County population projections, reported by NC OSP.

*Ind. AGR based on growth trends of surrounding industries, according to NC GSP.

HDR ID: NDR - 4
FACILITY: Corpening WWTP

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.75	0.64
Feb				0.71	0.71
Mar				0.73	0.86
Apr				0.54	1.08
May				0.53	0.88
Jun				0.46	0.83
Jul				0.46	0.81
Aug				0.46	0.95
Sep				0.58	0.62
Oct				0.74	0.67
Nov				0.68	0.73
Dec				0.82	0.75

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.94
1999	NA
2002	0.62
2003	0.79

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.30	1.66

Monthly

Month	Ann Avg Coefficient
Jan	1.21
Feb	1.14
Mar	1.18
Apr	0.87
May	0.86
Jun	0.74
Jul	0.74
Aug	0.74
Sep	0.94
Oct	1.19
Nov	1.10
Dec	1.33

Yearly

Year	Avg. Q (mgd)
2008	0.85
2018	0.98
2028	1.13
2038	1.31
2048	1.52
2058	1.75

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	696,000	57.8%	1.30	1.66	0.46
Ind/Inst	509,000	42.2%			0.33
Total	**1,205,000**	**-**	**-**	**-**	**0.79**

Wastewater Projections

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.49	0.55	0.63	0.72	0.82	0.93
Ind/Inst Demand	0.36	0.43	0.50	0.59	0.70	0.83
Total	**0.85**	**0.98**	**1.13**	**1.31**	**1.52**	**1.75**

OWNER: **Town of McAdenville**

HDR ID	Facility	Type
NDY - 30	McAdenville WWTP	Discharge

CONTACT: **Jerry Helton**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.06	0.06
Feb				0.05	0.06
Mar				0.05	0.06
Apr				0.06	0.09
May				0.06	0.07
Jun				0.06	0.07
Jul				0.05	0.05
Aug				0.05	0.06
Sep				0.05	0.06
Oct				0.06	0.06
Nov				0.06	0.11
Dec				0.06	0.10

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.06
1999	NA
2002	0.06
2003	0.07

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
0.75	0.50

Monthly

Month	Ann Avg Coefficient
Jan	0.79
Feb	0.89
Mar	0.88
Apr	1.27
May	1.00
Jun	1.00
Jul	0.72
Aug	0.85
Sep	0.84
Oct	0.87
Nov	1.56
Dec	1.45

Yearly

Year	Avg. Q (mgd)
2008	0.07
2018	0.08
2028	0.08
2038	0.08
2048	0.09
2058	0.09

Analysis Notes

Type	2002 LWSP	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	158	241	830	619	0.75	1.66
Com. Cust.	10	1,000				
Ind. Cust	1	320,000				
Inst. Cust	2	2,000				
TOTAL	**169**	**-**				

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	48,000	12.9%	0.75	0.50	0.01
Ind/Inst	324,000	87.1%			0.06
Total	**372,000**	**-**	**-**	**-**	**0.07**

Wastewater Projections

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.01	0.01	0.01	0.01	0.01	0.01
Ind/Inst Demand	0.06	0.07	0.07	0.07	0.08	0.08
Total	**0.07**	**0.08**	**0.08**	**0.08**	**0.09**	**0.09**

*Historical Flow Data Source: DMRs from Division of Water Quality

*Most flow is industrial…..textiles…..negative growth in the 1990s…..most assumptions will yield a rounding to 0.1 MGD discharge…..Assume modest growth as above.

OWNER: **Town of Mooresville**

HDR ID	Facility	Type
NWN - 3	Mooresville WTP	Withdrawal
NIBT - 1	Rocky River WWTP	Transfer

CONTACT: Wilce Martin

Proj. By: *JCH*

HDR ID: **NWN - 3**
FACILITY: **Mooresville WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	3.30	3.12
Feb				3.20	3.08
Mar				3.28	3.03
Apr				4.16	3.16
May				4.64	3.38
Jun				4.77	3.87
Jul				4.40	4.47
Aug				3.85	4.86
Sep				3.05	4.97
Oct				3.09	4.74
Nov				3.01	4.16
Dec				2.98	4.04

Yearly

Year	Avg. Q (mgd)
1992	1.91
1997	2.30
1999	2.83
2002	3.64
2003	3.91

7.8% very rapid AGR

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.91
Feb	0.88
Mar	0.90
Apr	1.14
May	1.27
Jun	1.31
Jul	1.21
Aug	1.06
Sep	0.84
Oct	0.85
Nov	0.83
Dec	0.82

Yearly

Year	Avg. Q (mgd)
2008	6.62
2018	11.86
2028	17.55
2038	22.47
2048	26.07
2058	28.80

Staggered AGR	
2000s	8.0
2010s	6.0
2020s	4.0
2030s	2.5
2040s	1.5
2050s	1.0

Analysis Notes

Type	2002 LWSP	Q (MGD)	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.	
Res. Cust	6,581	1.80	360	9,317	18,828	8.00	1.66	2000s
Com. Cust.	869	1.62	1,864			6.00		2010s
Ind. Cust						4.00		2020s
Inst. Cust						2.50		2030s
TOTAL	**7,450**	**3.42**	**-**			1.50		2040s
	Subtotal	**3.42**				1.00		2050s
	Non-metered/commercial	**0.09**						
	Unacct. For	0.10			Unaccounted For Water		2.8%	
	Backwash	0.06			Backwash Water		1.6%	
	Subtotal	**3.67** ***checks with 3.64***					4.4%	

*Mooresville currently expanding WTP from 6 MGD to 12 MGD
*Intake to 12 MGD by 2006
*WWTP is 5.2 MGD; but beginning study to expand that plant to 10.4 or 12 MGD.
*Pursuing an interconnect with Hickory to buy 1 MGD
*All discharge is to Rocky River - no current plans to bring water back to Catawba basin.
*Assume Mooresville, Hickory and others meet the majority of water demand in Iredell Co. that is within the Catawba basin
*High AGR from 2000-2030 accounts for expansion of service area into southern Iredell County.
*AGR is staggered to simulated expected short term aggressive service area expansion (Southern Iredell County), and subsequent "leveling-off".
*Industrial growth is lumped into AGR because historical data does not break industrial demand out.
*State Office of Planning #'s for Iredell Co.

1980s	1.20%
1990s	2.70%
2000s projected	2.00%
2010s projected	1.40%
2020s projected	1.20%

*Clearly Mooresville has seen much higher paced growth in 90s 7.3% 9317 18823
nearly identical to flow increases in last 10 years
*Last year 1200 new meters, 2 years ago - 500 new meters (90s average was ~300 new meters annually.
*Above equates to approx. 12% recent AGR - higher than 90s AGR of 7.3%
*Last 2 1/2 years, population growth in Mooresville city limits has increased to over 20,000.
*Mooresville is actively pursuing regional service provider status for southern Iredell Co.
*Future service area includes to Rowan Co on the east, Meck Co on the south, Lake on the west.
Are negotiating a service bndry w/Troutman.
*360 gpd/res customer is current design basis in Mooresville. Used by planning department, engineering, and consultants.
Higher than what was reported in 2002 LWSP ( ).
*Opening bids next week on 16" Emergency interconnect with Hickory (along NC 150) for 1 mgd.
Planning to negotiate a bulk water user agreement w/Hickory. Hickory is working on a 36" line along Sherrils Ford Rd, which would give Mooreville a capacity of up to 3 mgd with Hickory.
*Average daily use for July 2003 through June 2004 was 4.47 mgd. Winter usage rose above 4 mgd and stayed.
Summer usage was over 5 mgd.

Other Notes

*Another way to consider…Statesville 2058 projection is 11.8 MGD, Mooresville is 28.8 MGD for a total of 40.6 MGD.
*At 150 gpd per capita, could serve a population of 270,000 in Iredell Co.

*2000 population		121,361
*At AGR	1.5%	287,812

*This would assume much of the County is served
*Aggressive - but with expansion into Rowan, could be feasible

HDR ID: **NIBT - 1**
FACILITY: **Rocky River WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	2.32	2.33
Feb				2.31	2.61
Mar				2.51	2.87
Apr				2.61	3.15
May				2.58	3.25
Jun				2.57	2.92
Jul				2.49	2.46
Aug				2.89	2.83
Sep				2.64	2.64
Oct				2.34	2.39
Nov				2.41	0.00
Dec				2.59	0.00

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	2.72
2002	2.52
2003	2.74

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.92
Feb	0.91
Mar	1.00
Apr	1.03
May	1.02
Jun	1.02
Jul	0.99
Aug	1.15
Sep	1.05
Oct	0.93
Nov	0.95
Dec	1.03

Yearly

Year	Avg. Q (mgd)
2008	4.63
2018	8.30
2028	12.29
2038	15.73
2048	18.25
2058	20.16

	2000	2001	2002	2003
Water	3.06	3.63	3.64	3.91
Wastewater	2.40	2.45	2.52	2.74
	78%	67%	69%	70%

Use	70%

Analysis Notes
*Assumed 70% of Mooresville WTP flow is discharged by Rocky River WWTP as suggested by historical flow data.

OWNER: **City of Morganton**

HDR ID	Facility	Type
NWR - 3	Catawba River WTP	Withdrawal
NDR - 5	Catawba River Pollution Control Facility	Discharge
NDR - 6	Catawba River WTP	Discharge

CONTACT:

Proj. By: *JCH*

HDR ID: **NWR - 3**
FACILITY: **Catawba River WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	7.90	7.80
Feb				7.70	7.10
Mar				8.00	7.20
Apr				8.70	7.60
May				9.10	7.50
Jun				9.90	8.10
Jul				10.00	7.80
Aug				9.50	8.30
Sep				8.20	7.90
Oct				7.10	7.60
Nov				6.70	7.10
Dec				6.90	7.00

Yearly

Year	Avg. Q (mgd)
1992	11.23
1997	11.97
1999	NA
2002	8.32
2003	7.58

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.25	0.83

Monthly

Month	Ann Avg Coefficient
Jan	0.95
Feb	0.93
Mar	0.96
Apr	1.05
May	1.09
Jun	1.19
Jul	1.20
Aug	1.14
Sep	0.99
Oct	0.85
Nov	0.81
Dec	0.83

Yearly

Year	Avg. Q (mgd)
2008	8.85
2018	9.82
2028	10.90
2038	12.10
2048	13.44
2058	14.94

*In interviews with Morganton, it appeared that the current focus was on Main Street and that growth around Lake James would likely be absorbed by wholesale entities around Lake James and others
*Morganton has a high contribution of industrial flow as a % of the total.
*Morganton also has a relatively high institutional demand - we will assume an average of 0% growth (e.g. textiles) and 1.66% manufacturing and propose a 0.83% growth.
*Projections based on annual growth rate (residential and commercial) and gpd/customer.
*Morganton has taken a severe hit in the industrial demand over the last decade or so. They are recruiting industries, but nothing is imminent.
*Industrial still represents nearly 50% of usage.

Analysis Notes

Type	2008	2018	2028	2038	2048	2058
Res. Cust	9.039	10.235	11.589	13.121	14.857	16.822

Type	2000	2010	2020	2030	2040	2050
Res. Cust	9,039	10,235	11,589	13,121	14,857	16,822
Demand	1,347,000	1,525,000	1,727,000	1,955,000	2,214,000	2,506,000
Com. Cust.	543	615	696	788	892	1,011
Demand	1,120,000	1,269,000	1,436,000	1,627,000	1,842,000	2,085,000
Ind. Cust	90	98	107	116	126	137
Demand	2,921,000	3,173,000	3,447,000	3,743,000	4,066,000	4,416,000
Inst. Cust	122	132	144	156	170	184
Demand	778,000	845,000	917,000	996,000	1,082,000	1,176,000
Wholesale Cust. Demand	1,284,000	1,454,000	1,646,000	1,864,000	2,111,000	2,390,000
TOTALS	**9,795**	**10,948**	**12,391**	**14,026**	**15,875**	**17,969**
	8,850,000	**9,820,000**	**10,897,000**	**12,099,000**	**13,442,000**	**14,936,000**

Type	2002 LWSP	Q (MGD)	GPD/Cust	1997 LWSP	2002 LWSP	AGR	AGR Ind.
Res. Cust	8,390	1.25	149	20,550	20,812	1.25	0.83
Com. Cust.	504	1.04	2,063				
Ind. Cust	86	2.78	32,326			Unaccounted For Water	13.5%
Inst. Cust	116	0.74	6,379			Backwash Water	2.3%
TOTAL	**9,096**	**5.81**	**-**				15.8%

Sales to Other Systems

Drexel	0.24	
Brentwood	0.71	
Burke Co.	0.02	
Burke - Caldwell	0.22	y Morganton in early 2004
Subtotal Wholesale	1.19	
Process Water	0.19	
Total	**7.19**	
Total Use	**8.32**	
Unaccounted For Water	**1.13**	***checks***

Population Data

	AGR			
Burke County 1980s growth	0.44%	72504	75744	
Burke County 1990s growth	1.03%	75744	83894	
Data from State Office of Planning				
Burke County 2000s Projections	1.95%	83,894	101781	
Burke County 2010s Projections	1.22%	101,781	114870	
Burke County 2020s Projections	1.11%	114,870	128233	
From LWSP				*likely due to growth at*
*AGR between 1997 and 2002 LWSP indicates a		0.13%	AGR	*Lake James*
WPCOG information for Burke County				*& thus a wholesale cust. - Brentwood*
*1990s historical growth	1.64%	75,740	89,148	*this discrepancy from SOP*
*2000 - 2010 projections	1.36%	89,148	102,061	*results from 2000 #s being*
*2010 - 2020 projections	1.22%	102,061	115,167	*different, use WPCOG*

Future Population Projections (Burke County)

Use AGR	1.25%
2000	89,148
2010	100,940
2020	114,291
2030	129,408
2040	146,525
2050	165,906

*Base future projections for Morganton & wholesale customers on 1.25% AGR

This approach accounts for residential and commercial usage at the above population growth

*While this does not allow for extensive service area exp., the likely loss of other key ind. may 'free up' available capacity for industries

*Note - the industrial flow constitutent in 2060, maintains base flow of today as well as 0.5 MGD capacity + 1 MGD reserve.

HDR ID: **NDR - 5**
FACILITY: **Catawba River Pollution Control Facility**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	3.70	3.68
Feb				3.38	4.31
Mar				3.73	4.92
Apr				3.39	5.54
May				3.29	5.15
Jun				3.23	4.35
Jul				3.12	4.30
Aug				3.36	3.90
Sep				3.91	3.92
Oct				4.07	3.55
Nov				4.26	3.41
Dec				4.40	3.15

Yearly

Year	Avg. Q (mgd)
1992	5.90
1997	6.30
1999	NA
2002	3.60
2003	4.20

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.03
Feb	0.94
Mar	1.04
Apr	0.94
May	0.91
Jun	0.90
Jul	0.87
Aug	0.93
Sep	1.09
Oct	1.13
Nov	1.18
Dec	1.22

Yearly

Year	Avg. Q (mgd)
2008	4.69
2018	5.20
2028	5.78
2038	6.41
2048	7.12
2058	7.92

Catawba River WWTP
Wastewater Flow as % of Water Demand

11.23	52.5%	
11.97	52.6%	
8.32	43.3%	dry year
7.58	55.4%	wet year

very consistent
Morganton states that Borden 'consumes' a fair amount of water

Analysis Notes
*Annual average flows assumed to be 53% of Catawba River WTP flows, as suggested by the historical flow data.
*Data source: DMRs from DWQ and by Morganton

HDR ID: **NDR - 6**
FACILITY: **Catawba River WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.11
1999	NA
2002	0.19
2003	NA

0.92 in 1992
2.28 in 2002

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.03
Feb	0.94
Mar	1.04
Apr	0.94
May	0.91
Jun	0.90
Jul	0.87
Aug	0.93
Sep	1.09
Oct	1.13
Nov	1.18
Dec	1.22

Yearly

Year	Avg. Q (mgd)
2008	0.17
2018	0.19
2028	0.21
2038	0.23
2048	0.25
2058	0.28

Projection Analysis
*Annual average flows assumed to be 1.89% of Catawba River WTP flows, as suggested by the historical flow data.

OWNER: **City of Mount Holly**

HDR ID	Facility	Type
NWM - 3	Mount Holly WTP	Withdrawal
NDY - 23	Mount Holly WTP	Discharge
NDY - 24	Mount Holly WWTP	Discharge

CONTACT: **Don Price, Utility Director**

Proj. By: *JCH*

HDR ID: **NWM - 3**
FACILITY: **Mount Holly WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	1.80	NA
Feb				1.77	
Mar				1.69	
Apr				1.85	
May				1.87	
Jun				1.97	
Jul				2.19	
Aug				2.06	
Sep				1.92	
Oct				2.00	
Nov				2.05	
Dec				2.01	

Yearly

Year	Avg. Q (mgd)
1992	1.90
1997	2.01
1999	NA
2002	1.93
2003	NA

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
2.00	1.66

Monthly

Month	Ann Avg Coefficient
Jan	0.93
Feb	0.92
Mar	0.88
Apr	0.96
May	0.97
Jun	1.02
Jul	1.14
Aug	1.07
Sep	1.00
Oct	1.04
Nov	1.07
Dec	1.04

Yearly

Year	Avg. Q (mgd)	LWSP
2008	2.24	4.8
2018	2.57	7.3
2028	2.97	9.9
2038	3.45	14.5
2048	4.03	20.9
2058	4.73	

Analysis Notes
*Wastewater projections are based on the percentage of water usage by sector and the growth of those sectors.
*Res./Comm. AGR based on Gaston County population projections, reported by Office of State Planning.
*Ind. AGR based on growth trends of surrounding industries, according to NC GSP.

Type	2008	2018	2028	2038	2048	2058
Res. Cust	4,541	5,535	6,747	8,225	10,026	12,222
Demand	890,000	1,085,000	1,322,000	1,612,000	1,964,000	2,395,000

Com. Cust.	221	269	328	400	487	594
Demand	97,000	118,000	144,000	175,000	214,000	261,000
Ind. Cust	32	38	44	52	62	73
Demand	448,000	528,000	623,000	734,000	866,000	1,021,000
Inst. Cust	64	75	89	105	124	146
Demand	155,000	162,000	169,000	178,000	188,000	200,000
Wholesale	472,000	472,000	472,000	472,000	472,000	472,000
TOTALS	**4,857**	**5,842**	**7,120**	**8,677**	**10,575**	**12,889**
	2,241,000	**2,571,000**	**2,967,000**	**3,447,000**	**4,026,000**	**4,727,000**

Type	2002 LWSP	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	4,032	196	7,710	9,618	2.00	1.66
Com. Cust.	196	439				
Ind. Cust	29	14,000			Backwash & Unaccounted For	8%
Inst. Cust	58	552			2002 Wholesale	472,000
TOTAL	**4,315**	**-**				

*Projections based on annual growth rate (residential and commercial) and gpd/customer.
*Wholesale is to the Town of Stanley.

Population Data

Data from State Office of Planning			Population	Population
*Gaston County 1980s historical growth	0.74%	AGR	162,568	175,093
*Gaston County 1990s historical growth	0.62%	AGR	175,093	186,328
*Gaston County 2000s population projections	0.92%	AGR	186,328	204,156
*Gaston County 2010s population projections	0.60%	AGR	204,156	216,822
*Gaston County 2020s population projections	0.51%	AGR	216,822	228,066

*Mt. Holly has seen stagnant water demand growth in the last decade.
*Assume 2.00% AGR for residential, commercial, industrial demand
1.66% AGR for industrial/instituational demand, per previous NCGSP

HDR ID: **NDY - 23**
FACILITY: **Mount Holly WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
2.00	1.66

Monthly

Month	Ann Avg Coefficient
Jan	1.0
Feb	1.0
Mar	1.0
Apr	1.0
May	1.0
Jun	1.0
Jul	1.0
Aug	1.0
Sep	1.0
Oct	1.0
Nov	1.0
Dec	1.0

Yearly

Year	Avg. Q (mgd)
2008	0.06
2018	0.07
2028	0.08
2038	0.10
2048	0.12
2058	0.15

Type	Flow	Percentage	Res AGR	Ind AGR	2002 Base
Res/Com	876,000	66.7%	2.00	1.66	0.03
Ind/Inst	438,000	33.3%			0.02
Total	**1,314,000**	**-**	**-**	**-**	**0.05**

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.04	0.05	0.06	0.07	0.09	0.11
Ind/Inst Demand	0.02	0.02	0.03	0.03	0.04	0.04
Total	**0.06**	**0.07**	**0.08**	**0.10**	**0.12**	**0.15**

Analysis Notes

*Assumed that system water (0.052 mgd) reported in the 2002 LWSP as the basis for discharge.
*Discharge projections are based on the percentage of water usage by sector and the growth of those sectors.
*No data is available for WTP discharges.
*Virtually all values will round to 0.1
*Wastewater projections are based on a percentage of the water usage.

HDR ID: **NDY - 24**
FACILITY: **Mount Holly WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	1.87	2.08
Feb				2.08	2.37
Mar				2.57	2.65
Apr				2.49	2.70
May				2.58	2.44
Jun				2.52	2.14
Jul				2.43	2.36
Aug				2.64	2.53
Sep				2.49	2.29
Oct				2.40	2.26
Nov				2.22	2.20
Dec				2.13	2.09

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	1.74
1999	NA
2002	2.37
2003	2.34

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
2.00	1.66

Monthly

Month	Ann Avg Coefficient
Jan	0.89
Feb	1.01
Mar	1.13
Apr	1.16
May	1.04
Jun	0.92
Jul	1.01
Aug	1.08
Sep	0.98
Oct	0.96
Nov	0.94
Dec	0.89

Yearly

Year	Avg. Q (mgd)
2008	2.57
2018	3.10
2028	3.74
2038	4.51
2048	5.44
2058	6.56

Analysis Notes
*Historical Flow Data Source: DMRs from Division of Water Quality
*Discharge projs. are based on the % of water usage by sector and the growth of those sectors.
*Res./Comm. AGR based on Gaston County pop. projs, reported by Office of State Planning.
*Ind. AGR based on growth trends of surrounding industries, according to NC GSP.
*Mt. Holly's discharge is > than withdrawal because Stanley's wastewater is treated by Mt. Holly.

Type	Flow	Percentage	Res AGR	Ind AGR	1997 Base
Res/Com	876,000	66.7%	2.00	1.66	1.56
Ind/Inst	438,000	33.3%			0.78
Total	**1,314,000**	**-**	**-**	**-**	**2.34**

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	1.72	2.10	2.56	3.12	3.80	4.64
Ind/Inst Demand	0.85	1.00	1.18	1.39	1.64	1.93
Total	**2.57**	**3.10**	**3.74**	**4.51**	**5.44**	**6.56**

OWNER: **NC Wildlife Resources Comission**

HDR ID	Facility	Type
NWJ - 8	Armstrong State Fish Hatchery - Upper	Withdrawal
NWJ - 9	Armstrong State Fish Hatchery - Lower	Withdrawal
NWJ - 10	Armstrong State Fish Hatchery	Withdrawal
NWJ - 11	Marion State Fish Hatchery	Withdrawal
NWR - 5	Table Rock State Fish Hatchery	Withdrawal
NDJ - 11	Armstrong State Fish Hatchery - Upper	Discharge
NDJ - 12	Armstrong State Fish Hatchery - Lower	Discharge
NDJ - 13	Armstrong State Fish Hatchery	Discharge
NDJ - 14	Marion State Fish Hatchery	Discharge
NDR - 8	Table Rock State Fish Hatchery	Discharge

CONTACT: **Carl Kittel**

Proj. By: *JCH*

HDR ID: **NWJ - 8**
FACILITY: **Armstrong State Fish Hatchery - Upper**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	1.04	NA	NA
Feb			1.04		
Mar			0.78		
Apr			0.78		
May			0.78		
Jun			0.73		
Jul			0.69		
Aug			0.60		
Sep			0.52		
Oct			0.60		
Nov			0.69		
Dec			0.78		

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	0.75
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
0.00

Monthly

Month	Ann Avg Coefficient
Jan	1.39
Feb	1.39
Mar	1.04
Apr	1.04
May	1.04
Jun	0.97
Jul	0.92
Aug	0.80
Sep	0.69
Oct	0.80
Nov	0.92
Dec	1.04

Yearly

Year	Avg. Q (mgd)
2008	0.75
2018	0.75
2028	0.75
2038	0.75
2048	0.75
2058	0.75

Analysis Notes
*Daily capacity of withdrawal in 1999 is 1.04 mgd.
*Used 1999 withdrawal registration data from NCDWR to perform projections.
*AGR used for projections is not critical since all flow is assumed to return to system; flow is pass thru.

HDR ID: **NWJ - 9**
FACILITY: **Armstrong State Fish Hatchery - Lower**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	4.03	NA	NA
Feb			4.03		
Mar			3.60		
Apr			3.60		
May			3.50		
Jun			2.88		
Jul			2.74		
Aug			2.59		
Sep			2.59		
Oct			2.74		
Nov			3.17		
Dec			3.67		

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	3.26
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
0.00

Monthly

Month	Ann Avg Coefficient
Jan	1.24
Feb	1.24
Mar	1.10
Apr	1.10
May	1.07
Jun	0.88
Jul	0.84
Aug	0.79
Sep	0.79
Oct	0.84
Nov	0.97
Dec	1.13

Yearly

Year	Avg. Q (mgd)
2008	3.26
2018	3.26
2028	3.26
2038	3.26
2048	3.26
2058	3.26

Analysis Notes
*Daily capacity of withdrawal in 1999 is 1.04 mgd.
*Used 1999 withdrawal registration data from NCDWR to perform projections.
*AGR used for projections is not critical since all flow is assumed to return to system; flow is pass thru.

HDR ID: **NWJ - 10**
FACILITY: **Amstrong State Fish Hatchery**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	0.69	NA	NA
Feb			0.69		
Mar			0.52		
Apr			0.52		
May			0.52		
Jun			0.49		
Jul			0.46		
Aug			0.40		
Sep			0.35		
Oct			0.40		
Nov			0.46		
Dec			0.52		

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	0.50
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
0.00

Monthly

Month	Ann Avg Coefficient
Jan	1.38
Feb	1.38
Mar	1.04
Apr	1.04
May	1.04
Jun	0.98
Jul	0.92
Aug	0.80
Sep	0.70
Oct	0.80
Nov	0.92
Dec	1.04

Yearly

Year	Avg. Q (mgd)
2008	0.50
2018	0.50
2028	0.50
2038	0.50
2048	0.50
2058	0.50

Analysis Notes
*Daily capacity of withdrawal in 1999 is 1.04 mgd.
*Used 1999 withdrawal registration data from NCDWR to perform projections.
*AGR used for projections is not critical since all flow is assumed to return to system; flow is pass thru.

HDR ID: **NWJ - 11**
FACILITY: **Marion State Fish Hatchery**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	0.28	NA	NA
Feb			0.28		
Mar			0.28		
Apr			0.28		
May			0.28		
Jun			0.28		
Jul			0.00		
Aug			0.00		
Sep			0.28		
Oct			0.28		
Nov			0.28		
Dec			0.28		

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	0.28
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
0.00

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.00
Apr	1.00
May	1.00
Jun	1.00
Jul	0.00
Aug	0.00
Sep	1.00
Oct	1.00
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	0.28
2018	0.28
2028	0.28
2038	0.28
2048	0.28
2058	0.28

Analysis Notes
*Daily capacity of withdrawal in 1999 is 1.04 mgd.
*Used 1999 withdrawal registration data from NCDWR to perform projections.
*AGR used for projections is not critical since all flow is assumed to return to system; flow is pass thru.

HDR ID: **NWR - 5**
FACILITY: **Table Rock State Fish Hatchery**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	1.21	NA	NA
Feb			1.25		
Mar			1.19		
Apr			1.08		
May			1.17		
Jun			0.84		
Jul			1.17		
Aug			0.50		
Sep			0.49		
Oct			0.61		
Nov			0.61		
Dec			0.86		

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	0.92
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
0.00

Monthly

Month	Ann Avg Coefficient
Jan	1.32
Feb	1.37
Mar	1.30
Apr	1.18
May	1.28
Jun	0.92
Jul	1.28
Aug	0.55
Sep	0.54
Oct	0.67
Nov	0.67
Dec	0.94

Yearly

Year	Avg. Q (mgd)
2008	0.92
2018	0.92
2028	0.92
2038	0.92
2048	0.92
2058	0.92

Analysis Notes
*Daily capacity of withdrawal in 1999 is 1.04 mgd.
*Used 1999 withdrawal registration data from NCDWR to perform projections.
*AGR used for projections is not critical since all flow is assumed to return to system; flow is pass thru.

HDR ID: NDJ - 11
FACILITY: Armstrong State Fish Hatchery - Upper

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.75
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.39
Feb	1.39
Mar	1.04
Apr	1.04
May	1.04
Jun	0.97
Jul	0.92
Aug	0.80
Sep	0.69
Oct	0.80
Nov	0.92
Dec	1.04

Yearly

Year	Avg. Q (mgd)
2008	0.75
2018	0.75
2028	0.75
2038	0.75
2048	0.75
2058	0.75

Analysis Notes
*All hatcheries assumed to have a discharge that is approximately equal to the withdrawal.

HDR ID: **NDJ - 12**
FACILITY: **Armstrong State Fish Hatchery - Lower**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	3.26
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.24
Feb	1.24
Mar	1.10
Apr	1.10
May	1.07
Jun	0.88
Jul	0.84
Aug	0.79
Sep	0.79
Oct	0.84
Nov	0.97
Dec	1.13

Yearly

Year	Avg. Q (mgd)
2008	3.26
2018	3.26
2028	3.26
2038	3.26
2048	3.26
2058	3.26

Analysis Notes
*All hatcheries assumed to have a discharge that is approximately equal to the withdrawal.

HDR ID: **NDJ - 13**
FACILITY: **Amstrong State Fish Hatchery**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	0.50
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.38
Feb	1.38
Mar	1.04
Apr	1.04
May	1.04
Jun	0.98
Jul	0.92
Aug	0.80
Sep	0.70
Oct	0.80
Nov	0.92
Dec	1.04

Yearly

Year	Avg. Q (mgd)
2008	0.50
2018	0.50
2028	0.50
2038	0.50
2048	0.50
2058	0.50

Analysis Notes
*All hatcheries assumed to have a discharge that is approximately equal to the withdrawal.

HDR ID: **NDJ - 14**
FACILITY: **Marion State Fish Hatchery**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	0.3
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.00
Apr	1.00
May	1.00
Jun	1.00
Jul	0.00
Aug	0.00
Sep	1.00
Oct	1.00
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	0.28
2018	0.28
2028	0.28
2038	0.28
2048	0.28
2058	0.28

Analysis Notes
*All hatcheries assumed to have a discharge that is approximately equal to the withdrawal.

HDR ID: **NDR - 8**
FACILITY: **Table Rock State Fish Hatchery**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	0.92
2002	NA
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.00
Apr	1.00
May	1.00
Jun	1.00
Jul	0.00
Aug	0.00
Sep	1.00
Oct	1.00
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	0.92
2018	0.92
2028	0.92
2038	0.92
2048	0.92
2058	0.92

Analysis Notes
*All hatcheries assumed to have a discharge that is approximately equal to the withdrawal.

OWNER: **Nation Ford Chemical**

HDR ID	Facility	Type
SWF - 4	Nation Ford Chemical	Withdrawal
SDF - 3	Nation Ford Chemical	Discharge

CONTACT: Dan Lee

Proj. By: *PNB/LKM*

HDR ID: **SWF - 4**
FACILITY: **Nation Ford Chemical**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	0.90	NA	NA	1.08	1.08
Feb	0.87			1.04	1.04
Mar	0.90			1.08	1.08
Apr	0.93			1.01	1.08
May	0.90			1.08	0.84
Jun	0.93			1.08	0.95
Jul	0.90			1.08	1.08
Aug	0.90			1.08	1.08
Sep	0.93			1.04	1.08
Oct	0.90			1.08	1.08
Nov	0.93			1.08	1.08
Dec	0.90			1.01	1.08

Yearly

Year	Avg. Q (mgd)
1992	0.91
1997	NA
1999	NA
2002	1.06
2003	1.05

PROJECTION SUMMARY

AGR
3.00

Monthly

Month	Ann Avg Coefficient
Jan	1.02
Feb	0.98
Mar	1.02
Apr	0.95
May	1.02
Jun	1.02
Jul	1.02
Aug	1.02
Sep	0.98
Oct	1.02
Nov	1.02
Dec	0.95

Yearly

Year	Avg. Q (mgd)
2008	1.21
2018	1.63
2028	2.19
2038	2.94
2048	3.96
2058	5.32

Analysis Notes

*Assuming that 20% of the withdrawal is consumptive and 80% returned to Catawba River. Evidenced only in 1992.

*The NC GSP for chemical industry in the 1990s was - 7.34 % AGR

This applied to water demand would be an extremely high value and likely an overestimate.

We will apply a factor of 3% AGR, still an aggressive value; especially considering 10 year trend

This may, however, help account for other industrial growth in the region

AGR assumed 3%

HDR ID: **SDF - 3**
FACILITY: **Nation Ford Chemical**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	0.71	0.51	NA	1.08	NA
Feb	0.68	0.51		1.08	
Mar	0.69	0.51		1.08	
Apr	0.69	0.51		1.08	
May	0.70	0.51		1.08	
Jun	0.71	0.51		1.08	
Jul	0.68	0.51		1.08	
Aug	0.70	0.51		1.08	
Sep	0.70	0.51		1.08	
Oct	0.69	0.51		1.08	
Nov	0.76	0.51		1.08	
Dec	0.71	0.51		1.08	

Yearly

Year	Avg. Q (mgd)
1992	0.70
1997	0.51
1999	NA
2002	1.08
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.02
Feb	0.98
Mar	1.02
Apr	0.95
May	1.02
Jun	1.02
Jul	1.02
Aug	1.02
Sep	0.98
Oct	1.02
Nov	1.02
Dec	0.95

Yearly

Year	Avg. Q (mgd)
2008	0.97
2018	1.30
2028	1.75
2038	2.35
2048	3.16
2058	4.25

Comparison

	Withdrawal	Discharge	%
1992	0.91	0.70	77.2
2002	1.06	1.08	101.7

Analysis Notes

*Discharge rate does not correlate well with withdrawal rate in the historical data. Assumed 20% consumption rate..
This is similar to 1992 ratio of 22.8%

*1997 and 2002 discharge data is suspect since there is no monthly variation in the reporting of the discharges.

OWNER: **National Fruit Product Company, Inc.**

HDR ID	Facility	Type
NDY - 5	National Fruit Product Co., Inc.	Discharge

CONTACT: **Ron Stead**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.15
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
1.22

Monthly

Month	Ann Avg Coefficient
Jan	1.0
Feb	1.0
Mar	1.0
Apr	1.0
May	1.0
Jun	1.0
Jul	1.0
Aug	1.0
Sep	1.0
Oct	1.0
Nov	1.0
Dec	1.0

Yearly

Year	Avg. Q (mgd)
2008	0.17
2018	0.20
2028	0.22
2038	0.25
2048	0.28
2058	0.32

Analysis Notes

*Permit states that discharge is not limited.

*AGR based on 4.22% annual growth in food manufacturing industry, according to the NC GSP, adjusted down 3% for inflation.

OWNER: **City of Newton**

HDR ID	Facility	Type
NWY - 13	Newton WTP	Withdrawal
NWY - 14	Newton WTP	Withdrawal
NDY - 25	Clark Creek WWTP	Discharge

CONTACT: **Andy Brodgen**

Proj. By: *JCH*

HDR ID: **NWY - 13 & NWY - 14**
FACILITY: **Newton WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	3.82	2.18	NA	NA	NA
Feb	3.65	2.06			
Mar	3.52	1.96			
Apr	3.54	2.06			
May	3.80	2.14			
Jun	3.72	2.19			
Jul	4.09	2.36			
Aug	4.31	2.48			
Sep	3.63	2.42			
Oct	3.33	2.22			
Nov	3.02	2.02			
Dec	2.82	2.16			

Yearly

Jacobs Fork

Year	Avg. Q (mgd)
1992	3.60
1997	2.19
1999	NA
2002	2.23
2003	NA

City Lake

Year	Avg. Q (mgd)
1992	NA
1997	2.20
1999	NA
2002	2.50
2003	NA

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.40	1.66

Monthly

Month	Ann Avg Coefficient
Jan	0.99
Feb	0.94
Mar	0.89
Apr	0.94
May	0.98
Jun	1.00
Jul	1.08
Aug	1.13
Sep	1.10
Oct	1.01
Nov	0.92
Dec	0.99

Yearly

Year	Avg. Q (mgd)
2008	2.81
2018	3.24
2028	3.73
2038	4.31
2048	4.97
2058	5.75

Analysis Notes
*NWY - 13 & NWY - 14 treated as one withdrawal, since they both are used by a single treatment plant.
*Discharge projections are based on the percentage of water usage by sector and the growth of those sectors.
*Res./Comm. AGR based on Catwba County population projections, reported by Office of State Planning and WPCOG.
*Ind. AGR is based on the industrial trends, according to NC GSP.

Analysis Notes

Type	2008	2018	2028	2038	2048	2058

Res. Cust	5,160	5,929	6,814	7,830	8,998	10,340
Demand	1,127,000	1,295,000	1,488,000	1,710,000	1,965,000	2,258,000
Com. Cust.	656	754	866	996	1,144	1,315
Demand	233,000	268,000	308,000	354,000	406,000	467,000
Ind. Cust	24	28	33	39	46	55
Demand	727,500	844,100	980,000	1,139,300	1,327,800	1,547,700
Inst. Cust	2	3	3	4	5	5
Demand	34,000	40,000	47,000	55,000	65,000	76,000
Wholesale	124,000	142,000	163,000	187,000	215,000	248,000
TOTALS	**5,842**	**6,711**	**7,713**	**8,865**	**10,188**	**11,709**
	2,807,000	**3,236,000**	**3,733,000**	**4,307,000**	**4,974,000**	**5,746,000**

Type	1997 LWSP	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	4,428	218	9,077	12,560	1.40	1.66
Com. Cust.	563	355				
Ind. Cust	20	25,750			Backwash & Unaccounted For	20%
Inst. Cust	2	14,000			1997 Wholesale	106,000
TOTAL	**5,013**	**-**				

*2002 LWSP submitted, but unreliable. 2003 data not submitted. Information based on 1992 and 1997 data from LWSP.
*Census population of Newton grew from 9077 in 1990 to 12560 in 2000; a strong growth rate, but overall flows decreased.
*2 withdrawals, but 1 treatment plant. Combined to perform projections.
*Lower water demand is likely due to the reduction of industrial usage within the system.

Population Data

Data from State Office of Planning

	*Catawba County 1980s historical growth	1.19% AGR	
	*Catawba County 1990s historical growth	1.41% AGR	
	*Catawba County 2000-2030 pop. Projection	1.52% AGR	
WPCOG information for Catawba County			
	*1990s historical growth	1.81% AGR	*use WPCOG*
	*2000 - 2010 projections	1.59% AGR	
	*2010 - 2020 projections	1.37% AGR	*result is similar to OSP*
Future Projections			
	Use AGR	1.40% AGR	
	Hickory moving forward as a regional provider w/ stronger water source; more capacity; and competitive		
	This AGR is conservative based on OSP future projections		
	Industrial/Inst. Is approx. 0.25% of total; assume	1.66% AGR	as before for NC GSP

HDR ID: **NDY - 25**
FACILITY: **Clark Creek WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	3.69	3.08
Feb				3.50	3.56
Mar				3.54	3.95
Apr				3.35	4.48
May				3.35	4.31
Jun				3.31	4.23
Jul				3.34	3.81
Aug				3.41	3.84
Sep				3.34	3.38
Oct				4.09	3.21
Nov				3.55	3.32
Dec				3.75	3.37

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	2.61
1999	NA
2002	3.52
2003	3.71

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.40	1.66

Monthly

Month	Ann Avg Coefficient
Jan	1.05
Feb	1.00
Mar	1.00
Apr	0.95
May	0.95
Jun	0.94
Jul	0.95
Aug	0.97
Sep	0.95
Oct	1.16
Nov	1.01
Dec	1.06

Yearly

Year	Avg. Q (mgd)
2008	3.99
2018	4.63
2028	5.36
2038	6.22
2048	7.20
2058	8.35

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	1,167,000	68.2%	1.40	1.66	2.53
Ind/Inst	543,000	31.8%			1.18
Total	**1,710,000**	**-**	**-**	**-**	**3.71**

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	2.71	3.12	3.58	4.12	4.73	5.44
Ind/Inst Demand	1.28	1.51	1.78	2.10	2.47	2.91
Total	**3.99**	**4.63**	**5.36**	**6.22**	**7.20**	**8.35**

Analysis Notes
*Historical Flow Data Source: DMRs from Division of Water Quality
*NWY - 13 & NWY - 14 treated as one withdrawal, since they both are used by a single treatment plant.
*Projections are based on the percentage of water usage by sector and the growth of those sectors.
*Res./Comm. AGR based on Catwba County population projections, reported by Office of State Planning and WPCOG.
*Ind. AGR is based on the industrial trends, according to NC GSP.

OWNER: **Town of Old Fort**

HDR ID	Facility	Type
NDJ - 5	Old Fort WWTP	**Discharge**

CONTACT: **Wayne Stafford**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.34	0.37
Feb				0.36	0.40
Mar				0.38	0.40
Apr				0.37	0.45
May				0.36	0.44
Jun				0.35	0.39
Jul				0.32	0.38
Aug				0.38	0.44
Sep				0.37	0.35
Oct				0.37	0.32
Nov				0.40	0.35
Dec				0.34	0.33

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.58
1999	NA
2002	0.36
2003	0.39

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
2.00	1.66

Monthly

Month	Ann Avg Coefficient
Jan	0.94
Feb	1.03
Mar	1.03
Apr	1.15
May	1.13
Jun	1.01
Jul	0.97
Aug	1.13
Sep	0.89
Oct	0.82
Nov	0.90
Dec	0.85

Yearly

Year	Avg. Q (mgd)
2008	0.43
2018	0.51
2028	0.62
2038	0.74
2048	0.89
2058	1.07

Analysis Notes

Type	2002 LWSP	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	682	123	732	963	2.00	1.66

Type	2002 LWSP	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	682	123	732	963	2.00	1.66
Com. Cust.	92	360				
Ind. Cust	23	3,169				
Inst. Cust	8	3,513				
TOTAL	**797**	**-**				

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	117,300	53.7%	2.00	1.66	0.21
Ind/Inst	100,980	46.3%			0.18
Total	**218,280**	**-**	**-**	**-**	**0.39**

Wastewater Projections

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.23	0.28	0.34	0.42	0.51	0.62
Ind/Inst Demand	0.20	0.23	0.27	0.32	0.38	0.45
Total	**0.43**	**0.51**	**0.62**	**0.74**	**0.89**	**1.07**

*Data Source: DMRs from DWQ

*McDowell County 1980s	0.15% AGR		
*McDowell County 1990s	1.42% AGR	Local Water Supply Plan Projections	
*OSPL McDowell County 30 year projection is	1.33% AGR	0.42	2010
*For Future Discharge projection (blend Old Fort	2.00% AGR	0.47	2020
with Countywide projection)		0.52	2030
*City of Old Fort population growth in the 1990s: AGR =	2.78%	0.58	2040
		0.65	2050

OWNER: **Pharr Yarns**

HDR ID	Facility	HDR ID: Type
NDY - 6	Pharr Yarns Industrial WWTP	Discharge

CONTACT: **Mike Church**

Proj. By: JCH

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	7.08	0.09
Feb				0.15	0.08
Mar				0.11	0.08
Apr				0.18	0.08
May				0.10	0.09
Jun				0.11	0.09
Jul				0.10	0.07
Aug				0.11	0.06
Sep				0.09	0.05
Oct				0.08	0.07
Nov				0.06	0.05
Dec				0.08	0.07

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.06
1999	NA
2002	0.11
2003	0.07

PROJECTION SUMMARY

AGR Industrial
0.00

Monthly

Month	Ann Avg Coefficient
Jan	1.24
Feb	1.18
Mar	1.20
Apr	1.09
May	1.23
Jun	1.25
Jul	1.05
Aug	0.91
Sep	0.73
Oct	0.95
Nov	0.78
Dec	1.04

Yearly

Year	Avg. Q (mgd)
2008	0.07
2018	0.07
2028	0.07
2038	0.07
2048	0.07
2058	0.07

Analysis Notes

*Permitted limit is 1.0 mgd.

*AGR based on assumption of no future growth or decline, due to a negative trend for the textile industry.

OWNER: **Rock Hill**

HDR ID	Facility	Type
SWY - 1	Lake Wylie	Withdrawal
SWF - 5	Catawba River Plant	Withdrawal
SDF - 8	Manchester Creek WWTP	Discharge

CONTACT: Nick Stegall

Proj. By: *LKM*

HDR ID: **SWY - 1**
FACILITY: **Lake Wylie**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	9.53	NA	NA	NA	12.48
Feb	9.23				11.52
Mar	9.29				12.13
Apr	9.74				12.53
May	11.54				12.26
Jun	12.41				13.00
Jul	14.23				13.35
Aug	14.32				13.68
Sep	14.19				14.83
Oct	13.07				14.16
Nov	11.51				13.03
Dec	10.86				11.90

Yearly

Year	Avg. Q (mgd)
1992	NA
1994	8.62
1995	9.66
1996	10.64
1997	11.67
1998	12.07
1999	NA
2001	13.64
2002	NA
2003	12.91

PROJECTION SUMMARY

AGR
2.00

Monthly

Month	Ann Avg Coefficient
Jan	0.97
Feb	0.89
Mar	0.94
Apr	0.97
May	0.95
Jun	1.01
Jul	1.03
Aug	1.06
Sep	1.15
Oct	1.10
Nov	1.01
Dec	0.92

Yearly

Year	Avg. Q (mgd)
2008	14.25
2018	17.37
2028	21.18
2038	25.82
2048	31.47
2058	38.36

Analysis Notes
*Based on data below an AGR for Rock Hill's water withdrawal rate assumed at 2.0%
*This accouts for population growth and service area expansion

York Co. Population AGR

1980s	2.10%
1990s	2.10%
2000s	1.60% (projected)
2010s	1.50% (projected)

HDR ID: **SWF - 5**
FACILITY: **Catawba River Plant**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1996 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	5.69	9.13	NA	NA	NA	NA
Feb	5.74	9.77				
Mar	5.59	9.08				
Apr	6.17	10.47				
May	6.08	11.52				
Jun	5.98	12.31				
Jul	8.09	12.88				
Aug	6.82	11.93				
Sep	6.62	11.27				
Oct	6.35	11.31				
Nov	6.07	9.17				
Dec	6.27	9.23				

Yearly

Year	Avg. Q (mgd)
1992	6.29
1996	10.68
1997	NA
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

AGR

Monthly

Month	Ann Avg Coefficient
Jan	0.86
Feb	0.92
Mar	0.85
Apr	0.98
May	1.08
Jun	1.15
Jul	1.21
Aug	1.12
Sep	1.06
Oct	1.06
Nov	0.86
Dec	0.87

Yearly

Year	Avg. Q (mgd)
2008	0.00
2018	0.00
2028	0.00
2038	0.00
2048	0.00
2058	0.00

Analysis Notes
*Plant only used on emergency basis - withdrawal projections considered elsewhere

HDR ID: **SDF - 8**
FACILITY: **Manchester Creek WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	7.11	9.00	NA	8.17	NA
Feb	9.96	10.75		7.88	
Mar	8.75	10.50		8.84	
Apr	7.89	9.70		7.80	
May	7.35	8.70		7.55	
Jun	8.43	8.60		7.14	
Jul	7.15	8.60		7.14	
Aug	6.50	8.10		7.41	
Sep	6.23	8.00		7.84	
Oct	6.90	8.50		8.86	
Nov	7.76	8.60		9.21	
Dec	7.09	9.54		9.82	

Yearly

	Year	Avg. Q (mgd)
	1992	7.59
77.5%	1997	9.05
	1999	NA
59.6%	2002	8.14
	2003	NA

2002 est. based on 2001

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	0.97
Mar	1.09
Apr	0.96
May	0.93
Jun	0.88
Jul	0.88
Aug	0.91
Sep	0.96
Oct	1.09
Nov	1.13
Dec	1.21

Yearly

Year	Avg. Q (mgd)
2008	10.00
2018	10.20
2028	14.80
2038	18.10
2048	22.00
2058	26.90

Analysis Notes
*Historical data suggests that approx. 70% of water withdrawn by WTP is discharged to the Manchester WWTP.
*Assume trend continues

OWNER: **Schneider Mills**

HDR ID	Facility	Type
NDL - 1	Schneider Mills WWTP	Discharge

CONTACT: **Gary Elder**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.29	0.30
Feb				0.33	0.29
Mar				0.31	0.29
Apr				0.30	0.29
May				0.32	0.28
Jun				0.31	0.31
Jul				0.31	0.30
Aug				0.35	0.34
Sep				0.31	0.35
Oct				0.32	0.36
Nov				0.29	0.32
Dec				0.28	0.35

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.62
1999	NA
2002	0.31
2003	0.31

PROJECTION SUMMARY

AGR Industrial
0.00

Monthly

Month	Ann Avg Coefficient
Jan	0.94
Feb	1.05
Mar	1.00
Apr	0.96
May	1.03
Jun	0.98
Jul	0.99
Aug	1.13
Sep	1.01
Oct	1.03
Nov	0.95
Dec	0.89

Yearly

Year	Avg. Q (mgd)
2008	0.31
2018	0.31
2028	0.31
2038	0.31
2048	0.31
2058	0.31

Analysis Notes

*AGR based on assumption of no future growth or decline, since a negative trend for the textile industry.

OWNER: **SGL Carbon**

HDR ID	Facility	Type
NDR - 1	SGL Carbon Corporation	Discharge

CONTACT: **Rick Ives**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	1.99	0.88
Feb				2.00	0.71
Mar				2.23	0.96
Apr				2.07	0.91
May				2.16	0.74
Jun				2.26	1.10
Jul				2.08	0.68
Aug				2.02	1.06
Sep				1.16	0.74
Oct				0.90	0.73
Nov				0.75	0.60
Dec				0.71	0.67

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	3.66
1999	NA
2002	1.69
2003	0.81

PROJECTION SUMMARY

AGR Industrial
1.27

Monthly

Month	Ann Avg Coefficient
Jan	1.18
Feb	1.18
Mar	1.32
Apr	1.22
May	1.28
Jun	1.34
Jul	1.23
Aug	1.20
Sep	0.69
Oct	0.54
Nov	0.44
Dec	0.42

Yearly

Year	Avg. Q (mgd)
2008	0.87
2018	0.99
2028	1.12
2038	1.28
2048	1.45
2058	1.64

Analysis Notes

*Permit states that discharge is not limited.

*AGR based on 4.27% annual growth in chemicals industry in 1990s, according to NC GSP, adjusted down 3% for inflation.

OWNER: **Siemens Westinghouse**

HDR ID	Facility	Type
NWY - 5	Siemens Westinghouse	Withdrawal
NDY - 12	Siemens Westinghouse	Discharge

CONTACT: **Bob Carpenter**

Proj. By: *JCH*

HDR ID: **NWY - 5**
FACILITY: **Siemens Westinghouse**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	10.80	NA	NA
Feb			10.80		
Mar			10.80		
Apr			10.80		
May			10.80		
Jun			10.80		
Jul			10.80		
Aug			10.80		
Sep			10.80		
Oct			10.80		
Nov			10.80		
Dec			10.80		

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	10.8
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
0.00

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.00
Apr	1.00
May	1.00
Jun	1.00
Jul	1.00
Aug	1.00
Sep	1.00
Oct	1.00
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	10.80
2018	10.80
2028	10.80
2038	10.80
2048	10.80
2058	10.80

Projection Analysis
*AGR based on conversation with Plant Contact, in which he stated the withdrawal rate will not increase.

HDR ID: **NDY - 12**
FACILITY: **Siemens Westinghouse**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	10.76	NA	NA
Feb			10.76		
Mar			10.76		
Apr			10.76		
May			10.76		
Jun			10.76		
Jul			10.76		
Aug			10.76		
Sep			10.76		
Oct			10.76		
Nov			10.76		
Dec			10.76		

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	10.76
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
0.00

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.00
Mar	1.00
Apr	1.00
May	1.00
Jun	1.00
Jul	1.00
Aug	1.00
Sep	1.00
Oct	1.00
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	10.70
2018	10.70
2028	10.70
2038	10.70
2048	10.70
2058	10.70

Projection Analysis
*Assumed 0.1 mgd of plant flow consumed, which is conservative based on the amount estimated by the Plant Contact.

OWNER: **Springs Industrial**

HDR ID	Facility	Type
SWF - 3	Grace Complex	Withdrawal
SDF - 4	Grace Complex	Discharge

Contacts: Keith Griffin

Proj. By: *PNB/LKM*

HDR ID: **SWF - 3**
FACILITY: **Grace Complex**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	9.75	NA	NA	11.03	9.00
Feb	8.85			10.55	7.90
Mar	9.18			8.87	8.00
Apr	10.60			11.97	8.20
May	10.34			9.61	9.70
Jun	10.76			10.20	6.90
Jul	11.25			13.58	9.80
Aug	12.14			12.00	13.40
Sep	12.23			9.73	8.80
Oct	11.62			11.32	9.60
Nov	11.03			9.37	8.00
Dec	8.79			8.71	10.00

Yearly

Year	Avg. Q (mgd)
1992	10.55
1997	NA
1999	NA
2002	10.58
2003	9.11

PROJECTION SUMMARY

AGR
0.50

Monthly

Month	Ann Avg Coefficient
Jan	1.04
Feb	1.00
Mar	0.84
Apr	1.13
May	0.91
Jun	0.96
Jul	1.28
Aug	1.13
Sep	0.92
Oct	1.07
Nov	0.89
Dec	0.82

Yearly

Year	Avg. Q (mgd)
2008	10.90
2018	11.46
2028	12.05
2038	12.66
2048	13.31
2058	13.99

Analysis Notes

*The decline in the last decade is attributable to decreasing productivity and water conservation through plant improv.
*The plant contact projects plant withdrawals to be in the 9-11 MGD range for the near future w/ conservative growth growth in the future.
*We will use a conservative .5% AGR. With a starting point of 2002 for conservatism

HDR ID: **SDF - 4**
FACILITY: **Grace Complex**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan		9.60	NA	9.30	NA
Feb	7.00	10.10		9.90	
Mar	7.40	10.00		9.30	
Apr	7.50	9.80		9.30	
May	7.50	10.10		9.80	
Jun	7.50	10.70		10.20	
Jul	10.70	13.00		11.10	
Aug	10.60	11.50		11.90	
Sep	10.40	11.00		9.60	
Oct	9.10	10.70		9.00	
Nov	8.40	10.50		8.90	
Dec	7.00	10.50		8.50	

Yearly

Year	Avg. Q (mgd)
1992	8.46
1997	10.63
1999	NA
2002	9.73
2003	NA

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.96
Feb	1.02
Mar	0.96
Apr	0.96
May	1.01
Jun	1.05
Jul	1.14
Aug	1.22
Sep	0.99
Oct	0.92
Nov	0.91
Dec	0.87

Yearly

Year	Avg. Q (mgd)
2008	9.81
2018	10.31
2028	10.84
2038	11.40
2048	11.98
2058	12.59

Analysis Notes

*The plant purchases no water. It withdrawals water for once through cooling and then passes this water on to a WTP for treatment to be used as process water. If the supply of cooling water is greater than the demand for process water, then the cooling water is bypassed onto the reservoir.
In 1992 and prior, bypassed cooling water was not metered, this may account for the discrepency in consumptive use for that year.

*Use a 10% consumptive loss based off the 2002 data point.

*Flow data from 1992 not reliable because bypassed cooling water was not metered.

OWNER: **Town of Stanley**

HDR ID	Facility	Type
NWY - 15	Stanley WTP	Withdrawal
NDY - 31	Lola Street WWTP	Discharge

CONTACT: **Hil Miller**

Proj. By: *JCH*

HDR ID: **NWY - 15**
FACILITY: **Stanley WTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.64	NA
Feb				0.55	
Mar				0.69	
Apr				0.68	
May				0.67	
Jun				0.65	
Jul				0.86	
Aug				0.78	
Sep				0.45	
Oct				0.52	
Nov				0.63	
Dec				0.46	

Yearly

Year	Avg. Q (mgd)
1992	0.58
1997	0.68
1999	NA
2002	0.63
2003	NA

PROJECTION SUMMARY

AGR Res. & Comm.	AGR Industrial
0.00	0.00

Monthly

Month	Ann Avg Coefficient
Jan	1.01
Feb	0.88
Mar	1.09
Apr	1.08
May	1.06
Jun	1.03
Jul	1.37
Aug	1.24
Sep	0.72
Oct	0.83
Nov	1.00
Dec	0.73

Yearly

Year	Avg. Q (mgd)
2008	0.63
2018	0.63
2028	0.63
2038	0.63
2048	0.63
2058	0.63

LWSP

2010	0.9
2020	1.0
2030	1.2
2040	1.3
2050	2.0

Analysis Notes

*AGR from Stanley is assumed at 0.00 since Gastonia and Mt. Holly have projections that are aggressive in Gaston Co., and since current discussions are underway between Mt. Holly and Stanley for purchase of future water supply.

*Difficult to tell what portion of the total flow to Stanley was provided by Mt. Holly based on a review of both entities LWSPs. Thus we will flatline projections at the total usage in 2002 based on this finding and the note above.

Type	2008	2018	2028	2038	2048	2058
Res. Cust	1,374	1,374	1,374	1,374	1,374	1,374

Demand	271,000	271,000	271,000	271,000	271,000	271,000
Com. Cust.	91	91	91	91	91	91
Demand	91,000	91,000	91,000	91,000	91,000	91,000
Ind. Cust	12	12	12	12	12	12
Demand	130,000	130,000	130,000	130,000	130,000	130,000
Inst. Cust	30	30	30	30	30	30
Demand	151,000	151,000	151,000	151,000	151,000	151,000
Wholesale	0	0	0	0	0	0
TOTALS	**1,507**	**1,477**	**1,477**	**1,477**	**1,477**	**1,477**
	830,000	**830,000**	**830,000**	**830,000**	**830,000**	**830,000**

Type	2002 LWSP	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	1,374	197	2,897	3,053	0.00	0.00
Com. Cust.	91	1,000				
Ind. Cust	12	10,833			Backwash & Unaccounted For	23%
Inst. Cust	30	1,033			2002 Wholesale	0
TOTAL	**1,507**	**-**				

HDR ID: **NDY - 31**
FACILITY: **Lola Street WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.31	0.25
Feb				0.27	0.29
Mar				0.31	0.33
Apr				0.27	0.37
May				0.22	0.32
Jun				0.24	0.25
Jul				0.17	0.24
Aug				0.19	0.24
Sep				0.22	0.25
Oct				0.24	0.22
Nov				0.28	0.22
Dec				0.32	0.25

Yearly

Year	Avg. Q (mgd)
1992	0.46
1997	0.45
1999	NA
2002	0.25
2003	0.27

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
0.00	0.00

Monthly

Month	Ann Avg Coefficient
Jan	0.95
Feb	1.07
Mar	1.22
Apr	1.38
May	1.18
Jun	0.93
Jul	0.89
Aug	0.91
Sep	0.93
Oct	0.81
Nov	0.81
Dec	0.93

Yearly

Year	Avg. Q (mgd)
2008	0.27
2018	0.27
2028	0.27
2038	0.27
2048	0.27
2058	0.27

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	362,000	69.2%	0.00	0.00	0.19
Ind/Inst	161,000	30.8%			0.08
Total	**523,000**	**-**	**-**	**-**	**0.27**

Wastewater Projections

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.19	0.19	0.19	0.19	0.19	0.19
Ind/Inst Demand	0.08	0.08	0.08	0.08	0.08	0.08
Total	**0.27**	**0.27**	**0.27**	**0.27**	**0.27**	**0.27**

Analysis Notes
*Historical Flow Data Source: DMRs from Division of Water Quality
*Res./Comm. and Ind. AGRs based on assumption that the Town's future water demand will be met by Mt. Holly or Gastonia.

OWNER: **City of Statesville**

HDR ID	Facility	Type
NWL - 1	Future - At Lookout Shoals	Withdrawal

CONTACT: **Joe Hudson**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	4.25	NA
Feb				4.21	
Mar				4.29	
Apr				4.84	
May				5.06	
Jun				5.56	
Jul				4.47	
Aug				3.11	
Sep				2.61	
Oct				2.93	
Nov				2.91	
Dec				2.90	

Yearly

Year	Avg. Q (mgd)
1992	5.28
1997	5.18
1999	NA
2002	3.92
2003	NA

LOOKOUT

Year	Avg. Q (mgd)
1992	0.00
1997	0.00
2002	0.00
2003	0.00

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
2.00	1.66

LWSP

8.5	2010
8.9	2020
9.4	2030
9.9	2040
10.5	2050

Monthly

Month	Ann Avg Coefficient
Jan	1.08
Feb	1.07
Mar	1.09
Apr	1.23
May	1.29
Jun	1.42
Jul	1.14
Aug	0.79
Sep	0.66
Oct	0.75
Nov	0.74
Dec	0.74

Yearly

Lookout Shoals

Year	Avg. Q (mgd)
2008	4.51
2018	5.46
2028	6.62
2038	8.02
2048	9.00
2058	9.00

the allocation of Lookout Shoals is conservatively assigned,but within grandfathered amount assuming max day ratio of 1.75 which is reflective of 2002 data. Run this out to approx. 9 MGD then balance the rest with South Yadkin

(15/1.75) = 8.5 MGD, say 9 MGD

conversation with Jerry Byerly (asst. director) says S. Yadkin will only be a backup in the future….

Total for Statesville

Year	Avg. Q (mgd)
2008	4.51
2018	5.46
2028	6.62
2038	8.02
2048	9.73
2058	11.80

Analysis Notes

*Res./Comm. AGR based on population projections prepared by the City and the NC OSP.
*Ind. AGR based on moderate growth of industries served, according to NC GSP.
*2002 - dry year went to mandatory restrictions
*Stateville has approval to transfer up to 15 mgd from Lookout Shoals (Catawba Basin) to the South Yadkin Basin.
*2002 LWSP indicates that 6 mgd from Lookout Shoals is planned
*WTP is being expanded from 12 to 15 mgd.
*Lookout Shoals Supply is indicated at 6 MGD

Analysis Notes

Type	2008	2018	2028	2038	2048	2058
Res. Cust	9,866	12,027	14,661	17,871	21,785	26,556

Type	2000	2010	2020	2030	2040	2050
Res. Cust	9,866	12,027	14,661	17,871	21,785	26,556
Demand	1,351,000	1,647,000	2,008,000	2,448,000	2,984,000	3,637,000
Com. Cust.	2,068	2,520	3,072	3,745	4,565	5,565
Demand	1,971,000	2,402,000	2,928,000	3,570,000	4,352,000	5,305,000
Ind. Cust	115	135	160	188	222	261
Demand	276,500	311,100	352,000	399,300	454,800	518,700
Inst. Cust	97	115	135	159	188	221
Demand	232,000	273,000	322,000	380,000	448,000	528,000
Wholesale	411,000	501,000	611,000	745,000	908,000	1,106,000
TOTALS	**12,146**	**14,683**	**17,893**	**21,805**	**26,572**	**32,383**
	4,512,000	**5,462,000**	**6,618,000**	**8,024,000**	**9,731,000**	**11,803,000**

Type	2002 LWSP	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	8,761	137	17,567	23,320	2.00	1.66
Com. Cust.	1,836	953				
Ind. Cust	104	1,442			Backwash & Unaccounted For	6%
Inst. Cust	88	2,386			2002 Wholesale	365,000
TOTAL	**10,789**	**-**			Unaccounted for Only	4%

*Statesville's focus is on service area within City limits and ETJ, however it is likely that future metro Charlotte growth will impact growth in and around Statesville.

*Assume Mooresville, Hickory and others meet the majority of water demand in Iredell Co. that is within the Catawba basin

*Future projections will assume a 2.00% AGR for residential/commercial….This is very aggressive, but it is less than what Iredell and Statesville experienced in 1990.

*It is also more in line with the most aggressive projections in the planning report by the City.

*The Industria/Instituational flow will be assumed to increase at 1.66% to account for manufacturing - inflation thru the 1990s

*The actual total flow predicted in the Statesville projections is not quite as important as the allocation into Lookout Shoals intake vs South Yadkin intake.

Population Information

*Statesville is working on a planning study that indicates the following:

	S'ville AGR	Iredell AGR
1980s	-0.58%	1.19%
1990s	2.87%	2.81%
20-yr avg.	1.15%	2.00%
2000-2020 Low Prediction	1.39%	
2000-2020 High Prediction	2.01%	

*State Office of Planning #s

1980s	1.20%
1990s	2.70%
2000s projected	2.00%
2010s projected	1.40%
2020s projected	1.20%

*Current wholesale customers

	2002 (MGD)
Iredell Water Corp	0.112
West Iredell Water Corp	0.162
Town of Troutman	0.083
Watercrest Estates	0.008
	0.365

*South Yadkin River Intake (from LWSP)

3.924 MGD avg. withdrawal in 2002
6.817 MGD max. withdrawal in 2003
9.000 MGD available water supply…but that was nearly dried up in 2002
49 MG of raw water storage

*Plant capacity is 9 MGD; Statesville has a 15 MGD max day flow of future interbasin transfer grandfathered into the system.

*All wastewater currently discharged in the Yadkin basin

OWNER: **Town of Taylorsville**

HDR ID	Facility	Type
NDL - 2	Taylorsville WWTP	Discharge

CONTACT: **David Robinette**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	0.17	0.33
Feb				0.16	0.40
Mar				0.24	0.43
Apr				0.25	0.47
May				0.26	0.49
Jun				0.25	0.61
Jul				0.23	0.50
Aug				0.41	0.52
Sep				0.42	0.51
Oct				0.38	0.47
Nov				0.42	0.45
Dec				0.39	0.46

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.41
1999	NA
2002	0.30
2003	0.47

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.50	1.66

Monthly

Month	Ann Avg Coefficient
Jan	0.70
Feb	0.85
Mar	0.92
Apr	1.00
May	1.05
Jun	1.31
Jul	1.06
Aug	1.11
Sep	1.08
Oct	1.00
Nov	0.95
Dec	0.98

Yearly

Year	Avg. Q (mgd)
2008	0.51
2018	0.59
2028	0.69
2038	0.81
2048	0.95
2058	1.11

Analysis Notes

Type	2002 LWSP	GPD/Cust	1990 Pop	2000 Pop	AGR	AGR Ind.
Res. Cust	900	228	1,566	1,799	1.50	1.66
Com. Cust.	190	263	*Taylorsville population census data			
Ind. Cust	12	10,833				
Inst. Cust	20	2,500				
TOTAL	**1,102**	**-**				

Type	Flow	Percentage	Res AGR	Ind AGR	2003 Base
Res/Com	255,000	58.6%	1.50	1.66	0.28
Ind/Inst	180,000	41.4%			0.19
Total	**435,000**	**-**	**-**	**-**	**0.47**

Wastewater Projections

Type	2008	2018	2028	2038	2048	2058
Res/Com Demand	0.30	0.34	0.40	0.46	0.54	0.62
Ind/Inst Demand	0.21	0.25	0.29	0.35	0.41	0.48
Total	**0.51**	**0.59**	**0.69**	**0.81**	**0.95**	**1.11**

*Wastewater projections are based on the percentage of water usage and the growth rate of that usage.

*1980s pop. growth rate of Alex. Co. 0.97% AGR
*1990s pop. growth rate of Alex Co. 1.71% AGR
*2000 - 2030 pop. Proj. of Alex Co. 1.54% AGR
*Taylorsville pop growth of 90s 1.40% AGR
*For projections use 1.50% AGR
*Flows appear relatively flat for the last 6 years with a drop off in 2002 likely due to dry weather
*GPD/customer seems high, but a marginal impact in the big picture of the drainage basin
*Use 1.66 AGR for industrial based on GSP

OWNER: **Textron, Inc**

HDR ID	Facility	Type
NDY - 7	Textron Incorporated	Discharge

CONTACT: **Dave McCabe**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.07
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
1.66

Monthly

Month	Ann Avg Coefficient
Jan	1.0
Feb	1.0
Mar	1.0
Apr	1.0
May	1.0
Jun	1.0
Jul	1.0
Aug	1.0
Sep	1.0
Oct	1.0
Nov	1.0
Dec	1.0

Yearly

Year	Avg. Q (mgd)
2008	0.08
2018	0.10
2028	0.12
2038	0.14
2048	0.16
2058	0.19

Assumptions

*Multi-industry company: aerospace, tools and components, golf, financial.

*AGR based on annual growth of similar industries, according to NC GSP (4.66% - 3.00%)

OWNER: **TransMontaigne Terminaling, Inc**

HDR ID	Facility	Type
NDY - 8	Charlotte/Paw Creek Terminal #1	Discharge
NDY - 9	Charlotte/Paw Creek Terminal #2	Discharge

CONTACT: **Barbara Castleberry**

Proj. By: *JCH*

HDR ID: **NDY - 8**
FACILITY: **Charlotte/Paw Creek Terminal #1**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.25
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
0.00

Monthly

Month	Ann Avg Coefficient
Jan	1.0
Feb	1.0
Mar	1.0
Apr	1.0
May	1.0
Jun	1.0
Jul	1.0
Aug	1.0
Sep	1.0
Oct	1.0
Nov	1.0
Dec	1.0

Yearly

Year	Avg. Q (mgd)
2008	0.00
2018	0.00
2028	0.00
2038	0.00
2048	0.00
2058	0.00

Analysis Notes
*Discharges are infrequent (e.g. 1 per year), which yield insignificant annual discharge volumes.
*Projection is assumed to be 0.0 mgd on an annual average basis with no expected increase.
*Washdown areas

HDR ID: **NDY - 9**
FACILITY: **Charlotte/Paw Creek Terminal #2**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.28
1999	NA
2002	NA
2003	NA

PROJECTION SUMMARY

AGR Industrial
0.00

Monthly

Month	Ann Avg Coefficient
Jan	1.0
Feb	1.0
Mar	1.0
Apr	1.0
May	1.0
Jun	1.0
Jul	1.0
Aug	1.0
Sep	1.0
Oct	1.0
Nov	1.0
Dec	1.0

Yearly

Year	Avg. Q (mgd)
2008	0.00
2018	0.00
2028	0.00
2038	0.00
2048	0.00
2058	0.00

Analysis Notes
*Discharges are infrequent (e.g. 1 per year), which yield insignificant annual discharge volumes; wasdown areas.
*Projection is assumed to be 0.0 mgd on an annual average basis with no expected increase.

OWNER: **Union County Public Works Department**

HDR ID	Facility	Type
NDF - 5	Twelve Mile Creek WWTP	Discharge

CONTACT:

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	1.14	1.38
Feb				1.05	1.84
Mar				1.16	2.08
Apr				1.08	2.01
May				1.05	1.87
Jun				0.95	1.74
Jul				0.90	1.60
Aug				0.89	1.18
Sep				0.87	1.41
Oct				0.96	1.42
Nov				1.51	1.39
Dec				1.26	1.50

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	NA
1999	NA
2002	1.07
2003	1.62

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.07
Feb	0.98
Mar	1.09
Apr	1.01
May	0.98
Jun	0.89
Jul	0.84
Aug	0.83
Sep	0.81
Oct	0.90
Nov	1.41
Dec	1.18

Yearly

Year	Avg. Q (mgd)
2008	2.48
2018	3.94
2028	4.96
2038	5.82
2048	6.48
2058	7.20

WWTP	MGD Permitted
12-mile Crk	2.5
Crooked Crk	1.9
Subdivision WWTPs	
Hunley	0.23
Olde Sycamore	0.15
Tallwood	0.05
Grassy Crk	0.05
	4.88

Analysis Notes

*Union County 2002-2003 W/W Report states 12-Mile Creek treats approx. 20% of total County wastewater

*Total flows taken from 2002-2003 Wastewater Report.

*According to the 2002-2003 W/W Report, the total treatment capacity in County is 4.88 mgd

	2002	2003
Avg Water Demand	7.3	6.0
Avg 12-Mile Discharge	1.07	1.62
	14.7%	27.0%

Percentage of County Water Demand Discharging at 12-Mile WWTP: **20.0%**

Union Co. Overall Water Demand

Year	Avg. Q (mgd)
2008	12.4
2018	19.7
2028	24.8
2038	29.1
2048	32.4
2058	36.0

Owner: **Town of Valdese**

HDR ID	Facility	Type
NWR - 4	Valdese Water Treatment Plant	Withdrawal
NDR - 7	Lake Rhodhiss WWTP	Discharge

CONTACT: **David Cook, Chris Graybeal**

Proj. By: *LKM*

HDR ID: **NWR - 4**
FACILITY: **Lake Rhodhiss WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	5.28	NA
Feb				5.22	
Mar				5.27	
Apr				5.77	
May				6.27	
Jun				6.23	
Jul				5.65	
Aug				5.97	
Sep				5.55	
Oct				5.04	
Nov				4.63	
Dec				4.47	

Yearly

Year	Avg. Q (mgd)
1992	4.87
1997	6.04
1999	NA
2002	6.04
2003	NA

PROJECTION SUMMARY

AGR Res. & Com.	AGR Industrial
1.50	1.66

Monthly

Month	Ann Avg Coefficient
Jan	0.87
Feb	0.86
Mar	0.87
Apr	0.96
May	1.04
Jun	1.03
Jul	0.94
Aug	0.99
Sep	0.92
Oct	0.83
Nov	0.77
Dec	0.74

Yearly

Year	Avg. Q (mgd)
2008	6.23
2018	6.57
2028	6.95
2038	7.37
2048	7.82
2058	8.33

*Projections are based on the percentage of water usage by sector and the growth of those sectors.
*Res./Comm. AGR based on population projections from the NC Office of State Planning, System LWSPs, and WPCOG.
*Ind. AGR assigned conservative value despite negative trend of the textile industry according to NC GSP.

Analysis Notes

Type	2008	2018	2028	2038	2048	2058
Res. Cust	2,204	2,496	2,826	3,200	3,623	4,102
Demand	325,000	368,000	417,000	472,000	535,000	606,000
Com. Cust	171	194	220	249	282	319

Demand	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Com. Cust.	171	194	220	249	282	319
Demand	33,000	38,000	43,000	48,000	55,000	62,000
Ind. Cust	44	45	46	47	48	49
Demand	4,048,000	4,151,000	4,255,000	4,363,000	4,473,000	4,586,000
Inst. Cust	11	11	12	12	12	13
Demand	203,000	208,000	213,000	219,000	224,000	230,000
Wholesale						
Cust. Demand	1,293,000	1,464,000	1,657,000	1,877,000	2,125,000	2,406,000
TOTALS	**2,430**	**2,735**	**3,092**	**3,496**	**3,953**	**4,471**
	6,229,000	**6,574,000**	**6,950,000**	**7,366,000**	**7,823,000**	**8,327,000**

Type	2002 LWSP	Q (MGD)	GPD/Cust	1997 LWSP	2002 LWSP	AGR	AGR Ind.
Res. Cust	2,046	0.30	148	4,169	4,624	1.25	0.25
Com. Cust.	159	0.03	195				
Ind. Cust	43	3.99	92,744				
Inst. Cust	11	0.20	18,182				
TOTAL	**2,259**	**4.52**	**-**				

Unaccounted For Water	3.4%
Backwash Water	1.8%
	5.3%

Sales to Other Systems		
Icard Township WC	0.50	
Triple Community	0.50	
Burke County	0.10	
Rutherford College	0.10	
Subtotal Wholesale	1.20	
Process Water	0.11	
Total	**5.83**	
Total Use	**6.04**	
Unaccounted For Water	**0.21**	***checks***

LWSP Projections	
7.4	2010
6.8	2020
7.1	2030
7.9	2040
8.5	2050

*The industrial usage is still very large as compared to the rest of the flow distribution

Population Data		AGR			
	Burke County 1980s growth	0.44%	72504	75744	
	Burke County 1990s growth	1.03%	75744	83894	
Data from State Office of Planning					
	Burke County 2000s Projections	1.95%	83,894	101781	
	Burke County 2010s Projections	1.22%	101,781	114870	
	Burke County 2020s Projections	1.11%	114,870	128233	
From LWSP	*AGR between 1997 and 2002 LWSP indicates a		1.04% AGR		
WPCOG information for Burke County					
	*1990s historical growth	1.64%	75,740	89,148	*this discrepancy from SOP*
	*2000 - 2010 projections	1.36%	89,148	102,061	*results from 2000 #s being*
	*2010 - 2020 projections	1.22%	102,061	115,167	*different, use WPCOG*

Future Population Projections (Burke County)

Use AGR	1.25%
2000	89,148
2010	100,940
2020	114,291
2030	129,408
2040	146,525
2050	165,906

*Base future projections for Valdese and wholesale customers on 1.25% AGR

This approach accounts for residential and commercial usage at the above population growth

*While this does not allow for much service area exp., the likely loss of other key ind. may 'free up' available capacity for industries

*Valdese has a high contribution of industrial flow as a % of the total. Most of this industrial flow is textiles (and one bakery)

We will assume only a 0.25% AGR for industrial and institut.

HDR ID: **NDR - 7**
FACILITY: **Lake Rhodhiss WWTP**

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	4.71	3.70
Feb				4.70	4.36
Mar				4.68	5.23
Apr				4.94	5.42
May				4.87	4.99
Jun				4.72	4.63
Jul				4.09	4.36
Aug				4.59	4.99
Sep				4.13	4.66
				4.09	4.64
Nov				4.03	4.33
Dec				3.89	3.88

Yearly

Year	Avg. Q (mgd)
1992	4.10
1997	4.94
1999	NA
2002	4.45
2003	4.6

1992	84.2%
1997	81.8%
2002	73.7%

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.06
Feb	1.06
Mar	1.05
Apr	1.11
May	1.10
Jun	1.06
Jul	0.92
Aug	1.03
Sep	0.93
Oct	0.92
Nov	0.91
Dec	0.87

Yearly

Year	Avg. Q (mgd)
2008	5.2
2018	5.5
2028	5.8
2038	6.1
2048	6.5
2058	6.9

Analysis Notes
*Historical Flow Data Source: DMRs from Division of Water Quality, and by Valdese
*Assumed discharge is 83% of WTP Output, as suggested by the historical data.

OWNER: **City of York**

HDR ID	Facility	Type
SDG - 2	Fishing Creek WWTP	Discharge

CONTACT:

Proj. By: *LKM*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan		1.10	NA	0.90	NA
Feb	1.05	1.40		0.80	
Mar	2.56	1.30		0.95	
Apr	1.05	1.10		0.80	
May	1.03	1.00		0.90	
Jun	1.17	0.90		0.80	
Jul	0.89	0.90		0.80	
Aug	0.87	0.90		0.80	
Sep	0.90	0.90		0.90	
Oct	1.06	0.90		1.00	
Nov	1.06	0.90		1.10	
Dec	1.06	1.10		1.30	

Yearly

Year	Avg. Q (mgd)
1992	1.15
1997	1.03
1999	NA
2002	0.92
2003	NA

PROJECTION SUMMARY

AGR
3.00

Monthly

Month	Ann Avg Coefficient
Jan	0.98
Feb	0.87
Mar	1.03
Apr	0.87
May	0.98
Jun	0.87
Jul	0.87
Aug	0.87
Sep	0.98
Oct	1.09
Nov	1.19
Dec	1.41

Yearly

Year	Avg. Q (mgd)
2008	1.10
2018	1.48
2028	1.99
2038	2.67
2048	3.59
2058	4.82

Analysis Notes

*York WWTP discharge is IBT from French Broad River. Owner believes IBT for 4 MGD

*York has emergency connection with Rock Hill

1980s historical growth for York County	23.2%
1990s historical growth for York County	23.6%
2000/2025 population projections	46%
Peak AGR historical	2.4%
AGR for projections	3.0%

This AGR for projections is likely high due to rapid growth of York Co. - spillover from Meck. The City of York is likely not to see such a rapid pace and the past decade of flows are indicative of stagnant w/w discharge increases. Thus, the projection for future flows will be assumed at 3% which is clearly higher than what has happened at the plant in the past 10 years, and less than projections for the County as a whole.

e flows will be assumed at 3% which is clearly

OWNER: **Yorkshire Americas**

HDR ID	Facility	Type
NDY-10	Yorkshire Americas	Discharge

CONTACT: **Rod Lane**

Proj. By: *JCH*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	NA	NA	NA	NA	NA
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	NA
1997	0.27
1999	NA
2002	0.28
2003	0.28

PROJECTION SUMMARY

AGR Industrial
0.00

Monthly

Month	Ann Avg Coefficient
Jan	1.0
Feb	1.0
Mar	1.0
Apr	1.0
May	1.0
Jun	1.0
Jul	1.0
Aug	1.0
Sep	1.0
Oct	1.0
Nov	1.0
Dec	1.0

Yearly

Year	Avg. Q (mgd)
2008	0.00
2018	0.00
2028	0.00
2038	0.00
2048	0.00
2058	0.00

Analysis Notes
*Plant Contact stated that facility is closing in 6 months.

OWNER: **Concord/Kannapolis**

HDR ID	Facility	Type
	Future IBT	

CONTACT: Henry Waldroup

In the summer of 2004, Mosteller met with Waldroup and CH2M Hill regarding the Concord/Kannapolis IBT request and future water supply projections from the Catawba River.

At that time, Concord/Kannapolis was seeking an IBT request for 38 MGD from the Catawba River.
This request was based on water supply planning projections completed for current and future service areas.

For the purpose of this Study, it was deemed important to consider this potential, future IBT so as to accurately and conservatively account for future water withdrawals and net outflows from the Catawba.

The future projections outlined below are based on the information provided by Concord/Kannapolis at that meeting and from their planning studies.

IBT Analysis

IBT Request for Max. Daily Flow in Year 2035	38 mgd
Average Daily Flow Demand Projected in Year 2035	44.4 mgd
To Provide Reserve Capacity for 80% rule (/ 0.8)	55 mgd
Current Safe Yield Capacity in Yadkin Basin	31.5 mgd
Needed Capacity in Catawba Basin (Annual Average)	24 mgd
IBT Request based on Max. Daily Flow with 1.6 Peaking Factor	38 mgd

Projection Analysis:

Concord/Kannapolis Study - 2050 Average Daily Flow Demand	53.8 mgd
HDR Extrapolation - 2058 Average DailyFlow Demand	58.8 mgd
Current Safe Yield Capacity in Yadkin Basin	31.5 mgd
Average Daily Flow needed from Catawba Basin	27.3 mgd

OWNER: **City of Camden**

HDR ID	Facility	Type
	WWTP	Discharge

CONTACT: Jo Ellen Trueblood - (803) 425-6045

Proj. By: *Patrick Blandford*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	1.60	1.57	N/A	1.15	N/A
Feb	1.24	1.85		1.05	
Mar	1.71	1.80		1.15	
Apr	1.64	1.49		1.09	
May	1.25	1.48		0.93	
Jun	1.30	1.31		0.85	
Jul	1.06	1.44		0.81	
Aug	1.10	1.32		0.74	
Sep	1.44	1.33		1.02	
Oct	1.51	1.48		1.06	
Nov	1.71	1.88		1.34	
Dec	1.90	2.01		1.43	

Yearly

Year	Avg. Q (mgd)
1992	1.45
1997	1.58
1999	N/A
2002	1.05
2003	N/A

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.09
Feb	1.00
Mar	1.09
Apr	1.03
May	0.89
Jun	0.80
Jul	0.77
Aug	0.71
Sep	0.97
Oct	1.00
Nov	1.28
Dec	1.36

Yearly

Year	Avg. Q (mgd)
2008	1.90
2018	2.21
2028	2.56
2038	2.97
2048	3.45
2058	4.00

Analysis Notes

* Assumes a consumptive use of 30%, based on historical data from the City of Camden WTP

OWNER: Clariant LSM (Life Science Molecules)

HDR ID	Facility	Type
		Discharge

CONTACT: Jeffery Batson - (803) 254-1237

Proj. By: *Patrick Blandford*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan		0.39	N/A	0.30	N/A
Feb	0.00	0.44		0.34	
Mar	0.33	0.46		0.35	
Apr	0.46	0.69		0.31	
May	0.49	0.38		0.29	
Jun	0.42	0.41		0.28	
Jul	0.49	0.39		0.24	
Aug	0.41	0.45		0.28	
Sep	0.49	0.51		0.32	
Oct	0.41	0.48		0.26	
Nov	0.44	0.59		0.31	
Dec	0.36	0.43		0.30	

Yearly

Year	Avg. Q (mgd)
1992	0.39
1997	0.47
1999	N/A
2002	0.30
2003	N/A

PROJECTION SUMMARY

AGR
3.0%

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	1.13
Mar	1.19
Apr	1.04
May	0.96
Jun	0.95
Jul	0.80
Aug	0.94
Sep	1.06
Oct	0.87
Nov	1.04
Dec	1.01

Yearly

Year	Avg. Q (mgd)
2008	0.36
2018	0.48
2028	0.64
2038	0.86
2048	1.16
2058	1.56

Analysis Notes

* The NC GSP for chemical industry in the 1990s was 7.34 % AGR, which is 4.34% assuming 3% inflation.
* Assumed and AGR of 3%, which is lower than NCGSP, but aggressive compared to individual company's 10 year trend.

OWNER: **Cogsdill Tool**

HDR ID	Facility	Type
		Discharge

CONTACT: Don Mitchell - (803) 438-4000

Proj. By: *Patrick Blandford*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan		0.00	N/A	0.00	N/A
Feb		0.00		0.00	
Mar		0.01		0.00	
Apr					
May					
Jun		0.01			
Jul		0.01			
Aug		0.01		0.00	
Sep		0.01		0.01	
Oct		0.01		0.00	
Nov	0.00	0.00		0.00	
Dec		0.00		0.00	

Yearly

Year	Avg. Q (mgd)
1992	0.00
1997	0.01
1999	N/A
2002	0.00
2003	N/A

PROJECTION SUMMARY

AGR
0.0%

Monthly

Month	Ann Avg Coefficient
Jan	
Feb	
Mar	
Apr	
May	
Jun	
Jul	
Aug	
Sep	
Oct	
Nov	
Dec	

Yearly

Year	Avg. Q (mgd)
2008	
2018	
2028	
2038	
2048	
2058	

Analysis Notes

* Historical data shows this discharge to be negligible.

OWNER: **Carolina Water Service**

HDR ID	Facility	Type
	Oakland Plantation	Discharge

CONTACT: Bruce Haas - (803) 796-9545

Proj. By: *Patrick Blandford*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	N/A	0.11	N/A	0.07	N/A
Feb		0.11		0.07	
Mar		0.11		0.07	
Apr		0.10		0.07	
May		0.09		0.08	
Jun		0.11		0.07	
Jul		0.10		0.05	
Aug		0.10		0.05	
Sep		0.08		0.06	
Oct		0.10		0.01	
Nov		0.11		0.07	
Dec		0.12		0.07	

Yearly

Year	Avg. Q (mgd)
1992	N/A
1997	0.10
1999	N/A
2002	0.06
2003	N/A

PROJECTION SUMMARY

AGR
1.4%

Monthly

Month	Ann Avg Coefficient
Jan	1.12
Feb	1.15
Mar	1.14
Apr	1.15
May	1.25
Jun	1.12
Jul	0.89
Aug	0.90
Sep	0.92
Oct	0.10
Nov	1.11
Dec	1.15

Yearly

Year	Avg. Q (mgd)
2008	0.12
2018	0.14
2028	0.16
2038	0.16
2048	0.16
2058	0.16

Analysis Notes

* Small neighborhood wastewater service. Plant will likely increase discharge unitl permit is reached. Further increases will be sent to municpal treatment system.

* Assumed 1.4% AGR (AGR of area population) until permit level is reached.

OWNER: **Deroyal Textiles**

HDR ID	Facility	Type
	Camden	Discharge

CONTACT: Bruce Kritz - (803) 424-5111

Proj. By: *Patrick Blandford*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	0.06	0.14	N/A	0.14	N/A
Feb	0.08	0.13		0.13	
Mar	0.05	0.13		0.12	
Apr	0.07	0.12		0.13	
May	0.10	0.13		0.14	
Jun	0.19	0.13		0.15	
Jul	0.14	0.16		0.13	
Aug	0.13	0.12		0.17	
Sep	0.15	0.17		0.15	
Oct	0.19	0.22		0.15	
Nov	0.19	0.18		0.13	
Dec	0.14	0.21		0.10	

Yearly

Year	Avg. Q (mgd)
1992	0.12
1997	0.15
1999	N/A
2002	0.14
2003	N/A

PROJECTION SUMMARY

AGR
0.5%

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	0.95
Mar	0.88
Apr	0.95
May	1.00
Jun	1.08
Jul	0.95
Aug	1.24
Sep	1.11
Oct	1.13
Nov	0.99
Dec	0.71

Yearly

Year	Avg. Q (mgd)
2008	0.14
2018	0.15
2028	0.15
2038	0.16
2048	0.17
2058	0.18

Analysis Notes

* AGR of 0.5% used for consistency with other similar industries in the region.

OWNER: **DuPont/Investa**

HDR ID	Facility	Type
	May Plant	Withdrawal
	May Plant	Discharge

CONTACT:	Wayne Chapman (803) 425-2073	Dave Wilhelm - (803) 425-2319
	Hal Lefferts (803) 425-3462	Ed Kamenski (803) 425-2696
Proj. By:	*Blandford/Mosteller*	

HDR ID:
FACILITY: May Plant

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	1.77	3.28	N/A	2.46	2.58
Feb	2.31	3.66		2.53	2.62
Mar	2.24	3.80		2.48	2.79
Apr	2.55	3.70		2.55	2.92
May	2.60	3.86		2.67	2.63
Jun	2.43	3.66		2.83	2.75
Jul	3.30	3.37		3.19	2.98
Aug	3.48	3.34		2.91	2.59
Sep	3.26	3.44		2.94	2.59
Oct	2.92	3.19		2.60	2.47
Nov	2.91	3.34		2.64	2.51
Dec	2.92	3.15		2.83	2.24

Year	Avg. Q (mgd)
1992	2.73
1997	3.49
1999	3.14
2002	2.73
2003	2.65

PROJECTION SUMMARY

AGR
0.5%

Monthly

Month	Ann Avg Coefficient
Jan	0.90
Feb	0.93
Mar	0.91
Apr	0.93
May	0.98
Jun	1.04
Jul	1.17
Aug	1.07
Sep	1.08
Oct	0.95
Nov	0.97
Dec	1.04

Yearly

Year	Avg. Q (mgd)
2008	2.72
2018	2.86
2028	3.00
2038	3.16
2048	3.32
2058	3.49

Analysis Notes

* Used same AGR as other, similar industries.

HDR ID:
FACILITY: May Plant

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	2.58	2.68	N/A	1.80	N/A
Feb	2.59	3.02		2.18	
Mar	2.51	2.48		1.89	
Apr	2.51	2.43		1.91	
May	2.68	2.23		1.99	
Jun	2.73	2.69		2.13	
Jul	2.50	2.80		0.00	
Aug	3.62	0.00		2.26	
Sep	2.64	2.87		2.29	
Oct	3.10	2.77		1.83	
Nov	3.44	2.76		0.00	
Dec	2.47	2.79		0.00	

Year	Avg. Q (mgd)
1992	2.78
1997	2.68
1999	N/A
2002	2.03
2003	N/A

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.90
Feb	0.93
Mar	0.91
Apr	0.93
May	0.98
Jun	1.04
Jul	1.17
Aug	1.07
Sep	1.08
Oct	0.95
Nov	0.97
Dec	1.04

Yearly

Year	Avg. Q (mgd)
2008	2.04
2018	2.14
2028	2.25
2038	2.37
2048	2.49
2058	2.61

Analysis Notes
* Assumes a 75% of withdrawn water is returned (i.e. 25% consumptive use of withdrawn water).
* Used 2002 monthly withdrawal flows for Ann Avg Coefficients because monthly return data is too inconsistent.

OWNER: **Eastover Richland County**

HDR ID	Facility	Type
		Discharge

CONTACT: Andy Metts - (803) 401-0050

Proj. By: *Patrick Blandford*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	N/A	N/A	N/A		N/A
Feb					
Mar				0.02	
Apr				0.01	
May				0.02	
Jun				0.03	
Jul				0.04	
Aug				0.05	
Sep				0.05	
Oct				0.04	
Nov				0.05	
Dec				0.06	

Yearly

Year	Avg. Q (mgd)
1992	N/A
1997	N/A
1999	N/A
2002	N/A
2003	N/A

PROJECTION SUMMARY

AGR
0.0%

Monthly

Month	Ann Avg Coefficient
Jan	
Feb	
Mar	
Apr	
May	
Jun	
Jul	
Aug	
Sep	
Oct	
Nov	
Dec	

Yearly

Year	Avg. Q (mgd)
2008	
2018	
2028	
2038	
2048	
2058	

Analysis Notes

* Historical data shows this discharge to be negligible.

OWNER: **International Paper**

HDR ID	Facility	Type
	Eastover Plant	Withdrawal
	Eastover Plant	Discharge

CONTACT: John Baker (803) 353-7440
James Witkowski - (803) 353-7916

Proj. By: *Blandford/Mosteller*

HDR ID:
FACILITY: Eastover Plant

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	23.26	26.82	N/A	28.42	28.29
Feb	22.67	26.33		26.72	26.80
Mar	24.43	27.72		27.55	25.69
Apr	24.30	28.83		29.93	27.73
May	23.65	28.85		30.58	27.60
Jun	25.81	29.42		30.83	28.81
Jul	25.82	30.48		31.55	28.84
Aug	25.35	31.61		29.26	30.03
Sep	25.75	30.86		28.10	30.10
Oct	25.69	29.33		25.90	28.47
Nov	25.82	27.21		27.83	26.72
Dec	24.57	29.46		28.55	26.83

Year	Avg. Q (mgd)
1992	24.83
1997	29.00
1999	27.65
2002	28.85
2003	28.15

PROJECTION SUMMARY

AGR
0.5%

Monthly

Month	Ann Avg Coefficient
Jan	0.98
Feb	0.93
Mar	0.95
Apr	1.04
May	1.06
Jun	1.07
Jul	1.09
Aug	1.01
Sep	0.97
Oct	0.90
Nov	0.96
Dec	0.99

Yearly

Year	Avg. Q (mgd)
2008	28.86
2018	30.33
2028	31.89
2038	33.52
2048	35.23
2058	37.03

Analysis Notes
* AGR of 0.5% used for consistency with other similar industries in the region.

HDR ID:
FACILITY: Eastover Plant

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	23.04	26.08	N/A	29.85	N/A
Feb	20.27	31.74		28.21	
Mar	23.52	27.29		28.19	
Apr	25.41	29.39		30.26	
May	23.71	23.86		26.27	
Jun	26.19	33.75		31.15	
Jul	25.20	35.11		29.70	
Aug	27.30	37.15		37.00	
Sep	23.99	34.41		30.71	
Oct	24.70	33.80		26.60	
Nov	24.60	29.37		29.91	
Dec	22.66	30.31		29.78	

Year	Avg. Q (mgd)
1992	24.22
1997	31.02
1999	N/A
2002	29.80
2003	N/A

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	1.00
Feb	0.95
Mar	0.95
Apr	1.02
May	0.88
Jun	1.05
Jul	1.00
Aug	1.24
Sep	1.03
Oct	0.89
Nov	1.00
Dec	1.00

Yearly

Year	Avg. Q (mgd)
2008	28.28
2018	29.73
2028	31.25
2038	32.85
2048	34.53
2058	36.29

Analysis Notes
* Assumes Consumptive Use of 2%, consistent with historical data.

OWNER: Hanson Aggregates

HDR ID	Facility	Type
	Hasskamp Plant	Discharge

CONTACT: Jim Zadorozny - (770) 617-7398 cellular

Proj. By: *Patrick Blandford*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	N/A	0.01	N/A		N/A
Feb		0.01		0.58	
Mar		1.60		0.58	
Apr		0.00		0.21	
May		0.07		0.69	
Jun		0.00		0.38	
Jul		0.02		0.21	
Aug		0.45		0.21	
Sep		0.00		0.21	
Oct		0.09			
Nov		0.09			
Dec		0.11			

Yearly

Year	Avg. Q (mgd)
1992	N/A
1997	0.20
1999	N/A
2002	0.38
2003	N/A

PROJECTION SUMMARY

AGR
0.0%

Monthly

Month	Ann Avg Coefficient
Jan	0.06
Feb	0.06
Mar	7.85
Apr	0.02
May	0.35
Jun	0.01
Jul	0.07
Aug	2.18
Sep	0.00
Oct	0.42
Nov	0.44
Dec	0.51

Yearly

Year	Avg. Q (mgd)
2008	0.00
2018	0.00
2028	0.00
2038	0.00
2048	0.00
2058	0.00

Analysis Notes

* This facility is not currently in operation, and is an intermittent discharge with in operation.

OWNER: **Huron Tech Corporation**

HDR ID	Facility	Type
		Discharge

CONTACT: Jeffrey Heath - (803) 353-8787

Proj. By: *Patrick Blandford*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	N/A	N/A	N/A	0.14	N/A
Feb				0.14	
Mar				0.14	
Apr				0.13	
May				0.13	
Jun				0.12	
Jul				0.11	
Aug				0.11	
Sep				0.12	
Oct				0.12	
Nov				0.11	
Dec				0.24	

Yearly

Year	Avg. Q (mgd)
1992	N/A
1997	N/A
1999	N/A
2002	0.13
2003	N/A

PROJECTION SUMMARY

AGR
0.5%

Monthly

Month	Ann Avg Coefficient
Jan	1.02
Feb	1.01
Mar	1.05
Apr	0.97
May	0.97
Jun	0.86
Jul	0.84
Aug	0.84
Sep	0.90
Oct	0.91
Nov	0.85
Dec	1.77

Yearly

Year	Avg. Q (mgd)
2008	0.14
2018	0.14
2028	0.15
2038	0.16
2048	0.17
2058	0.18

Analysis Notes

* AGR of 0.5% used for consistency with other similar industries in the region.

OWNER: **Kawashima Textiles**

HDR ID	Facility	Type
		Discharge

CONTACT: Tom Steel - (803) 421-0033

Proj. By: *Patrick Blandford*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	0.37	0.30	N/A	0.20	N/A
Feb	0.36	0.30		0.20	
Mar	0.36	0.29			
Apr	0.37	0.30			
May	0.37	0.31			
Jun	0.40	0.31			
Jul	0.42	0.27			
Aug	0.43	0.30			
Sep	0.40	0.32			
Oct	0.38	0.32			
Nov	0.40	0.31			
Dec	0.36	0.21			

Yearly

Year	Avg. Q (mgd)
1992	0.39
1997	0.30
1999	N/A
2002	0.28
2003	N/A

PROJECTION SUMMARY

AGR
1.0%

Monthly

Month	Ann Avg Coefficient
Jan	1.03
Feb	1.02
Mar	0.99
Apr	1.01
May	1.05
Jun	1.04
Jul	0.92
Aug	1.01
Sep	1.08
Oct	1.08
Nov	1.05
Dec	0.72

Yearly

Year	Avg. Q (mgd)
2008	0.30
2018	0.33
2028	0.36
2038	0.40
2048	0.44
2058	0.49

Analysis Notes

* Textile Industry - Assume 1.0% growth, which is conservation given negative trend in overall industry sector.

OWNER: **Kennecot Ridgeway Gold Mine**

HDR ID	Facility	Type
		Discharge

CONTACT: Roy - (803) 337-3276 ext 210

Proj. By: *Patrick Blandford*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan		N/A	N/A	0.01	N/A
Feb				0.03	
Mar				0.01	
Apr				0.06	
May				0.05	
Jun				0.44	
Jul				0.01	
Aug				0.01	
Sep	0.26			0.48	
Oct				0.05	
Nov	0.41			0.10	
Dec				0.77	

Yearly

Year	Avg. Q (mgd)
1992	0.34
1997	N/A
1999	N/A
2002	0.17
2003	N/A

PROJECTION SUMMARY

AGR
0.0%

Monthly

Month	Ann Avg Coefficient
Jan	0.05
Feb	0.19
Mar	0.04
Apr	0.38
May	0.27
Jun	2.63
Jul	0.04
Aug	0.04
Sep	2.87
Oct	0.31
Nov	0.58
Dec	4.59

Yearly

Year	Avg. Q (mgd)
2008	0.00
2018	0.00
2028	0.00
2038	0.00
2048	0.00
2058	0.00

Analysis Notes

* Mining operation discharges washwater and stormwater intermittently.

OWNER: Kershaw County-Lugoff

HDR ID	Facility	Type
	WWTP	Discharge

CONTACT: Steve Mulhairen, David Brown (803) 425-1507

Proj. By: *Patrick Blandford*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan		0.20	N/A	0.25	N/A
Feb	0.89	0.24		0.24	
Mar		0.22		0.27	
Apr		0.19		0.24	
May		0.20		0.29	
Jun	0.97	0.28		0.28	
Jul	0.92	0.37		0.24	
Aug	0.86	0.33		0.27	
Sep	0.86	0.34		0.29	
Oct		0.45		0.28	
Nov	1.31	0.38		0.25	
Dec	1.19	0.37		0.20	

Yearly

Year	Avg. Q (mgd)
1992	0.27
1997	0.30
1999	N/A
2002	0.26
2003	N/A

PROJECTION SUMMARY

Monthly

Month	Ann Avg Coefficient
Jan	0.97
Feb	0.93
Mar	1.05
Apr	0.92
May	1.12
Jun	1.11
Jul	0.92
Aug	1.04
Sep	1.12
Oct	1.08
Nov	0.96
Dec	0.78

Yearly

Year	Avg. Q (mgd)
2008	0.33
2018	0.46
2028	0.59
2038	0.68
2048	0.79
2058	0.89

Staggered AGR	
2003-2008	4.12%
2008-2018	3.50%
2018-2028	2.50%
2028-2038	1.50%
2038-2048	1.50%
2048-2058	1.20%

Analysis Notes

* This plant services the western half of the county, primarily Lugoff and Elgin.
* Assumed staggered AGRs used in Lugoff-Elgin Water Authority Projections.

OWNER: **New South Inc**

HDR ID	Facility	Type
		Discharge

CONTACT: Bennie Wadford - (803) 424-2811

Proj. By: *Patrick Blandford*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	N/A	N/A	N/A	N/A	N/A
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	N/A
1997	N/A
1999	N/A
2002	N/A
2003	N/A

PROJECTION SUMMARY

AGR
0.0%

Monthly

Month	Ann Avg Coefficient
Jan	
Feb	
Mar	
Apr	
May	
Jun	
Jul	
Aug	
Sep	
Oct	
Nov	
Dec	

Yearly

Year	Avg. Q (mgd)
2008	
2018	
2028	
2038	
2048	
2058	

Analysis Notes

* Lumber mill with a holding pond that discharges during storm events. Intermittent discharge consisting of a flow of 25-100 GPM during the duration of the storm event.

OWNER: **Palmetto Utility Inc**

HDR ID	Facility	Type
	WWTP	Discharge

CONTACT: Stan Jones - (803) 699-2422 (803) 699-2422

Proj. By: *Patrick Blandford*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	N/A	N/A	N/A	N/A	N/A
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	N/A
1997	N/A
1999	N/A
2002	N/A
2003	N/A

PROJECTION SUMMARY

AGR
0.0%

Monthly

Month	Ann Avg Coefficient
Jan	
Feb	
Mar	
Apr	
May	
Jun	
Jul	
Aug	
Sep	
Oct	
Nov	
Dec	

Yearly

Year	Avg. Q (mgd)
2008	0.00
2018	0.00
2028	0.00
2038	0.00
2048	0.00
2058	0.00

Analysis Notes

* This WWTP discharges to groundwater.

OWNER: **South Carolina Army National Guard**

HDR ID	Facility	Type
	McCrady Training Facility	Discharge

CONTACT: Jeff Wachowski - (803) 806-4490

Proj. By: *Patrick Blandford*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	N/A	N/A	N/A	N/A	N/A
Feb					
Mar					
Apr					
May					
Jun					
Jul					
Aug					
Sep					
Oct					
Nov					
Dec					

Yearly

Year	Avg. Q (mgd)
1992	N/A
1997	N/A
1999	N/A
2002	N/A
2003	N/A

PROJECTION SUMMARY

AGR
0.0%

Monthly

Month	Ann Avg Coefficient
Jan	
Feb	
Mar	
Apr	
May	
Jun	
Jul	
Aug	
Sep	
Oct	
Nov	
Dec	

Yearly

Year	Avg. Q (mgd)
2008	
2018	
2028	
2038	
2048	
2058	

Analysis Notes

* Discharge is for a wash rack for military equipment.
* This is primarily a closed system that recycles it water. They discharge very infrequently (maybe a couple times a year) during heavy rain events.

OWNER: **SC Department of Corrections**

HDR ID	Facility	Type
	Wateree River Corrections Institue	Withdrawal
	Wateree River Corrections Institue	Discharge

CONTACT: Dunbar Delk (803) 896-1696 Mark McCown 896-3467
Water/Waste Treatment (803) 432-6191
Proj. By: *Blandford/Mosteller*

HDR ID:
FACILITY: Wateree River Corrections Institue

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2001 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	N/A	N/A	N/A	N/A	N/A	N/A
Feb						
Mar						
Apr						
May						
Jun						
Jul						
Aug						
Sep						
Oct						
Nov						
Dec						

Year	Avg. Q (mgd)
1992	N/A
1997	N/A
1999	N/A
2001	42.77
2002	55.00
2003	142.51

PROJECTION SUMMARY

AGR
0.5%

Monthly

Month	Ann Avg Coefficient
Jan	
Feb	
Mar	
Apr	
May	
Jun	
Jul	
Aug	
Sep	
Oct	
Nov	
Dec	

Yearly

Year	Avg. Q (mgd)
2008	0.00
2018	0.00
2028	0.00
2038	0.00
2048	0.00
2058	0.00

Analysis Notes
* WTP treats groundwater - no surface water withdrawals.

HDR ID:
FACILITY: Wateree River Corrections Institue

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	N/A	0.05	N/A	0.11	N/A
Feb		0.06		0.11	
Mar		0.07		0.11	
Apr		0.08		0.12	
May		0.09		0.12	
Jun		0.10		0.12	
Jul		0.12		0.12	
Aug		0.11		0.12	
Sep		0.11		0.12	
Oct		0.09		0.12	
Nov		0.07		0.12	
Dec		0.06		0.10	

Year	Avg. Q (mgd)
1992	N/A
1997	0.08
1999	N/A
2002	0.12
2003	N/A

PROJECTION SUMMARY

AGR
1.0%

Monthly

Month	Ann Avg Coefficient
Jan	0.96
Feb	0.96
Mar	0.96
Apr	1.01
May	1.04
Jun	1.04
Jul	1.05
Aug	1.03
Sep	1.01
Oct	1.02
Nov	1.02
Dec	1.02

Yearly

Year	Avg. Q (mgd)
2008	0.12
2018	0.13
2028	0.15
2038	0.16
2048	0.18
2058	0.20

Analysis Notes
* Plant has no intentions to grow suddenly, WWTP running at about half-capacity.
* Use 2002 discharge as baseline and a modest AGR of 1%

OWNER: **SC E&G**

HDR ID	Facility	Type
	Wateree Station	Withdrawal
	Wateree Station	Discharge

CONTACT: Gary Williams (803) 217-4021

Proj. By: *Blandford/Mosteller*

HDR ID:
FACILITY: Wateree Station

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)	2004 Avg Q (mgd)
Jan	N/A	N/A	N/A	N/A	N/A	489.20
Feb						484.80
Mar						483.50
Apr						461.20
May						442.40
Jun						486.10
Jul						472.10
Aug						475.60
Sep						489.60
Oct						382.10
Nov						409.60
Dec						489.60

Year	Avg. Q (mgd)
1992	N/A
1997	N/A
1999	N/A
2002	N/A
2003	N/A
2004	463.82

PROJECTION SUMMARY

AGR
1.0%

Monthly

Month	Ann Avg Coefficient
Jan	1.05
Feb	1.05
Mar	1.04
Apr	0.99
May	0.95
Jun	1.05
Jul	1.02
Aug	1.03
Sep	1.06
Oct	0.82
Nov	0.88
Dec	1.06

Yearly

Year	Once-Thru Cooling Avg. Q (mgd)	Cooling Tower Avg. Q (mgd)	Total Avg. Q (mgd)
2008	482.65	20.20	502.85
2018	533.15	22.31	555.46
2028	588.92	24.65	613.57
2038	650.54	27.23	677.77
2048	718.60	30.08	748.67
2058	793.78	33.22	827.00

Analysis Notes
* Plant uses a once-through cooling process and a cooling tower.
* Projections based on 1.0% AGR beginning with the 2004 flow data.

HDR ID:
FACILITY: Wateree Station

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan		376.50	N/A	329.00	N/A
Feb	469.90	369.00		445.75	
Mar	343.50	288.50		536.80	
Apr	217.00	227.40		396.40	
May	367.20	341.50		401.50	
Jun	489.60	375.70		463.70	
Jul	489.60	417.20		484.20	
Aug	471.80	471.60		492.10	
Sep	471.80	462.30		483.90	
Oct	489.60	463.20		387.40	
Nov	391.60	495.00		331.90	
Dec	391.60	499.20			

Year	Avg. Q (mgd)
1992	417.56
1997	398.93
1999	N/A
2002	432.06
2003	N/A

PROJECTION SUMMARY

Consumpitve Use
7.0%

Monthly

Month	Ann Avg Coefficient
Jan	0.76
Feb	1.03
Mar	1.24
Apr	0.92
May	0.93
Jun	1.07
Jul	1.12
Aug	1.14
Sep	1.12
Oct	0.90
Nov	0.77
Dec	0.77

Yearly

Year	Once-Thru Cooling Avg. Q (mgd)	Cooling Tower Avg. Q (mgd)	Total Avg. Q (mgd)
2008	448.86	18.79	467.65
2018	495.83	20.75	516.58
2028	547.70	22.92	570.62
2038	605.00	25.32	630.32
2048	668.30	27.97	696.27
2058	738.22	30.90	769.11

Analysis Notes
* Assume a 7% Consumptive Rate, based on most recent data for withdrawal (2004) and return (2002) flow rates.

OWNER: **United States Air Force**

HDR ID	Facility	Type
	Shaw Base	Discharge

CONTACT: Earl Morrison - (803) 895-5071

Proj. By: *Patrick Blandford*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan		0.70	N/A	0.71	N/A
Feb		0.75		0.72	
Mar		0.71		0.74	
Apr		0.70		0.72	
May		0.77		0.68	
Jun		0.78		0.73	
Jul	0.74	0.74		0.72	
Aug		0.77		0.68	
Sep	0.74	0.67		0.65	
Oct	0.75	0.66		0.65	
Nov	0.84	0.64		0.65	
Dec	0.79	0.64		0.65	

Yearly

Year	Avg. Q (mgd)
1992	0.77
1997	0.71
1999	N/A
2002	0.69
2003	N/A

PROJECTION SUMMARY

AGR
1.0%

Monthly

Month	Ann Avg Coefficient
Jan	1.03
Feb	1.04
Mar	1.07
Apr	1.04
May	0.99
Jun	1.06
Jul	1.03
Aug	0.98
Sep	0.94
Oct	0.94
Nov	0.95
Dec	0.93

Yearly

Year	Avg. Q (mgd)
2008	0.73
2018	0.81
2028	0.90
2038	0.99
2048	1.09
2058	1.21

Analysis Notes

* Base can be subject to closure, but contact thinks it is more likely that they will grow by receiving personnel from closed bases.

* Assumed a 1.0% AGR to project the permit level flow to be reached by 2058.

OWNER: **United States Marine Corps**

HDR ID	Facility	Type
	Vehicle	Discharge

CONTACT: No contact name - (803) 783-0759

Proj. By: *Patrick Blandford*

HISTORICAL DATA SUMMARY

Monthly

Month	1992 Avg Q (mgd)	1997 Avg Q (mgd)	1999 Avg Q (mgd)	2002 Avg Q (mgd)	2003 Avg Q (mgd)
Jan	N/A	0.00	N/A	0.00	N/A
Feb		0.00		0.00	
Mar		0.00		0.00	
Apr		0.00		0.00	
May		0.00		0.00	
Jun		0.00		0.00	
Jul		0.00		0.00	
Aug		0.00		0.00	
Sep		0.00		0.00	
Oct		0.00		0.00	
Nov		0.00		0.00	
Dec		0.00		0.00	

Yearly

Year	Avg. Q (mgd)
1992	0.00
1997	0.00
1999	N/A
2002	0.00
2003	N/A

PROJECTION SUMMARY

AGR
0.0%

Monthly

Month	Ann Avg Coefficient
Jan	
Feb	
Mar	
Apr	
May	
Jun	
Jul	
Aug	
Sep	
Oct	
Nov	
Dec	

Yearly

Year	Avg. Q (mgd)
2008	0.00
2018	0.00
2028	0.00
2038	0.00
2048	0.00
2058	0.00

Analysis Notes

* This discharge is intermittent from a vehicle washdown station.

APPENDIX E

AGRICULTURAL/IRRIGATIONAL WATER WITHDRAWAL DETAIL SHEETS

Agricultural/Irrigation Flow Projections by Reservoir - Summary

HDR ID	County	Sq Mi in Lake Watershed	% of Land Area in Catawba Basin	Total Withdrawals (mgd)								Crop Withdrawals (mgd)							
				2000	2002	2008	2018	2028	2038	2048	2058	2000	2002	2008	2018	2028	2038	2048	2058
LAKE JAMES																			
	Avery	39.6	16.0%	0.53	0.53	0.55	0.58	0.61	0.64	0.67	0.71	0.10	0.10	0.10	0.11	0.11	0.12	0.13	0.13
	Buncombe	1.8	0.3%	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Burke	57.9	11.3%	0.28	0.29	0.30	0.31	0.33	0.36	0.39	0.42	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.06
	McDowell	286.0	64.1%	0.79	0.83	0.96	1.23	1.60	2.09	2.75	3.66	0.18	0.19	0.25	0.36	0.54	0.80	1.18	1.74
	Mitchell	0.1	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Yancey	0.1	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NWJ-12	**Basin Agricultural/Irrigation Demand**			**1.61**	**1.66**	**1.81**	**2.13**	**2.55**	**3.09**	**3.82**	**4.80**	**0.36**	**0.37**	**0.43**	**0.54**	**0.72**	**0.98**	**1.37**	**1.94**
LAKE RHODHISS																			
	Avery	47.7	19.3%	0.64	0.64	0.66	0.70	0.73	0.77	0.81	0.85	0.12	0.12	0.12	0.13	0.14	0.14	0.15	0.16
	Burke	308.9	60.0%	1.51	1.53	1.58	1.67	1.78	1.90	2.05	2.23	0.41	0.41	0.40	0.38	0.36	0.34	0.33	0.31
	Caldwell	245.8	51.8%	1.35	1.38	1.48	1.68	1.92	2.22	2.58	3.02	0.26	0.26	0.25	0.24	0.23	0.21	0.20	0.19
	McDowell	98.2	22.0%	0.27	0.28	0.33	0.42	0.55	0.72	0.95	1.26	0.06	0.07	0.08	0.12	0.18	0.27	0.40	0.60
	Rutherford	0.2	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Watauga	4.0	1.3%	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NWR-6	**Basin Agricultural/Irrigation Demand**			**3.78**	**3.85**	**4.06**	**4.48**	**5.00**	**5.63**	**6.41**	**7.37**	**0.86**	**0.86**	**0.86**	**0.87**	**0.91**	**0.98**	**1.09**	**1.26**
LAKE HICKORY																			
	Alexander	55.3	21.0%	0.42	0.44	0.49	0.60	0.72	0.88	1.07	1.30	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02
	Burke	20.5	4.0%	0.10	0.10	0.10	0.11	0.12	0.13	0.14	0.15	0.03	0.03	0.03	0.03	0.02	0.02	0.02	0.02
	Caldwell	135.8	28.6%	0.74	0.76	0.82	0.93	1.06	1.23	1.43	1.67	0.14	0.14	0.14	0.13	0.12	0.12	0.11	0.11
NWH-3	**Basin Agricultural/Irrigation Demand**			**1.27**	**1.30**	**1.41**	**1.63**	**1.90**	**2.23**	**2.63**	**3.12**	**0.19**	**0.18**	**0.18**	**0.17**	**0.17**	**0.16**	**0.15**	**0.15**
LOOKOUT SHOALS				0.00															
	Alexander	123.0	46.7%	0.93	0.97	1.09	1.32	1.61	1.95	2.37	2.89	0.03	0.03	0.03	0.04	0.04	0.04	0.04	0.04
	Catawba	21.3	5.2%	0.17	0.17	0.18	0.20	0.21	0.23	0.26	0.29	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03
	Iredell	3.4	0.6%	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01
	Wilkes	0.1	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NWL-2	**Basin Agricultural/Irrigation Demand**			**1.13**	**1.17**	**1.30**	**1.55**	**1.85**	**2.22**	**2.67**	**3.22**	**0.06**	**0.06**	**0.06**	**0.06**	**0.07**	**0.07**	**0.08**	**0.08**
LAKE NORMAN																			
	Catawba	169.8	41.1%	1.35	1.37	1.44	1.56	1.70	1.87	2.06	2.28	0.16	0.16	0.17	0.18	0.18	0.19	0.20	0.21
	Iredell	128.3	21.6%	0.89	0.91	0.96	1.05	1.15	1.27	1.41	1.56	0.13	0.14	0.15	0.19	0.23	0.28	0.34	0.41
	Lincoln	21.3	6.9%	0.10	0.10	0.11	0.14	0.17	0.20	0.25	0.30	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.05
	Mecklenburg	24.5	4.5%	0.38	0.38	0.39	0.40	0.41	0.43	0.45	0.47	0.04	0.04	0.03	0.03	0.03	0.02	0.02	0.02
NWN-8	**Basin Agricultural/Irrigation Demand**			**2.71**	**2.75**	**2.89**	**3.15**	**3.44**	**3.77**	**4.16**	**4.60**	**0.34**	**0.35**	**0.37**	**0.41**	**0.46**	**0.52**	**0.60**	**0.69**

Agricultural/Irrigation Flow Projections by Reservoir - Summary

HDR ID	County	Sq Mi in Lake Watershed	% of Land Area in Catawba Basin	Total Withdrawals (mgd)								Crop Withdrawals (mgd)							
				2000	2002	2008	2018	2028	2038	2048	2058	2000	2002	2008	2018	2028	2038	2048	2058
MOUNTAIN ISLAND LAKE																			
	Gaston	12.1	3.3%	0.09	0.09	0.10	0.10	0.11	0.12	0.13	0.14	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02
	Lincoln	9.4	3.1%	0.04	0.04	0.05	0.06	0.07	0.09	0.10	0.13	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
	Mecklenburg	38.3	7.0%	0.59	0.59	0.60	0.62	0.65	0.67	0.70	0.73	0.06	0.06	0.05	0.05	0.04	0.03	0.03	0.03
NWM-5	**Basin Agricultural/Irrigation Demand**			**0.72**	**0.73**	**0.75**	**0.79**	**0.83**	**0.88**	**0.94**	**1.00**	**0.08**	**0.08**	**0.07**	**0.07**	**0.07**	**0.06**	**0.06**	**0.07**
LAKE WYLIE																			
	Burke	127.1	24.7%	0.62	0.63	0.65	0.69	0.73	0.78	0.85	0.92	0.17	0.17	0.16	0.16	0.15	0.14	0.13	0.13
	Catawba	198.1	47.9%	1.57	1.60	1.68	1.82	1.99	2.18	2.40	2.66	0.19	0.19	0.19	0.20	0.21	0.23	0.24	0.25
	Cleveland	3.1	0.7%	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Gaston	340.4	93.6%	2.56	2.60	2.72	2.93	3.16	3.43	3.73	4.06	0.29	0.30	0.31	0.35	0.38	0.42	0.47	0.52
	Lincoln	255.7	83.3%	1.16	1.21	1.36	1.65	2.00	2.43	2.96	3.59	0.20	0.21	0.23	0.28	0.33	0.39	0.47	0.56
	Mecklenburg	101.4	18.5%	1.56	1.57	1.60	1.65	1.71	1.78	1.85	1.93	0.16	0.15	0.14	0.12	0.11	0.09	0.08	0.07
	York	136.8	19.7%	0.44	0.45	0.48	0.55	0.62	0.71	0.82	0.95	0.20	0.20	0.23	0.28	0.34	0.42	0.51	0.62
SWY-5	**Basin Agricultural/Irrigation Demand**			**7.94**	**8.08**	**8.50**	**9.31**	**10.25**	**11.34**	**12.62**	**14.13**	**1.20**	**1.22**	**1.28**	**1.39**	**1.53**	**1.69**	**1.90**	**2.15**
FISHING CREEK LAKE																			
	Mecklenburg	243.5	44.3%	3.74	0.44	3.83	3.96	4.11	4.27	4.44	4.63	0.38	0.37	0.34	0.29	0.25	0.22	0.19	0.17
	Union	162.4	25.4%	2.50	2.52	2.59	2.70	2.82	2.94	3.08	3.22	0.08	0.08	0.08	0.09	0.10	0.11	0.12	0.14
	Chester	23.7	4.0%	0.04	0.04	0.04	0.05	0.05	0.05	0.05	0.06	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02
	Lancaster	239.3	43.1%	1.05	1.06	1.12	1.21	1.31	1.42	1.55	1.68	0.41	0.41	0.43	0.45	0.47	0.49	0.52	0.55
	York	120.3	17.3%	0.39	0.40	0.43	0.48	0.55	0.63	0.72	0.83	0.17	0.18	0.20	0.25	0.30	0.37	0.45	0.55
SWF-8	**Basin Agricultural/irrigation Demand**			**7.72**	**4.47**	**8.01**	**8.40**	**8.84**	**9.32**	**9.84**	**10.42**	**1.05**	**1.05**	**1.06**	**1.09**	**1.14**	**1.21**	**1.30**	**1.41**
GREAT FALLS LAKE																			
	Chester	111.1	18.9%	0.20	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.08
	York	177.9	25.6%	0.57	0.59	0.63	0.71	0.81	0.93	1.07	1.23	0.26	0.27	0.30	0.37	0.45	0.54	0.66	0.81
SWG-1	**Basin Agricultural/irrigation Demand**			**0.77**	**0.79**	**0.84**	**0.93**	**1.04**	**1.17**	**1.32**	**1.49**	**0.31**	**0.33**	**0.36**	**0.43**	**0.51**	**0.61**	**0.74**	**0.89**
ROCKY CREEK LAKE																			
	Chester	196.4	33.5%	0.35	0.35	0.36	0.38	0.40	0.42	0.44	0.47	0.10	0.10	0.11	0.11	0.12	0.13	0.13	0.14
	Fairfield	13.0	1.8%	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.07	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.06
	Lancaster	44.6	8.0%	0.19	0.20	0.21	0.23	0.24	0.27	0.29	0.31	0.08	0.08	0.08	0.08	0.09	0.09	0.10	0.10
SWC-1	**Basin Agricultural/irrigation Demand**			**0.59**	**0.60**	**0.62**	**0.66**	**0.70**	**0.75**	**0.80**	**0.85**	**0.23**	**0.23**	**0.23**	**0.25**	**0.26**	**0.27**	**0.29**	**0.30**
LAKE WATEREE																			
	Fairfield	226.9	32.0%	0.87	0.88	0.91	0.96	1.01	1.07	1.13	1.19	0.79	0.79	0.82	0.86	0.90	0.95	1.00	1.05
	Kershaw	85.1	11.5%	0.08	0.08	0.09	0.10	0.11	0.13	0.14	0.16	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.07
	Lancaster	72.9	13.1%	0.32	0.32	0.34	0.37	0.40	0.43	0.47	0.51	0.12	0.13	0.13	0.14	0.14	0.15	0.16	0.17
SWW-4	**Basin Agricultural/irrigation Demand**			**1.27**	**1.29**	**1.34**	**1.43**	**1.52**	**1.63**	**1.75**	**1.87**	**0.93**	**0.94**	**0.98**	**1.03**	**1.09**	**1.15**	**1.22**	**1.29**

Agricultural/Irrigation Flow Projections by Reservoir - Summary

HDR ID	County	Sq Mi in Lake Watershed	% of Land Area in Catawba Basin	Livestock Withdrawals (mgd)								Golf Course Withdrawals (mgd)							
				2000	2002	2008	2018	2028	2038	2048	2058	2000	2002	2008	2018	2028	2038	2048	2058
LAKE JAMES																			
	Avery	39.6	16.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.43	0.43	0.44	0.47	0.49	0.52	0.54	0.57
	Buncombe	1.8	0.3%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Burke	57.9	11.3%	0.06	0.07	0.07	0.09	0.10	0.12	0.14	0.17	0.14	0.14	0.15	0.16	0.16	0.17	0.18	0.19
	McDowell	286.0	64.1%	0.16	0.17	0.19	0.23	0.28	0.34	0.41	0.51	0.45	0.47	0.53	0.64	0.78	0.95	1.16	1.41
	Mitchell	0.1	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Yancey	0.1	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NWJ-12	**Basin Agricultural/Irrigation Demand**			**0.23**	**0.24**	**0.27**	**0.32**	**0.39**	**0.47**	**0.56**	**0.68**	**1.02**	**1.05**	**1.12**	**1.27**	**1.44**	**1.65**	**1.89**	**2.18**
LAKE RHODHISS																			
	Avery	47.7	19.3%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.51	0.52	0.53	0.56	0.59	0.62	0.65	0.69
	Burke	308.9	60.0%	0.34	0.35	0.39	0.46	0.55	0.65	0.77	0.91	0.76	0.76	0.79	0.83	0.87	0.91	0.96	1.01
	Caldwell	245.8	51.8%	0.33	0.34	0.35	0.36	0.38	0.40	0.42	0.44	0.76	0.79	0.89	1.08	1.32	1.61	1.96	2.39
	McDowell	98.2	22.0%	0.06	0.06	0.06	0.08	0.10	0.12	0.14	0.17	0.15	0.16	0.18	0.22	0.27	0.33	0.40	0.49
	Rutherford	0.2	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Watauga	4.0	1.3%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
NWR-6	**Basin Agricultural/Irrigation Demand**			**0.73**	**0.75**	**0.81**	**0.91**	**1.03**	**1.17**	**1.34**	**1.53**	**2.19**	**2.24**	**2.40**	**2.70**	**3.06**	**3.48**	**3.98**	**4.58**
LAKE HICKORY																			
	Alexander	55.3	21.0%	0.35	0.36	0.41	0.50	0.61	0.74	0.90	1.10	0.06	0.06	0.07	0.08	0.10	0.12	0.15	0.18
	Burke	20.5	4.0%	0.02	0.02	0.03	0.03	0.04	0.04	0.05	0.06	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.07
	Caldwell	135.8	28.6%	0.18	0.19	0.19	0.20	0.21	0.22	0.23	0.24	0.42	0.44	0.49	0.60	0.73	0.89	1.08	1.32
NWH-3	**Basin Agricultural/Irrigation Demand**			**0.55**	**0.57**	**0.63**	**0.73**	**0.85**	**1.01**	**1.19**	**1.41**	**0.53**	**0.54**	**0.61**	**0.73**	**0.88**	**1.07**	**1.29**	**1.56**
LOOKOUT SHOALS																			
	Alexander	123.0	46.7%	0.78	0.81	0.91	1.11	1.35	1.65	2.01	2.45	0.13	0.13	0.15	0.18	0.22	0.27	0.33	0.40
	Catawba	21.3	5.2%	0.03	0.03	0.04	0.05	0.06	0.07	0.09	0.10	0.12	0.12	0.12	0.13	0.13	0.14	0.15	0.15
	Iredell	3.4	0.6%	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02
	Wilkes	0.1	0.0%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NWL-2	**Basin Agricultural/Irrigation Demand**			**0.82**	**0.85**	**0.96**	**1.17**	**1.42**	**1.73**	**2.11**	**2.57**	**0.25**	**0.26**	**0.28**	**0.32**	**0.37**	**0.42**	**0.49**	**0.57**
LAKE NORMAN																			
	Catawba	169.8	41.1%	0.26	0.27	0.31	0.38	0.46	0.56	0.68	0.83	0.92	0.93	0.96	1.01	1.06	1.12	1.17	1.23
	Iredell	128.3	21.6%	0.30	0.31	0.33	0.36	0.40	0.44	0.49	0.54	0.46	0.46	0.48	0.50	0.53	0.55	0.58	0.61
	Lincoln	21.3	6.9%	0.04	0.04	0.05	0.06	0.07	0.09	0.11	0.14	0.04	0.04	0.04	0.05	0.06	0.08	0.10	0.12
	Mecklenburg	24.5	4.5%	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.33	0.33	0.34	0.36	0.38	0.40	0.42	0.44
NWN-8	**Basin Agricultural/Irrigation Demand**			**0.62**	**0.63**	**0.69**	**0.81**	**0.94**	**1.10**	**1.29**	**1.51**	**1.75**	**1.77**	**1.83**	**1.93**	**2.03**	**2.15**	**2.27**	**2.40**

Agricultural/Irrigation Flow Projections by Reservoir - Summary

HDR ID	County	Sq Mi in Lake Watershed	% of Land Area in Catawba Basin	Livestock Withdrawals (mgd)								Golf Course Withdrawals (mgd)							
				2000	2002	2008	2018	2028	2038	2048	2058	2000	2002	2008	2018	2028	2038	2048	2058
MOUNTAIN ISLAND LAKE																			
	Gaston	12.1	3.3%	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.09
	Lincoln	9.4	3.1%	0.02	0.02	0.02	0.03	0.03	0.04	0.05	0.06	0.02	0.02	0.02	0.02	0.03	0.03	0.04	0.05
	Mecklenburg	38.3	7.0%	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.52	0.52	0.54	0.57	0.59	0.63	0.66	0.69
NWM-5	**Basin Agricultural/Irrigation Demand**			**0.04**	**0.04**	**0.05**	**0.05**	**0.06**	**0.07**	**0.09**	**0.10**	**0.60**	**0.61**	**0.63**	**0.66**	**0.70**	**0.74**	**0.79**	**0.83**
LAKE WYLIE																			
	Burke	127.1	24.7%	0.14	0.15	0.16	0.19	0.23	0.27	0.32	0.37	0.31	0.31	0.32	0.34	0.36	0.38	0.40	0.42
	Catawba	198.1	47.9%	0.31	0.32	0.36	0.44	0.53	0.65	0.79	0.97	1.08	1.09	1.12	1.18	1.24	1.30	1.37	1.44
	Cleveland	3.1	0.7%	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
	Gaston	340.4	93.6%	0.28	0.29	0.33	0.40	0.49	0.60	0.73	0.89	1.99	2.01	2.07	2.18	2.29	2.41	2.53	2.66
	Lincoln	255.7	83.3%	0.52	0.54	0.61	0.74	0.90	1.10	1.34	1.63	0.44	0.46	0.52	0.64	0.77	0.94	1.15	1.40
	Mecklenburg	101.4	18.5%	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	1.37	1.38	1.43	1.50	1.57	1.66	1.74	1.83
	York	136.8	19.7%	0.07	0.07	0.07	0.08	0.08	0.09	0.09	0.09	0.17	0.18	0.18	0.19	0.20	0.21	0.22	0.23
SWY-5	**Basin Agricultural/Irrigation Demand**			**1.35**	**1.40**	**1.57**	**1.88**	**2.27**	**2.73**	**3.30**	**3.99**	**5.39**	**5.45**	**5.66**	**6.04**	**6.45**	**6.91**	**7.42**	**8.00**
FISHING CREEK LAKE																			
	Mecklenburg	243.5	44.3%	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	3.29	0.00	3.42	3.60	3.78	3.97	4.18	4.39
	Union	162.4	25.4%	2.10	2.11	2.15	2.21	2.28	2.35	2.42	2.50	0.33	0.34	0.36	0.39	0.44	0.48	0.53	0.59
	Chester	23.7	4.0%	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.03
	Lancaster	239.3	43.1%	0.08	0.08	0.08	0.09	0.10	0.11	0.12	0.14	0.56	0.57	0.61	0.67	0.74	0.82	0.90	1.00
	York	120.3	17.3%	0.06	0.06	0.06	0.07	0.07	0.08	0.08	0.08	0.15	0.15	0.16	0.17	0.18	0.18	0.19	0.20
SWF-8	**Basin Agricultural/irrigation Demand**			**2.32**	**2.33**	**2.38**	**2.46**	**2.54**	**2.62**	**2.71**	**2.80**	**4.36**	**1.09**	**4.57**	**4.86**	**5.16**	**5.49**	**5.84**	**6.21**
GREAT FALLS LAKE																			
	Chester	111.1	18.9%	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.11	0.11	0.12	0.12	0.13	0.14	0.14	0.15
	York	177.9	25.6%	0.09	0.09	0.10	0.10	0.11	0.11	0.12	0.12	0.23	0.23	0.23	0.25	0.26	0.27	0.29	0.30
SWG-1	**Basin Agricultural/irrigation Demand**			**0.11**	**0.12**	**0.12**	**0.13**	**0.13**	**0.14**	**0.15**	**0.16**	**0.34**	**0.34**	**0.35**	**0.37**	**0.39**	**0.41**	**0.43**	**0.45**
ROCKY CREEK LAKE																			
	Chester	196.4	33.5%	0.04	0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.20	0.20	0.21	0.22	0.23	0.24	0.26	0.27
	Fairfield	13.0	1.8%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01
	Lancaster	44.6	8.0%	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.03	0.10	0.11	0.11	0.12	0.14	0.15	0.17	0.19
SWC-1	**Basin Agricultural/irrigation Demand**			**0.06**	**0.06**	**0.06**	**0.07**	**0.07**	**0.08**	**0.08**	**0.09**	**0.31**	**0.31**	**0.33**	**0.35**	**0.37**	**0.40**	**0.43**	**0.46**
LAKE WATEREE																			
	Fairfield	226.9	32.0%	0.02	0.02	0.02	0.03	0.03	0.03	0.03	0.03	0.06	0.07	0.07	0.08	0.08	0.09	0.10	0.11
	Kershaw	85.1	11.5%	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07
	Lancaster	72.9	13.1%	0.02	0.02	0.03	0.03	0.03	0.03	0.04	0.04	0.17	0.17	0.18	0.20	0.23	0.25	0.28	0.30
SWW-4	**Basin Agricultural/irrigation Demand**			**0.06**	**0.06**	**0.06**	**0.07**	**0.07**	**0.08**	**0.08**	**0.09**	**0.28**	**0.28**	**0.30**	**0.33**	**0.37**	**0.40**	**0.45**	**0.49**

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *ALEXANDER*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	263	-
In Lake Hickory Watershed	55	21.0%
In Lookout Shoals Watershed	123	46.7%
Total in Catawba River Basin	178	68%

Livestock

Year	Demand (mgd)
1985	0.38
1990	0.79
1995	2.23
2000	1.66

**Data from USGS*

AGR *(referenced from 2000)*	
15 Yr	10.3%
10 Yr	7.7%
5 Yr	-5.7%
Assigned	2.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)		Pct of Total Irrigation *(golf courses and crops only)*	Pct from Surface Water
	Ground	Surface		
Golf Courses	0.03	0.27	81%	90%
Crops	0.00	0.07	19%	100%

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.16	0.12	0.03
1990	0.15	0.11	0.03
1995	0.40	0.29	0.08
2000	0.37	0.27	0.07

**Golf course and crop irrigation data from USGS*
**"Total" column includes ground and surface waters*
**"Golf Courses" and "Crops" columns include surface water only*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	5.7%	5.7%
10 Yr	9.4%	9.4%
5 Yr	-1.5%	-1.5%
Assigned	2.0%	0.5%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock			Golf Courses			Crops		
	Total	Hickory	L. Shoals	Total	Hickory	L. Shoals	Total	Hickory	L. Shoals
2000	1.66	0.35	0.78	0.27	0.06	0.13	0.07	0.01	0.03
2002	1.73	0.36	0.81	0.28	0.06	0.13	0.07	0.01	0.03
2008	1.94	0.41	0.91	0.32	0.07	0.15	0.07	0.02	0.03
2018	2.37	0.50	1.11	0.39	0.08	0.18	0.08	0.02	0.04
2028	2.89	0.61	1.35	0.47	0.10	0.22	0.08	0.02	0.04
2038	3.52	0.74	1.65	0.57	0.12	0.27	0.08	0.02	0.04
2048	4.29	0.90	2.01	0.70	0.15	0.33	0.09	0.02	0.04
2058	5.24	1.10	2.45	0.85	0.18	0.40	0.09	0.02	0.04

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *AVERY*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	247	-
In Lake James Watershed	40	16.0%
In Lake Rhodhiss Watershed	48	19.3%
Total in Catawba River Basin	87	35%

Livestock

Year	Demand (mgd)
1985	0.05
1990	3.04
1995	3.06
2000	0.02

**Data from USGS*

AGR *(referenced from 2000)*	
15 Yr	-5.9%
10 Yr	-39.5%
5 Yr	-63.4%
Assigned	0.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)		Pct of Total Irrigation *(golf courses and crops only)*	Pct from Surface Water
	Ground	Surface		
Golf Courses	0.00	2.66	80%	100%
Crops	0.03	0.62	20%	95%

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.00	0.00	0.00
1990	1.43	1.15	0.27
1995	3.65	2.93	0.68
2000	3.31	2.66	0.62

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	-	-
10 Yr	8.8%	8.8%
5 Yr	-1.9%	-1.9%
Assigned	0.5%	0.5%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock			Golf Courses			Crops		
	Total	James	Rhodhiss	Total	James	Rhodhiss	Total	James	Rhodhiss
2000	0.02	0.00	0.00	2.66	0.43	0.51	0.62	0.10	0.12
2002	0.02	0.00	0.00	2.69	0.43	0.52	0.63	0.10	0.12
2008	0.02	0.00	0.00	2.77	0.44	0.53	0.65	0.10	0.12
2018	0.02	0.00	0.00	2.91	0.47	0.56	0.68	0.11	0.13
2028	0.02	0.00	0.00	3.06	0.49	0.59	0.71	0.11	0.14
2038	0.02	0.00	0.00	3.22	0.52	0.62	0.75	0.12	0.14
2048	0.02	0.00	0.00	3.38	0.54	0.65	0.79	0.13	0.15
2058	0.02	0.00	0.00	3.55	0.57	0.69	0.83	0.13	0.16

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *BUNCOMBE*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	660	-
In Lake James Watershed	2	0.3%
Total in Catawba River Basin	2	0%

Livestock

Year	Demand (mgd)
1985	0.60
1990	0.91
1995	1.17
2000	0.34

**Data from USGS*

AGR (referenced from 2000)	
15 Yr	-3.7%
10 Yr	-9.4%
5 Yr	-21.9%
Assigned	0.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)		Pct of Total Irrigation (golf courses and crops only)	Pct from Surface Water
	Ground	Surface		
Golf Courses	0.00	2.36	81%	100%
Crops	0.03	0.51	19%	94%

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.09	0.07	0.02
1990	0.54	0.44	0.09
1995	2.18	1.77	0.38
2000	2.90	2.36	0.51

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	26.1%	26.1%
10 Yr	18.3%	18.3%
5 Yr	5.9%	5.9%
Assigned	0.0%	0.5%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock		Golf Courses		Crops	
	Total	James	Total	James	Total	James
2000	0.34	0.00	2.36	0.01	0.51	0.00
2002	0.34	0.00	2.36	0.01	0.52	0.00
2008	0.34	0.00	2.36	0.01	0.53	0.00
2018	0.34	0.00	2.36	0.01	0.56	0.00
2028	0.34	0.00	2.36	0.01	0.59	0.00
2038	0.34	0.00	2.36	0.01	0.62	0.00
2048	0.34	0.00	2.36	0.01	0.65	0.00
2058	0.34	0.00	2.36	0.01	0.68	0.00

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *BURKE*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	515	-
In Lake James Watershed	58	11.3%
in Lake Rhodhiss Watershed	309	60.0%
in Lake Hickory Watershed	20	4.0%
in Lake Wylie Watershed	127	24.7%
Total in Catawba River Basin	387	75%

Livestock

Year	Demand (mgd)
1985	0.26
1990	1.92
1995	0.43
2000	0.57

**Data from USGS*

AGR (referenced from 2000)	
15 Yr	5.4%
10 Yr	-11.4%
5 Yr	5.8%
Assigned	1.7%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)		Pct of Total Irrigation *(golf courses and crops only)*	Pct from Surface Water
	Ground	Surface		
Golf Courses	0.07	1.26	65%	95%
Crops	0.03	0.69	35%	96%

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.01	0.01	0.00
1990	0.78	0.48	0.26
1995	2.68	1.65	0.90
2000	2.05	1.26	0.69

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	42.6%	-
10 Yr	10.1%	10.1%
5 Yr	-5.2%	-5.2%
Assigned	0.5%	-0.5%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock					Golf Courses					Crops				
	Total	James	Rhodhiss	Hickory	Wylie	Total	James	Rhodhiss	Hickory	Wylie	Total	James	Rhodhiss	Hickory	Wylie
2000	0.57	0.06	0.34	0.02	0.14	1.26	0.14	0.76	0.05	0.31	0.69	0.08	0.41	0.03	0.17
2002	0.59	0.07	0.35	0.02	0.15	1.27	0.14	0.76	0.05	0.31	0.68	0.08	0.41	0.03	0.17
2008	0.65	0.07	0.39	0.03	0.16	1.31	0.15	0.79	0.05	0.32	0.66	0.07	0.40	0.03	0.16
2018	0.77	0.09	0.46	0.03	0.19	1.38	0.16	0.83	0.05	0.34	0.63	0.07	0.38	0.03	0.16
2028	0.91	0.10	0.55	0.04	0.23	1.45	0.16	0.87	0.06	0.36	0.60	0.07	0.36	0.02	0.15
2038	1.08	0.12	0.65	0.04	0.27	1.52	0.17	0.91	0.06	0.38	0.57	0.06	0.34	0.02	0.14
2048	1.28	0.14	0.77	0.05	0.32	1.60	0.18	0.96	0.06	0.40	0.54	0.06	0.33	0.02	0.13
2058	1.52	0.17	0.91	0.06	0.37	1.68	0.19	1.01	0.07	0.42	0.52	0.06	0.31	0.02	0.13

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *CALDWELL*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	474	-
In Lake Rhodhiss Watershed	246	51.8%
In Lake Hickory Watershed	136	28.6%
Total in Catawba River Basin	382	80%

Livestock

Year	Demand (mgd)
1985	0.20
1990	0.69
1995	0.65
2000	0.39

**Data from USGS*

AGR *(referenced from 2000)*	
15 Yr	4.6%
10 Yr	-5.5%
5 Yr	-9.7%
Assigned	0.5%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)		Pct of Total Irrigation *(golf courses and crops only)*	Pct from Surface Water
	Ground	Surface		
Golf Courses	0.16	1.46	75%	90%
Crops	0.05	0.50	25%	91%

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.13	0.09	0.03
1990	0.48	0.32	0.11
1995	3.38	2.27	0.78
2000	2.17	1.46	0.50

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	20.6%	20.6%
10 Yr	16.3%	16.3%
5 Yr	-8.5%	-8.5%
Assigned	2.0%	-0.5%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock			Golf Courses			Crops		
	Total	Rhodhiss	Hickory	Total	Rhodhiss	Hickory	Total	Rhodhiss	Hickory
2000	0.39	0.20	0.11	1.46	0.76	0.42	0.50	0.26	0.14
2002	0.39	0.20	0.11	1.52	0.79	0.44	0.50	0.26	0.14
2008	0.41	0.21	0.12	1.71	0.89	0.49	0.48	0.25	0.14
2018	0.43	0.22	0.12	2.09	1.08	0.60	0.46	0.24	0.13
2028	0.45	0.23	0.13	2.54	1.32	0.73	0.43	0.23	0.12
2038	0.47	0.24	0.14	3.10	1.61	0.89	0.41	0.21	0.12
2048	0.50	0.26	0.14	3.78	1.96	1.08	0.39	0.20	0.11
2058	0.52	0.27	0.15	4.60	2.39	1.32	0.37	0.19	0.11

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *CATAWBA*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	413	-
In Lookout Shoals Lake Watershed	21	5.2%
In Lake Norman Watershed	170	41.1%
In Lake Wylie Watershed	198	47.9%
Total in Catawba River Basin	389	94%

Livestock

Year	Demand (mgd)
1985	0.31
1990	0.39
1995	0.55
2000	0.64

**Data from USGS*

AGR *(referenced from 2000)*	
15 Yr	5.0%
10 Yr	5.1%
5 Yr	3.1%
Assigned	2.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)		Pct of Total Irrigation *(golf courses and crops)*	Pct from Surface Water
	Ground	Surface		
Golf Courses	0.56	2.25	85%	80%
Crops	0.10	0.39	15%	80%

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.09	0.06	0.01
1990	0.17	0.12	0.02
1995	3.54	2.41	0.42
2000	3.30	2.25	0.39

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	27.1%	27.1%
10 Yr	34.5%	34.5%
5 Yr	-1.4%	-1.4%
Assigned	0.5%	0.5%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock				Golf Courses				Crops			
	Total	Lookout S.	Norman	Wylie	Total	Lookout S.	Norman	Wylie	Total	Lookout S.	Norman	Wylie
2000	0.64	0.03	0.26	0.31	2.25	0.12	0.92	1.08	0.39	0.02	0.16	0.19
2002	0.67	0.03	0.27	0.32	2.27	0.12	0.93	1.09	0.39	0.02	0.16	0.19
2008	0.75	0.04	0.31	0.36	2.34	0.12	0.96	1.12	0.41	0.02	0.17	0.19
2018	0.91	0.05	0.38	0.44	2.46	0.13	1.01	1.18	0.43	0.02	0.18	0.20
2028	1.11	0.06	0.46	0.53	2.59	0.13	1.06	1.24	0.45	0.02	0.18	0.21
2038	1.36	0.07	0.56	0.65	2.72	0.14	1.12	1.30	0.47	0.02	0.19	0.23
2048	1.66	0.09	0.68	0.79	2.86	0.15	1.17	1.37	0.50	0.03	0.20	0.24
2058	2.02	0.10	0.83	0.97	3.00	0.15	1.23	1.44	0.52	0.03	0.21	0.25

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *CHESTER*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	586	-
In Fishing Creek Reservoir Watershe	24	4.0%
In Great Falls Reservoir Watershed	111	18.9%
In Rocky Creek Reservoir Watershe	196	33.5%
Total in Catawba River Basin	331	57%

Livestock

Year	Demand (mgd)
1985	0.13
1990	0.13
1995	0.13
2000	NA

**Data from USGS*

AGR *(referenced from 2000)*	
15 Yr	NA
10 Yr	NA
5 Yr	NA
Assigned	0.5%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)	Pct of Total Irrigation *(golf courses and crops only)*
Golf Courses	0.60	66%
Crops	0.31	34%

**Data from 2000 South Carolina Water Plan*

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.00	0.00	0.00
1990	0.00	0.00	0.00
1995	0.00	0.00	0.00
2000	0.91	0.60	0.31

**Data from USGS*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	-	-
10 Yr	-	-
5 Yr	-	-
Assigned	0.5%	0.5%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock				Golf Courses				Crops			
	Total	Fish. Crk.	Great Falls	Rocky Crk	Total	Fish. Crk.	Great Falls	Rocky Crk	Total	Fish. Crk.	Great Falls	Rocky Crk
2000	0.13	0.01	0.03	0.04	0.60	0.02	0.11	0.20	0.31	0.01	0.06	0.10
2002	0.13	0.01	0.03	0.05	0.61	0.02	0.11	0.20	0.31	0.01	0.06	0.10
2008	0.14	0.01	0.03	0.05	0.62	0.03	0.12	0.21	0.32	0.01	0.06	0.11
2018	0.15	0.01	0.03	0.05	0.66	0.03	0.12	0.22	0.34	0.01	0.06	0.11
2028	0.15	0.01	0.03	0.05	0.69	0.03	0.13	0.23	0.36	0.01	0.07	0.12
2038	0.16	0.01	0.03	0.05	0.73	0.03	0.14	0.24	0.37	0.02	0.07	0.13
2048	0.17	0.01	0.03	0.06	0.76	0.03	0.14	0.26	0.39	0.02	0.07	0.13
2058	0.18	0.01	0.03	0.06	0.80	0.03	0.15	0.27	0.41	0.02	0.08	0.14

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *CLEVELAND*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	468	-
In Lake Wylie Watershed	3	0.7%
Total in Catawba River Basin	3	1%

Livestock

Year	Demand (mgd)
1985	0.60
1990	0.54
1995	1.06
2000	0.93

**Data from USGS*

AGR (referenced from 2000)	
15 Yr	3.0%
10 Yr	5.6%
5 Yr	-2.6%
Assigned	0.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)		Pct of Total Irrigation (golf courses and crops only)	Pct from Surface Water
	Ground	Surface		
Golf Courses	0.25	2.26	88%	90%
Crops	0.04	0.30	12%	88%

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.43	0.34	0.05
1990	0.88	0.70	0.09
1995	2.41	1.91	0.25
2000	2.85	2.26	0.30

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	13.4%	13.4%
10 Yr	12.5%	12.5%
5 Yr	3.4%	3.4%
Assigned	0.0%	-1.6%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock		Golf Courses		Crops	
	Total	Wylie	Total	Wylie	Total	Wylie
2000	0.93	0.01	2.26	0.01	0.30	0.00
2002	0.93	0.01	2.26	0.01	0.29	0.00
2008	0.93	0.01	2.26	0.01	0.26	0.00
2018	0.93	0.01	2.26	0.01	0.23	0.00
2028	0.93	0.01	2.26	0.01	0.19	0.00
2038	0.93	0.01	2.26	0.01	0.17	0.00
2048	0.93	0.01	2.26	0.01	0.14	0.00
2058	0.93	0.01	2.26	0.01	0.12	0.00

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *FAIRFIELD*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	710	-
In Rocky Creek Reservoir Watershec	13	1.8%
In Lake Wateree Watershed	227	32.0%
Total in Catawba River Basin	240	34%

Livestock

Year	Demand (mgd)
1985	0.06
1990	0.07
1995	0.07
2000	NA

**Data from USGS*

AGR *(referenced from 2000)*	
15 Yr	NA
10 Yr	NA
5 Yr	NA
Assigned	0.5%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)	Pct of Total Irrigation *(golf courses*
Golf Courses	0.20	8%
Crops	2.46	92%

**Data from 2000 South Carolina Water Plan*

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.00	0.00	0.00
1990	0.00	0.00	0.00
1995	0.00	0.00	0.00
2000	2.66	0.20	2.46

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	-	-
10 Yr	-	-
5 Yr	-	-
Assigned	1.0%	0.5%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock			Golf Courses			Crops		
	Total	Rocky Crk	Wateree	Total	Rocky Crk	Wateree	Total	Rocky Crk	Wateree
2000	0.07	0.00	0.02	0.20	0.00	0.06	2.46	0.05	0.79
2002	0.07	0.00	0.02	0.20	0.00	0.07	2.48	0.05	0.79
2008	0.07	0.00	0.02	0.22	0.00	0.07	2.56	0.05	0.82
2018	0.08	0.00	0.03	0.24	0.00	0.08	2.69	0.05	0.86
2028	0.08	0.00	0.03	0.26	0.00	0.08	2.83	0.05	0.90
2038	0.09	0.00	0.03	0.29	0.01	0.09	2.97	0.05	0.95
2048	0.09	0.00	0.03	0.32	0.01	0.10	3.13	0.06	1.00
2058	0.10	0.00	0.03	0.36	0.01	0.11	3.29	0.06	1.05

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *GASTON*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	364	-
In Mountain Island Lake Watershed	12	3.3%
In Lake Wylie Watershed	340	93.6%
Total in Catawba River Basin	352	97%

Livestock

Year	Demand (mgd)
1985	0.25
1990	0.20
1995	0.25
2000	0.30

**Data from USGS*

AGR *(referenced from 2000)*	
15 Yr	1.2%
10 Yr	4.1%
5 Yr	3.7%
Assigned	2.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)		Pct of Total Irrigation *(golf courses and crops only)*	Pct from Surface Water
	Ground	Surface		
Golf Courses	0.38	2.13	88%	85%
Crops	0.04	0.31	12%	89%

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.04	0.03	0.00
1990	0.34	0.25	0.04
1995	2.26	1.68	0.24
2000	2.86	2.13	0.31

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	32.9%	-
10 Yr	23.7%	23.7%
5 Yr	4.8%	4.8%
Assigned	0.5%	1.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock			Golf Courses			Crops		
	Total	Mtn. Islnd.	Wylie	Total	Mtn. Islnd.	Wylie	Total	Mtn. Islnd.	Wylie
2000	0.30	0.01	0.28	2.13	0.07	1.99	0.31	0.01	0.29
2002	0.31	0.01	0.29	2.15	0.07	2.01	0.32	0.01	0.30
2008	0.35	0.01	0.33	2.22	0.07	2.07	0.34	0.01	0.31
2018	0.43	0.01	0.40	2.33	0.08	2.18	0.37	0.01	0.35
2028	0.52	0.02	0.49	2.45	0.08	2.29	0.41	0.01	0.38
2038	0.64	0.02	0.60	2.57	0.09	2.41	0.45	0.02	0.42
2048	0.78	0.03	0.73	2.71	0.09	2.53	0.50	0.02	0.47
2058	0.95	0.03	0.89	2.84	0.09	2.66	0.55	0.02	0.52

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *IREDELL*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	593	-
In Lookout Shoals Lake Watershed	3	0.6%
In Lake Norman Watershed	128	21.6%
Total in Catawba River Basin	132	22%

Livestock

Year	Demand (mgd)
1985	1.03
1990	1.15
1995	1.62
2000	1.40

**Data from USGS*

AGR *(referenced from 2000)*	
15 Yr	2.1%
10 Yr	2.0%
5 Yr	-2.9%
Assigned	1.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)		Pct of Total Irrigation *(golf courses and crops only)*	Pct from Surface Water
	Ground	Surface		
Golf Courses	0.24	2.12	78%	90%
Crops	0.07	0.60	22%	90%

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.78	0.55	0.15
1990	0.54	0.38	0.11
1995	2.42	1.69	0.48
2000	3.03	2.12	0.60

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	9.5%	9.5%
10 Yr	18.8%	18.8%
5 Yr	4.6%	4.6%
Assigned	0.5%	2.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock			Golf Courses			Crops		
	Total	Lookout S.	Norman	Total	Lookout S.	Norman	Total	Lookout S.	Norman
2000	1.40	0.01	0.30	2.12	0.01	0.46	0.60	0.00	0.13
2002	1.43	0.01	0.31	2.14	0.01	0.46	0.62	0.00	0.14
2008	1.52	0.01	0.33	2.21	0.01	0.48	0.70	0.00	0.15
2018	1.67	0.01	0.36	2.32	0.01	0.50	0.86	0.00	0.19
2028	1.85	0.01	0.40	2.44	0.01	0.53	1.04	0.01	0.23
2038	2.04	0.01	0.44	2.56	0.01	0.55	1.27	0.01	0.28
2048	2.26	0.01	0.49	2.69	0.02	0.58	1.55	0.01	0.34
2058	2.49	0.01	0.54	2.83	0.02	0.61	1.89	0.01	0.41

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *KERSHAW*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	740	-
In Lake Wateree Watershed	85	11.5%
Total in Catawba River Basin	85	11%

Livestock

Year	Demand (mgd)
1985	0.05
1990	0.10
1995	0.10
2000	NA

**Data from USGS*

AGR *(referenced from 2000)*	
15 Yr	NA
10 Yr	NA
5 Yr	NA
Assigned	0.5%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)	Pct of Total Irrigation *(golf courses and crops only)*
Golf Courses	0.36	64%
Crops	0.20	36%

**Data from 2000 South Carolina Water Plan*

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.06	0.04	0.02
1990	0.36	0.23	0.13
1995	0.10	0.06	0.04
2000	0.57	0.36	0.20

**Data from USGS*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	16.2%	16.2%
10 Yr	4.7%	4.7%
5 Yr	41.6%	41.6%
Assigned	1.0%	2.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock		Golf Courses		Crops	
	Total	Wateree	Total	Wateree	Total	Wateree
2000	0.10	0.01	0.36	0.04	0.20	0.02
2002	0.10	0.01	0.37	0.04	0.21	0.02
2008	0.11	0.01	0.39	0.05	0.24	0.03
2018	0.11	0.01	0.44	0.05	0.29	0.03
2028	0.12	0.01	0.48	0.06	0.36	0.04
2038	0.12	0.01	0.53	0.06	0.43	0.05
2048	0.13	0.01	0.59	0.07	0.53	0.06
2058	0.14	0.02	0.65	0.07	0.65	0.07

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *LANCASTER*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	555	-
In Fishing Creek Reservoir Watershe	239	43.1%
In Rocky Creek Reservoir Watershe	45	8.0%
In Lake Wateree Watershed	73	13.1%
Total in Catawba River Basin	357	64%

Livestock

Year	Demand (mgd)
1985	0.08
1990	0.17
1995	0.17
2000	NA

**Data from USGS*

AGR *(referenced from 2000)*	
15 Yr	NA
10 Yr	NA
5 Yr	NA
Assigned	1.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)	Pct of Total Irrigation *(golf courses and crops only)*
Golf Courses	1.30	58%
Crops	0.95	42%

**Data from 2000 South Carolina Water Plan*

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.00	0.00	0.00
1990	0.00	0.00	0.00
1995	0.00	0.00	0.00
2000	2.25	1.30	0.95

**Data from USGS*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	-	-
10 Yr	-	-
5 Yr	-	-
Assigned	1.0%	0.5%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock				Golf Courses				Crops			
	Total	Fish. Crk.	Rocky Crk	Wateree	Total	Fish. Crk.	Rocky Crk	Wateree	Total	Fish. Crk.	Rocky Crk	Wateree
2000	0.18	0.08	0.01	0.02	1.30	0.56	0.10	0.17	0.95	0.41	0.08	0.12
2002	0.18	0.08	0.01	0.02	1.33	0.57	0.11	0.17	0.96	0.41	0.08	0.13
2008	0.19	0.08	0.02	0.03	1.41	0.61	0.11	0.18	0.99	0.43	0.08	0.13
2018	0.21	0.09	0.02	0.03	1.55	0.67	0.12	0.20	1.04	0.45	0.08	0.14
2028	0.24	0.10	0.02	0.03	1.72	0.74	0.14	0.23	1.09	0.47	0.09	0.14
2038	0.26	0.11	0.02	0.03	1.90	0.82	0.15	0.25	1.15	0.49	0.09	0.15
2048	0.29	0.12	0.02	0.04	2.10	0.90	0.17	0.28	1.21	0.52	0.10	0.16
2058	0.32	0.14	0.03	0.04	2.32	1.00	0.19	0.30	1.27	0.55	0.10	0.17

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *LINCOLN*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	307	-
In Lake Norman Watershed	21	6.9%
In Mountain Island Lake Watershed	9	3.1%
In Lake Wylie Watershed	256	83.3%
Total in Catawba River Basin	286	93%

Livestock

Year	Demand (mgd)
1985	0.34
1990	0.44
1995	0.87
2000	0.62

**Data from USGS*

AGR (referenced from 2000)	
15 Yr	4.1%
10 Yr	3.5%
5 Yr	-6.6%
Assigned	2.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd) Ground	Water Demand (mgd) Surface	Pct of Total Irrigation (golf courses and crops)	Pct from Surface Water
Golf Courses	0.06	0.53	69%	90%
Crops	0.03	0.24	31%	89%

Year	Irrigation Demand (mgd) Total	Golf Courses	Crops
1985	0.34	0.21	0.09
1990	0.03	0.02	0.01
1995	0.78	0.48	0.22
2000	0.86	0.53	0.24

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)	Golf Courses	Crops
15 Yr	6.4%	6.4%
10 Yr	39.9%	39.9%
5 Yr	2.0%	2.0%
Assigned	2.0%	1.8%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock Total	Livestock Norman	Livestock Mtn. Islnd.	Livestock Wylie	Golf Courses Total	Golf Courses Norman	Golf Courses Mtn. Islnd.	Golf Courses Wylie	Crops Total	Crops Norman	Crops Mtn. Islnd.	Crops Wylie
2000	0.62	0.04	0.02	0.52	0.53	0.04	0.02	0.44	0.24	0.02	0.01	0.20
2002	0.65	0.04	0.02	0.54	0.55	0.04	0.02	0.46	0.25	0.02	0.01	0.21
2008	0.73	0.05	0.02	0.61	0.62	0.04	0.02	0.52	0.28	0.02	0.01	0.23
2018	0.89	0.06	0.03	0.74	0.76	0.05	0.02	0.63	0.33	0.02	0.01	0.28
2028	1.08	0.07	0.03	0.90	0.92	0.06	0.03	0.77	0.40	0.03	0.01	0.33
2038	1.32	0.09	0.04	1.10	1.12	0.08	0.03	0.94	0.47	0.03	0.01	0.39
2048	1.60	0.11	0.05	1.34	1.37	0.10	0.04	1.14	0.57	0.04	0.02	0.47
2058	1.96	0.14	0.06	1.63	1.67	0.12	0.05	1.39	0.68	0.05	0.02	0.56

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *McDOWELL*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	446	-
In Lake James Watershed	286	64.1%
In Lake Rhodhiss Water	98	22.0%
Total in Catawba River Basin	384	86%

Livestock

Year	Demand (mgd)
1985	0.10
1990	7.57
1995	3.58
2000	0.25

**Data from USGS*

AGR *(referenced from 2000)*	
15 Yr	6.3%
10 Yr	-28.9%
5 Yr	-41.3%
Assigned	2.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)		Pct of Total Irrigation *(golf courses and crops only)*	Pct from Surface Water
	Ground	Surface		
Golf Courses	0.04	0.70	73%	95%
Crops	0.00	0.28	27%	100%

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.02	0.01	0.01
1990	0.16	0.11	0.04
1995	0.84	0.58	0.23
2000	1.02	0.70	0.28

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	30.0%	30.0%
10 Yr	20.4%	20.4%
5 Yr	4.0%	4.0%
Assigned	2.0%	4.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock			Golf Courses			Crops		
	Total	James	Rhodhiss	Total	James	Rhodhiss	Total	James	Rhodhiss
2000	0.25	0.16	0.06	0.70	0.45	0.15	0.2800	0.18	0.06
2002	0.26	0.17	0.06	0.73	0.47	0.16	0.3028	0.19	0.07
2008	0.29	0.19	0.06	0.82	0.53	0.18	0.3832	0.25	0.08
2018	0.36	0.23	0.08	1.00	0.64	0.22	0.5672	0.36	0.12
2028	0.44	0.28	0.10	1.22	0.78	0.27	0.84	0.54	0.18
2038	0.53	0.34	0.12	1.49	0.95	0.33	1.24	0.80	0.27
2048	0.65	0.41	0.14	1.81	1.16	0.40	1.84	1.18	0.40
2058	0.79	0.51	0.17	2.21	1.41	0.49	2.72	1.74	0.60

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *MECKLENBURG*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	550	-
In Lake Norman Watershed	24.5	4.5%
In Mountain Island Lake Watershed	38	7.0%
In Lake Wylie Watershed	101	18.5%
In Fishing Creek Reservoir Watershed	244	44.3%
Total in Catawba River Basin	408	74%

Livestock

Year	Demand (mgd)
1985	0.27
1990	0.23
1995	0.30
2000	0.17

**Data from USGS*

AGR (referenced from 2000)	
15 Yr	-3.0%
10 Yr	-3.0%
5 Yr	-10.7%
Assigned	0.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)		Pct of Total Irrigation (golf courses and crops only)	Pct from Surface Water
	Ground	Surface		
Golf Courses	2.47	7.42	90%	75%
Crops	0.28	0.85	10%	75%

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.04	0.03	0.00
1990	0.58	0.39	0.04
1995	12.09	8.14	0.93
2000	11.02	7.42	0.85

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	45.4%	-
10 Yr	34.2%	34.2%
5 Yr	-1.8%	-1.8%
Assigned	0.5%	-1.4%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock					Golf Courses					Crops				
	Total	Norman	Mtn. Islnd.	Wylie	Fish. Crk.	Total	Norman	Mtn. Islnd.	Wylie	Fish. Crk.	Total	Norman	Mtn. Islnd.	Wylie	Fish. Crk.
2000	0.17	0.01	0.01	0.03	0.08	7.42	0.33	0.52	1.37	3.29	0.8500	0.04	0.06	0.16	0.38
2002	0.17	0.01	0.01	0.03	0.08	7.49	0.33	0.52	1.38	3.32	0.83	0.04	0.06	0.15	0.37
2008	0.17	0.01	0.01	0.03	0.08	7.72	0.34	0.54	1.43	3.42	0.76	0.03	0.05	0.14	0.34
2018	0.17	0.01	0.01	0.03	0.08	8.12	0.36	0.57	1.50	3.60	0.66	0.03	0.05	0.12	0.29
2028	0.17	0.01	0.01	0.03	0.08	8.53	0.38	0.59	1.57	3.78	0.57	0.03	0.04	0.11	0.25
2038	0.17	0.01	0.01	0.03	0.08	8.97	0.40	0.63	1.66	3.97	0.50	0.02	0.03	0.09	0.22
2048	0.17	0.01	0.01	0.03	0.08	9.43	0.42	0.66	1.74	4.18	0.43	0.02	0.03	0.08	0.19
2058	0.17	0.01	0.01	0.03	0.08	9.91	0.44	0.69	1.83	4.39	0.38	0.02	0.03	0.07	0.17

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *MITCHELL*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	222	-
In Lake James Watershed	0	0.0%
Total in Catawba River Basin	0	0%

Livestock

Year	Demand (mgd)
1985	0.08
1990	2.34
1995	2.36
2000	0.03

**Data from USGS*

AGR (referenced from 2000)	
15 Yr	-6.3%
10 Yr	-35.3%
5 Yr	-58.2%
Assigned	0.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)		Pct of Total Irrigation (golf courses and crops only)	Pct from Surface Water
	Ground	Surface		
Golf Courses	0.00	0.30	83%	100%
Crops	0.00	0.06	17%	100%

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.01	0.01	0.00
1990	0.10	0.08	0.02
1995	0.38	0.32	0.06
2000	0.36	0.30	0.06

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	27.0%	-
10 Yr	13.7%	13.7%
5 Yr	-1.1%	-1.1%
Assigned	0.0%	-5.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock		Golf Courses		Crops	
	Total	James	Total	James	Total	James
2000	0.03	0.00	0.30	0.00	0.06	0.00
2002	0.03	0.00	0.30	0.00	0.05	0.00
2008	0.03	0.00	0.30	0.00	0.04	0.00
2018	0.03	0.00	0.30	0.00	0.02	0.00
2028	0.03	0.00	0.30	0.00	0.01	0.00
2038	0.03	0.00	0.30	0.00	0.01	0.00
2048	0.03	0.00	0.30	0.00	0.01	0.00
2058	0.03	0.00	0.30	0.00	0.00	0.00

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *RUTHERFORD*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	566	-
In Lake Rhodhiss Watershed	0	0.0%
Total in Catawba River Basin	0	0%

Livestock

Year	Demand (mgd)
1985	0.23
1990	0.41
1995	0.34
2000	0.35

**Data from USGS*

AGR (referenced from 2000)	
15 Yr	2.8%
10 Yr	-1.6%
5 Yr	0.6%
Assigned	1.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)		Pct of Total Irrigation (golf courses and crops only)	Pct from Surface Water
	Ground	Surface		
Golf Courses	0.09	1.68	87%	95%
Crops	0.01	0.25	13%	96%

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.04	0.03	0.00
1990	0.05	0.04	0.01
1995	2.45	2.03	0.30
2000	2.03	1.68	0.25

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	29.9%	-
10 Yr	44.8%	44.8%
5 Yr	-3.7%	-3.7%
Assigned	0.0%	-1.6%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock		Golf Courses		Crops	
	Total	Rhodhiss	Total	Rhodhiss	Total	Rhodhiss
2000	0.35	0.00	1.68	0.00	0.25	0.00
2002	0.36	0.00	1.68	0.00	0.24	0.00
2008	0.38	0.00	1.68	0.00	0.22	0.00
2018	0.42	0.00	1.68	0.00	0.19	0.00
2028	0.46	0.00	1.68	0.00	0.16	0.00
2038	0.51	0.00	1.68	0.00	0.13	0.00
2048	0.56	0.00	1.68	0.00	0.11	0.00
2058	0.62	0.00	1.68	0.00	0.10	0.00

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *UNION*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	639	-
In Fishing Creek Reservoir Watershed	162	25.4%
Catawba River Basin	162	25%

Livestock

Year	Demand (mgd)
1985	2.32
1990	2.31
1995	8.14
2000	8.26

**Data from USGS*

AGR (referenced from 2000)	
15 Yr	8.8%
10 Yr	13.6%
5 Yr	0.3%
Assigned	0.3%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd) Ground	Water Demand (mgd) Surface	Pct of Total Irrigation (golf courses and crops only)	Pct from Surface Water
Golf Courses	1.06	1.30	82%	55%
Crops	0.23	0.30	18%	57%

Year	Irrigation Demand (mgd) Total	Golf Courses	Crops
1985	0.48	0.22	0.05
1990	2.11	0.95	0.22
1995	1.23	0.55	0.13
2000	2.89	1.30	0.30

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)	Golf Courses	Crops
15 Yr	12.7%	12.7%
10 Yr	3.2%	3.2%
5 Yr	18.6%	18.6%
Assigned	1.0%	1.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock Total	Livestock Fishing Creek	Golf Courses Total	Golf Courses Fishing Creek	Crops Total	Crops Fishing Creek
2000	8.26	2.10	1.30	0.33	0.30	0.08
2002	8.31	2.11	1.33	0.34	0.31	0.08
2008	8.46	2.15	1.41	0.36	0.32	0.08
2018	8.72	2.21	1.55	0.39	0.36	0.09
2028	8.98	2.28	1.72	0.44	0.40	0.10
2038	9.26	2.35	1.90	0.48	0.44	0.11
2048	9.54	2.42	2.10	0.53	0.48	0.12
2058	9.83	2.50	2.32	0.59	0.53	0.14

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *WATAUGA*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	313	-
In Lake Rhodhiss Watershed	4	1.3%
Total in Catawba River Basin	4	1%

Livestock

Year	Demand (mgd)
1985	0.19
1990	0.68
1995	0.28
2000	0.15

**Data from USGS*

AGR (referenced from 2000)	
15 Yr	-1.6%
10 Yr	-14.0%
5 Yr	-11.7%
Assigned	0.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)		Pct of Total Irrigation (golf courses and crops only)	Pct from Surface Water
	Ground	Surface		
Golf Courses	0.00	1.03	86%	100%
Crops	0.00	0.17	14%	100%

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.03	0.03	0.00
1990	0.25	0.21	0.04
1995	1.47	1.26	0.21
2000	1.20	1.03	0.17

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	27.9%	-
10 Yr	17.0%	17.0%
5 Yr	-4.0%	-4.0%
Assigned	0.0%	-3.8%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock		Golf Courses		Crops	
	Total	Rhodhiss	Total	Rhodhiss	Total	Rhodhiss
2000	0.15	0.00	1.03	0.01	0.17	0.00
2002	0.15	0.00	1.03	0.01	0.16	0.00
2008	0.15	0.00	1.03	0.01	0.12	0.00
2018	0.15	0.00	1.03	0.01	0.08	0.00
2028	0.15	0.00	1.03	0.01	0.06	0.00
2038	0.15	0.00	1.03	0.01	0.04	0.00
2048	0.15	0.00	1.03	0.01	0.03	0.00
2058	0.15	0.00	1.03	0.01	0.02	0.00

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *WILKES*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	760	-
In Lookout Shoals Lake Watershed	0	0.0%
Total in Catawba River Basin	0	0%

Livestock

Year	Demand (mgd)
1985	0.54
1990	2.46
1995	8.84
2000	8.22

**Data from USGS*

AGR (referenced from 2000)	
15 Yr	19.9%
10 Yr	12.8%
5 Yr	-1.4%
Assigned	2.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd) Ground	Water Demand (mgd) Surface	Pct of Total Irrigation (golf courses and crops only)	Pct from Surface Water
Golf Courses	0.10	0.93	79%	90%
Crops	0.02	0.26	21%	93%

Year	Irrigation Demand (mgd) Total	Golf Courses	Crops
1985	0.18	0.13	0.04
1990	0.12	0.09	0.02
1995	0.81	0.58	0.16
2000	1.31	0.93	0.26

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)	Golf Courses	Crops
15 Yr	14.1%	14.1%
10 Yr	27.0%	27.0%
5 Yr	10.1%	10.1%
Assigned	0.0%	0.5%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock Total	Livestock Lookout Shoals	Golf Courses Total	Golf Courses Lookout Shoals	Crops Total	Crops Lookout Shoals
2000	8.22	0.00	0.93	0.00	0.26	0.00
2002	8.55	0.00	0.93	0.00	0.26	0.00
2008	9.63	0.00	0.93	0.00	0.27	0.00
2018	11.74	0.00	0.93	0.00	0.28	0.00
2028	14.31	0.00	0.93	0.00	0.30	0.00
2038	17.45	0.00	0.93	0.00	0.31	0.00
2048	21.27	0.00	0.93	0.00	0.33	0.00
2058	25.92	0.00	0.93	0.00	0.35	0.00

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *YANCEY*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	313	-
In Lake James Watershed	0	0.0%
Total in Catawba River Basin	0	0%

Livestock

Year	Demand (mgd)
1985	0.13
1990	1.59
1995	0.14
2000	0.07

**Data from USGS*

AGR (referenced from 2000)	
15 Yr	-4.0%
10 Yr	-26.8%
5 Yr	-12.9%
Assigned	0.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)		Pct of Total Irrigation (golf courses and crops only)	Pct from Surface Water
	Ground	Surface		
Golf Courses	0.00	0.59	76%	100%
Crops	0.06	0.13	24%	68%

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.00	0.00	0.00
1990	0.20	0.15	0.03
1995	0.72	0.54	0.12
2000	0.78	0.59	0.13

**Data from USGS*
**Total column includes ground and surface waters*
**Golf Courses and Crops columns include surface water only*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	-	-
10 Yr	14.6%	14.6%
5 Yr	1.6%	1.6%
Assigned	0.0%	0.5%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock		Golf Courses		Crops	
	Total	James	Total	James	Total	James
2000	0.07	0.00	0.59	0.00	0.13	0.00
2002	0.07	0.00	0.59	0.00	0.13	0.00
2008	0.07	0.00	0.59	0.00	0.14	0.00
2018	0.07	0.00	0.59	0.00	0.14	0.00
2028	0.07	0.00	0.59	0.00	0.15	0.00
2038	0.07	0.00	0.59	0.00	0.16	0.00
2048	0.07	0.00	0.59	0.00	0.17	0.00
2058	0.07	0.00	0.59	0.00	0.17	0.00

Agricultural/Irrigation Water Demand Projections for Livestock, Crops, and Golf Courses

COUNTY *YORK*

County Land Area Distribution

Designation/Watershed	Area (Sq. Miles)	Pct of Total
Total County	696	-
In Lake Wylie Watershed	137	19.7%
In Fishing Creek Reservoir Watershe	120	17.3%
In Great Falls Reservoir Watershed	178	25.6%
Total in Catawba River Basin	435	63%

Livestock

Year	Demand (mgd)
1985	0.22
1990	0.35
1995	0.35
2000	NA

**Data from USGS*

AGR *(referenced from 2000)*	
15 Yr	NA
10 Yr	NA
5 Yr	NA
Assigned	0.5%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Golf Course and Crop Irrigation Data *(for 2000)*

Irrigation Type	Water Demand (mgd)	Pct of Total Irrigation *(golf courses and crops only)*
Golf Courses	3.20	21%
Crops	1.00	79%

**Data from 2000 South Carolina Water Plan*

Year	Irrigation Demand (mgd)		
	Total	Golf Courses	Crops
1985	0.12	0.03	0.09
1990	0.13	0.03	0.10
1995	0.10	0.02	0.08
2000	4.20	0.88	3.32

**Data from USGS*

AGR (referenced from 2000)		
	Golf Courses	Crops
15 Yr	26.7%	26.7%
10 Yr	41.6%	41.6%
5 Yr	111.2%	111.2%
Assigned	0.5%	2.0%

**AGRs based on Historical Demand*
**Assigned AGR based on judgement of projector.*

Agricultural/Irrigation Surface Water Demand Projections (in mgd)

Year	Livestock				Golf Courses				Crops			
	Total	Wylie	Fish. Crk.	Great Falls	Total	Wylie	Fish. Crk.	Great Falls	Total	Wylie	Fish. Crk.	Great Falls
2000	0.36	0.07	0.06	0.09	0.88	0.17	0.15	0.23	3.32	0.65	0.57	0.85
2002	0.36	0.07	0.06	0.09	0.89	0.18	0.15	0.23	3.45	0.68	0.60	0.88
2008	0.37	0.07	0.06	0.10	0.92	0.18	0.16	0.23	3.89	0.76	0.67	0.99
2018	0.39	0.08	0.07	0.10	0.96	0.19	0.17	0.25	4.74	0.93	0.82	1.21
2028	0.41	0.08	0.07	0.11	1.01	0.20	0.18	0.26	5.78	1.14	1.00	1.48
2038	0.43	0.09	0.08	0.11	1.07	0.21	0.18	0.27	7.04	1.39	1.22	1.80
2048	0.46	0.09	0.08	0.12	1.12	0.22	0.19	0.29	8.58	1.69	1.48	2.20
2058	0.48	0.09	0.08	0.12	1.18	0.23	0.20	0.30	10.46	2.06	1.81	2.68

APPENDIX F

DUKE POWER WATER CONSUMPTION PROJECTION DETAIL SHEETS

Table F.1 - Duke Power Service Area Future Population and Energy Demand Projections[1]

Year	Population	Population AGR	Per Capita Daily Energy Demand (KWH)	Energy Demand (GWH)	Energy Demand AGR
2004	1,874,163	-	132.3	90,508	-
2005	1,913,847	2.12%	130.6	91,244	0.81%
2006	1,953,529	2.07%	128.9	91,881	0.70%
2007	1,993,214	2.03%	128.0	93,147	1.38%
2008	2,032,897	1.99%	127.6	94,680	1.65%
2009	2,072,581	1.95%	127.2	96,201	1.61%
2010	2,111,508	1.88%	126.9	97,794	1.66%
2011	2,148,698	1.76%	126.7	99,351	1.59%
2012	2,186,188	1.74%	126.5	100,945	1.60%
2013	2,224,554	1.75%	126.4	102,602	1.64%
2014	2,263,667	1.76%	126.2	104,251	1.61%
2015	2,303,467	1.76%	126.0	105,896	1.58%
2016	2,344,021	1.76%	125.8	107,599	1.61%
2017	2,385,737	1.78%	125.5	109,289	1.57%
2018	2,429,107	1.82%	125.2	111,015	1.58%
2019	2,473,957	1.85%	124.9	112,759	1.57%
2020	2,518,300	1.79%	124.6	114,543	1.58%
2021	2,557,249	1.55%	124.6	116,306	1.54%
2022	2,596,518	1.54%	124.7	118,166	1.60%
2023	2,636,708	1.55%	124.8	120,068	1.61%
2024	2,677,688	1.55%	124.8	121,990	1.60%
2025	2,719,098	1.55%	124.9	123,941	1.60%
2026	2,760,758	1.53%	125.0	125,924	1.60%
2027	2,803,595	1.55%	125.0	127,939	1.60%
2028	2,848,022	1.58%	125.0	129,986	1.60%
2029	2,893,880	1.61%	125.0	132,066	1.60%
2030	2,940,538	1.61%	125.0	134,179	1.60%
2031	2,988,009	1.61%	125.0	136,326	1.60%
2032	3,036,310	1.62%	125.0	138,507	1.60%
2033	3,085,454	1.62%	125.0	140,723	1.60%
2034	3,135,458	1.62%	124.9	142,975	1.60%
2035	3,186,336	1.62%	124.9	145,262	1.60%
2036	3,238,105	1.62%	124.9	147,587	1.60%
2037	3,290,780	1.63%	124.8	149,948	1.60%
2038	3,344,378	1.63%	124.8	152,347	1.60%
2039	3,398,916	1.63%	124.8	154,785	1.60%
2040	3,454,411	1.63%	124.7	157,261	1.60%
2041	3,510,880	1.63%	124.7	159,778	1.60%
2042	3,568,341	1.64%	124.6	162,334	1.60%
2043	3,626,812	1.64%	124.6	164,931	1.60%
2044	3,686,311	1.64%	124.5	167,570	1.60%
2045	3,746,856	1.64%	124.5	170,251	1.60%
2046	3,808,468	1.64%	124.4	172,975	1.60%
2047	3,871,165	1.65%	124.4	175,743	1.60%
2048	3,934,967	1.65%	124.3	178,555	1.60%
2049	3,999,894	1.65%	124.3	181,412	1.60%
2050	4,065,967	1.65%	124.2	184,314	1.60%
2051	4,133,206	1.65%	124.1	187,263	1.60%
2052	4,201,633	1.66%	124.1	190,260	1.60%
2053	4,271,269	1.66%	124.0	193,304	1.60%
2054	4,342,137	1.66%	123.9	196,397	1.60%
2055	4,414,258	1.66%	123.8	199,539	1.60%
2056	4,487,656	1.66%	123.8	202,732	1.60%
2057	4,562,354	1.66%	123.7	205,975	1.60%
2058	4,638,375	1.67%	123.6	209,271	1.60%

1 - Analysis provided by Duke Power

Assumption Notes:

* Service Area Population Data between 2004 - 2023 from North Carolina Demographic Office.
* Energy Forecast between 2004 - 2023 based on Population Projections.
* Energy Demand Forecasts between 2024 - 2058 assumes Energy AGR of 1.6%.

Table F.2 - Monthly Total Energy Demand Projections (in GWH)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2004	7,961	6,951	7,121	6,698	7,217	7,970	8,865	8,835	7,484	6,992	6,961	7,453
2005	8,054	6,990	7,172	6,750	7,263	8,031	8,958	8,906	7,551	7,046	7,007	7,517
2006	8,137	7,051	7,226	6,806	7,298	8,068	9,005	8,937	7,600	7,107	7,062	7,586
2007	8,270	7,160	7,249	6,878	7,415	8,224	9,186	9,131	7,651	7,083	7,171	7,729
2008	8,402	7,295	7,367	6,991	7,536	8,367	9,336	9,276	7,779	7,195	7,286	7,849
2009	8,539	7,393	7,489	7,106	7,654	8,504	9,488	9,427	7,910	7,315	7,404	7,973
2010	8,679	7,514	7,613	7,224	7,782	8,646	9,649	9,586	8,036	7,439	7,525	8,101
2011	8,816	7,634	7,734	7,341	7,908	8,783	9,804	9,737	8,165	7,558	7,644	8,226
2012	8,953	7,774	7,856	7,458	8,046	8,922	9,959	9,890	8,294	7,676	7,765	8,353
2013	9,101	7,882	7,988	7,581	8,179	9,065	10,135	10,056	8,436	7,803	7,890	8,488
2014	9,245	8,007	8,115	7,702	8,308	9,219	10,293	10,218	8,579	7,929	8,016	8,620
2015	9,392	8,134	8,245	7,824	8,431	9,366	10,456	10,381	8,718	8,054	8,142	8,754
2016	9,540	8,282	8,376	7,950	8,569	9,514	10,625	10,546	8,850	8,187	8,270	8,889
2017	9,689	8,393	8,508	8,076	8,712	9,666	10,795	10,713	8,993	8,314	8,401	9,028
2018	9,841	8,524	8,643	8,203	8,855	9,818	10,967	10,882	9,138	8,447	8,530	9,167
2019	9,994	8,658	8,781	8,331	8,994	9,972	11,145	11,054	9,282	8,578	8,663	9,306
2020	10,149	8,814	8,917	8,459	9,133	10,131	11,318	11,228	9,435	8,714	8,797	9,448
2021	10,309	8,930	9,056	8,595	9,268	10,290	11,495	11,406	9,579	8,852	8,934	9,592
2022	10,472	9,071	9,202	8,732	9,419	10,454	11,682	11,588	9,733	8,997	9,075	9,741
2023	10,637	9,216	9,349	8,873	9,578	10,622	11,871	11,774	9,892	9,139	9,221	9,897

Figure F.1 - Duke Power Service Area Population and Energy Demand Projections

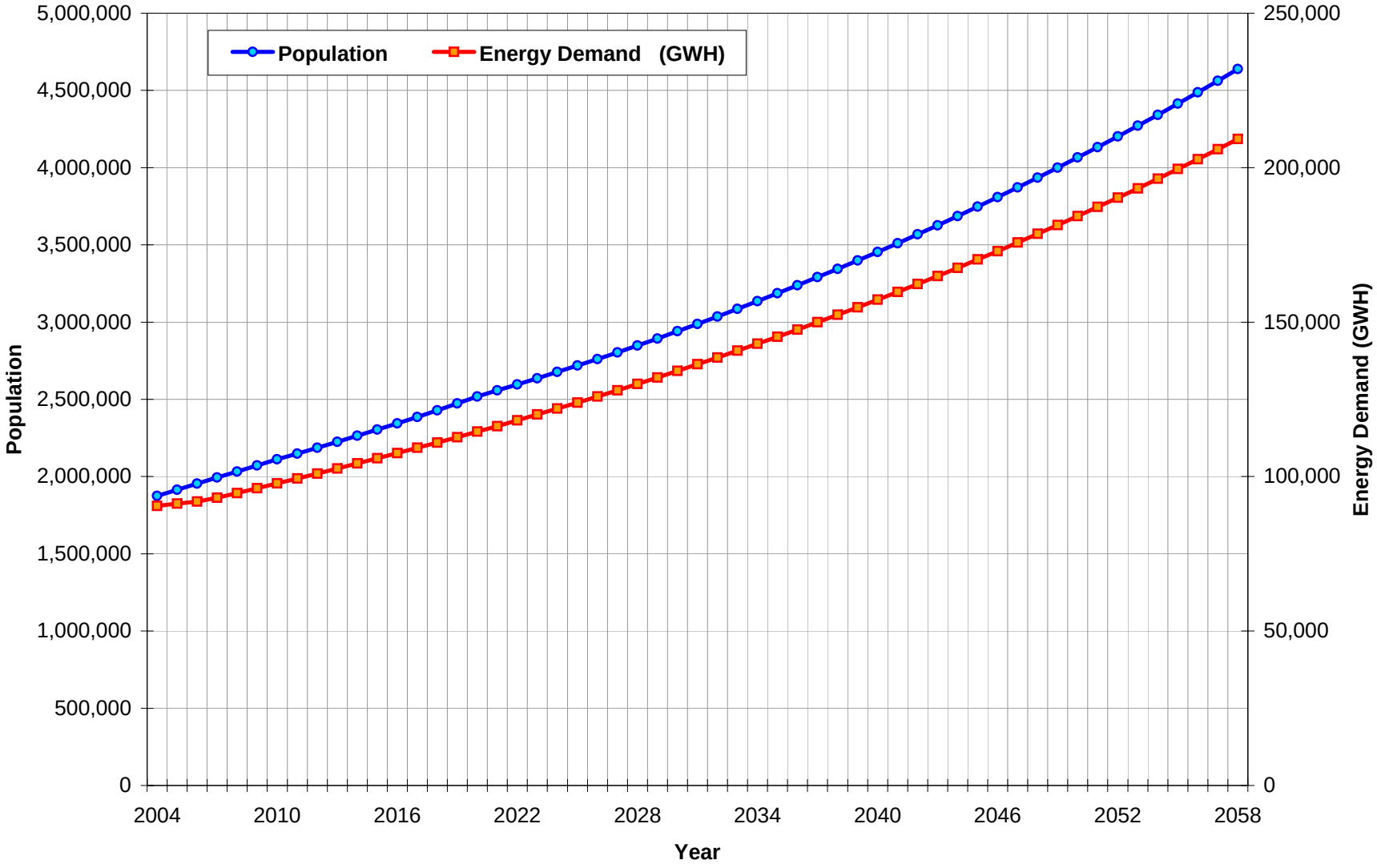


Table F.3 - Energy Generation Projections Summary (in MWH)

Year	2003	2008	2018	2028	2038	2048	2058
Total Energy Demand	**-**	94,679,570	111,014,780	129,986,259	152,347,216	178,554,830	209,270,823
Additional Energy							
Future Additional Energy Required	-	**	16,335,210	18,971,479	22,360,958	26,207,614	30,715,993
Future Additional Energy Supplied*	-	**	8,167,605	9,485,739	11,180,479	13,103,807	15,357,996
Lake James							
Future Expansion Station	0	0	0	0	0	13,103,807	13,103,807
Total	*0*	*0*	*0*	*0*	*0*	*13,103,807*	*13,103,807*
Lake Norman							
Marshall Steam Station	15,061,020	15,061,020	15,061,020	15,061,020	15,061,020	15,061,020	15,061,020
McGuire Nuclear Station	18,708,474	18,708,474	18,708,474	18,708,474	18,708,474	18,708,474	18,708,474
Future Expansion Station	0	0	8,167,605	8,167,605	8,167,605	8,167,605	8,167,605
Total	*33,769,494*	*33,769,494*	*41,937,099*	*41,937,099*	*41,937,099*	*41,937,099*	*41,937,099*
Mountain Island Lake							
Riverbend Steam Station	1,787,876	1,787,876	1,787,876	1,787,876	1,787,876	1,787,876	1,787,876
Total	*1,787,876*	*1,787,876*	*1,787,876*	*1,787,876*	*1,787,876*	*1,787,876*	*1,787,876*
Lake Wylie							
Allen Steam Station	5,450,518	5,450,518	5,450,518	5,450,518	5,450,518	5,450,518	5,450,518
Catawba Nuclear Station	20,696,906	20,696,906	20,696,906	20,696,906	20,696,906	20,696,906	20,696,906
Future Expansion Station	0	0	0	9,485,739	9,485,739	9,485,739	9,485,739
Total	*26,147,424*	*26,147,424*	*26,147,424*	*35,633,163*	*35,633,163*	*35,633,163*	*35,633,163*
Lake Wateree							
Future Expansion Station	0	0	0	0	11,180,479	11,180,479	26,538,475
Total	*0*	*0*	*0*	*0*	*11,180,479*	*11,180,479*	*26,538,475*

* Except where noted, it is assumed that half of all additional energy required is to be supplied by facilities to be constructed in the Catawba River Basin.

** Additional energy assumed to be provided by other means.

Water Demand Detail Sheet for Power Generation Facilities on Lake James

Facility Future - New
Lake James

YEAR	Energy Demand (MWH)	Water Consumption Rate (CFS/MWH)	Water Demand (CFS)	Water Demand (MGD)
2003	0	-	-	-
2008	0	-	-	-
2018	0	-	-	-
2028	0	-	-	-
2038	0	-	-	-
2048	13,103,807	1.81E-06	23.7	15.3
2058	13,103,807	1.81E-06	23.7	15.3

* 2048 - 2058 water consumption rate assumed to be 67.5% of Catawba Nuclear Station's consumption rate.

Water Demand Detail Sheet for Power Generation Facilities on Lake Norman

Facility Marshall Steam Station
Lake Norman

YEAR	Energy Demand (MWH)	Water Consumption Rate (CFS/MWH)	Water Demand (CFS)	Water Demand (MGD)
2003	15,061,020	1.34E-06	20.2	13.1
2008	15,061,020	1.34E-06	20.2	13.1
2018	15,061,020	1.34E-06	20.2	13.1
2028	15,061,020	1.34E-06	20.2	13.1
2038	15,061,020	1.34E-06	20.2	13.1
2048	15,061,020	1.34E-06	20.2	13.1
2058	15,061,020	1.34E-06	20.2	13.1

Facility McGuire Nuclear Station
Lake Norman

YEAR	Energy Demand (MWH)	Water Consumption Rate (CFS/MWH)	Water Demand (CFS)	Water Demand (MGD)
2003	18,708,474	1.93E-06	36.1	23.3
2008	18,708,474	1.93E-06	36.1	23.3
2018	18,708,474	1.93E-06	36.1	23.3
2028	18,708,474	1.93E-06	36.1	23.3
2038	18,708,474	1.93E-06	36.1	23.3
2048	18,708,474	1.93E-06	36.1	23.3
2058	18,708,474	1.93E-06	36.1	23.3

Facility Future - New
Lake Norman

YEAR	Energy Demand (MWH)	Water Consumption Rate (CFS/MWH)	Water Demand (CFS)	Water Demand (MGD)
2003	0	-	-	-
2008	0	-	-	-
2018	8,167,605	1.81E-06	14.8	9.6
2028	8,167,605	1.81E-06	14.8	9.6
2038	8,167,605	1.81E-06	14.8	9.6
2048	8,167,605	4.95E-06	40.4	26.1
2058	8,167,605	4.95E-06	40.4	26.1

* 2018 - 2038 water consumption rate assumed to be 67.5% of Catawba Nuclear Station's consumption rate.

* 2048 - 2058 water consumption rate assumes cooling tower conversion at the existing Marshall Steam Station.

Water Demand Detail Sheet for Power Generation Facilities on Mountain Island Lake

Facility Riverbend Steam Station
Lake Mountain Island

YEAR	Energy Demand (MWH)	Water Consumption Rate (CFS/MWH)	Water Demand (CFS)	Water Demand (MGD)
2003	1,787,876	2.16E-06	3.9	2.5
2008	1,787,876	2.16E-06	3.9	2.5
2018	1,787,876	2.16E-06	3.9	2.5
2028	1,787,876	2.16E-06	3.9	2.5
2038	1,787,876	2.16E-06	3.9	2.5
2048	1,787,876	2.16E-06	3.9	2.5
2058	1,787,876	2.16E-06	3.9	2.5

Water Demand Detail Sheet for Power Generation Facilities on Lake Wylie

Facility Allen Steam Station
Lake Wylie

YEAR	Energy Demand (MWH)	Water Consumption Rate (CFS/MWH)	Water Demand (CFS)	Water Demand (MGD)
2003	5,450,518	1.72E-06	9.4	6.1
2008	5,450,518	1.72E-06	9.4	6.1
2018	5,450,518	1.72E-06	9.4	6.1
2028	5,450,518	1.72E-06	9.4	6.1
2038	5,450,518	1.72E-06	9.4	6.1
2048	5,450,518	1.72E-06	9.4	6.1
2058	5,450,518	1.72E-06	9.4	6.1

Facility Catawba Nuclear Station
Lake Wylie

YEAR	Energy Demand (MWH)	Water Consumption Rate (CFS/MWH)	Water Demand (CFS)	Water Demand (MGD)
2003	20,696,906	2.68E-06	55.4	35.8
2008	20,696,906	2.68E-06	55.4	35.8
2018	20,696,906	2.68E-06	55.4	35.8
2028	20,696,906	2.68E-06	55.4	35.8
2038	20,696,906	2.68E-06	55.4	35.8
2048	20,696,906	2.68E-06	55.4	35.8
2058	20,696,906	2.68E-06	55.4	35.8

Facility Future - New
Lake Wylie

YEAR	Energy Demand (MWH)	Water Consumption Rate (CFS/MWH)	Water Demand (CFS)	Water Demand (MGD)
2003	0	-	-	-
2008	0	-	-	-
2018	0	-	-	-
2028	9,485,739	1.81E-06	17.2	11.1
2038	9,485,739	1.81E-06	17.2	11.1
2048	9,485,739	1.81E-06	17.2	11.1
2058	9,485,739	1.81E-06	17.2	11.1

* 2028 - 2058 water consumption rate assumed to be 67.5% of Catawba Nuclear Station's consumption rate.

Water Demand Detail Sheet for Power Generation Facilities on Lake Wateree

Facility Future - New
Lake Wateree

YEAR	Energy Demand (MWH)	Water Consumption Rate (CFS/MWH)	Water Demand (CFS)	Water Demand (MGD)
2003	0	-	-	-
2008	0	-	-	-
2018	0	-	-	-
2028	0	-	-	-
2038	11,180,479	1.81E-06	20.2	13.1
2048	11,180,479	1.81E-06	20.2	13.1
2058	26,538,475	2.31E-06	61.4	39.7

* 2038 - 2048 water consumption rate assumed to be 67.5% of Catawba Nuclear Station's consumption rate.

* 2058 water consumption rate assumes additional energy demand will consume water similar to Catawba Nuclear Station's rate.

APPENDIX G

RAW WATER INTAKE SUMMARY TABLE

Safe Yield - Reservoir Intake Level Evaluation

Lake System	Entity/Source Description	Facility	Lake/River	Description	Elevation (FT MSL)	Study Verified	Comments	Contact Name	Contact Number
LAKE JAMES									
	Full Pond Elevation			**Full Pond**	**1200.00**	**Y**			
	Critical Boat Access Levels			**Public Access**	**1192.00**	**Y**			
	Hydro Operations			**Hydro**	**1161.00**	**Y**		Ed Bruce	704-382-5239
LAKE RHODHISS									
	Full Pond Elevation			**Full Pond**	**995.10**	**Y**			
	Critical Boat Access Levels			**Public Access**	**986.10**	**Y**			
	Town of Granite Falls	Granite Falls WTP	Lake	Intake	972.40	Y		Shuford Wise	828-396-7111
	City of Lenoir	Lenoir WTP	Lake	Intake	976.00	Y	Second critical level	Mack Edmisten	828-757-2160
	City of Morganton	Catawba River WTP	River	Top of Weir	1004.00	Y		Don Danford	828-438-5285
	Town of Valdese	Valdese WTP	Lake	Intake	984.50	Y	Second critical level	Chris Graybeal	828-879-2127
	Hydro Operations			**Hydro**	**974.20**	**Y**		Ed Bruce	704-382-5239
LAKE HICKORY									
	Full Pond Elevation			**Full Pond**	**935.00**	**Y**			
	Critical Boat Access Levels			**Public Access**	**926.00**	**Y**			
	City of Hickory	Hickory WTP	Lake	Intake	923.00	Y	Highest intake elevation	Gene Haynes	828-323-7427
	Town of Longview	Longview WTP	Lake	Intake	929.00	Y	*follow-up phone call*	Rani Holland	828-322-8021
	Hydro Operations			**Hydro**	**908.00**	**Y**		Ed Bruce	704-382-5239
LOOKOUT SHOALS LAKE									
	Full Pond Elevation			**Full Pond**	**838.10**	**Y**			
	Critical Boat Access Levels			**Public Access**	**830.10**	**Y**			
	City of Statesville	Statesville WTP	Lake	Intake	813.00	Y	Upper Intake	Joe Hudson	704-878-3438
	Hydro Operations			**Hydro**	**811.00**	**Y**		Ed Bruce	704-382-5239
LAKE NORMAN									
	Full Pond Elevation			**Full Pond**	**760.00**	**Y**			
	Critical Boat Access Levels			**Public Access**	**751.00**	**Y**			
	Burlington/Spillman (currently unused)	Mooresville Plant	Lake	Intake	735.00	Y	Assumed low, before lake	Roger Spillman	336-284-2551
	Charlotte-Mecklenburg	North Mecklenburg WTP	Lake	Intake	745.00	Y	Hydraulic limitation	Barry Gullet	704-391-5098
	Lincoln County	Lincoln County WTP	Lake	Intake	743.00	Y	Upper intakes	Stephen Gilbert	704-736-8495
	Town of Mooresville	Mooresville WTP	Lake	Intake	745.00	Y		Wilce Martin	704-663-7282
	Duke Energy Corporation	Marshall Steam Station	Lake	Intake	735.00	Y		Ed Bruce	704-382-5239
	Duke Energy Corporation	McGuire Nuclear Station	Lake	Intake	750.00	Y	Could be higher	Ed Bruce	704-382-5239
	Hydro Operations			**Hydro**	**725.00**	**Y**		Ed Bruce	704-382-5239
MOUNTAIN ISLAND LAKE									
	Full Pond Elevation			**Full Pond**	**647.50**	**Y**			
	Critical Boat Access Levels			**Public Access**	**638.50**	**Y**			
	Charlotte-Mecklenburg	Franklin and Vest WTP	Lake	Intake	625.50		Screen Invert	Barry Gullet	704-391-5098
	City of Gastonia	Gastonia WTP	Lake	Intake	635.50	Y		Matt Jordan	704-866-6821
	City of Mount Holly	Mount Holly WTP	Lake	Intake	627.50	Y	Estimate	Don Price	704-822-2939
	Duke Energy Corporation	Riverbend Steam Station	Lake	Intake	641.75	Y		Ed Bruce	704-382-5239
	Hydro Operations			**Hydro**	**625.00**	**Y**		Ed Bruce	704-382-5239
LAKE WYLIE									

Safe Yield - Reservoir Intake Level Evaluation

Lake System	Entity/Source Description	Facility	Lake/River	Description	Elevation (FT MSL)	Study Verified	Comments	Contact Name	Contact Number
	Full Pond Elevation			**Full Pond**	**569.40**	**Y**			
	Critical Boat Access Levels			**Public Access**	**564.90**	**Y**			
	Confidential Industry	Dyeing & Finishing Plant 15	Lake	Intake	561.70	Y	Estimate	John Bowyer	704-951-2531
	Clariant Corporation	Mt. Holly Plant	Lake	Intake	562.00	Y	Not used, may re-activate, Est.	Bill Archer	704-822-2702
	Siemens Westinghouse	Siemens Westinghouse	Lake	Intake	559.00	Y	Lowest useable elevation	Jack Bradshaw	704-551-5333
	City of Belmont	Belmont WTP	Lake	Intake	561.40	Y	Lowest useable elevation	Chuck Flowers	704-825-5586
	Duke Energy Corporation	Allen Steam Plant	Lake	Intake	555.00	Y	Lowest useable elevation	Ed Bruce	704-382-5239
	Rock Hill	Rock Hill WTP	Lake	Intake	546.83	Y	Lowest useable elevation	Nick Stegall	803-329-5519
	City of York	Future Intake Site	Lake	Intake	-	-	Future	Charles Helms	803-684-7172
	Duke Energy Corporation	Catatwba Nuclear Station	Lake	Intake	559.40	Y		Ed Bruce	704-382-5239
	Hydro Operations			**Hydro**	**543.50**	**Y**		Ed Bruce	704-382-5239
FISHING CREEK RESERVOIR									
	Full Pond Elevation			**Full Pond**	**417.20**	**Y**			
	Critical Boat Access Levels			**Public Access**	**412.20**	**Y**			
	Celanese Acetate	Celriver Plant	River	Intake	455.00	Y	Intake in Sump from River	Danny McCaskill	803-325-6390
	Bowater	Pulp and Paper Mill	River	Intake	445.00	Y		Dale Herendon	803-981-8009
	Springs Industrial	Grace Complex	River/Backwater	Intake	408.00	Y	Hydraulic limitation	Keith Griffin	803-547-1533
	Nation Ford Chemical	Industrial Facility	River	Intake			No contact made - multiple try	Dan Lee	803-548-3210 (16)
	Rock Hill (Not in Use)	Not in Use	River	Intake	490.00	Y	In River Channel (not in use)	Nick Stegall	803-329-5519
	Union County/Lancaster County	Catawba River Plant	River	Intake	447.00	Y		Mike Bailes	803-286-5949
	Chester Metro	Chester Metro WTP	Lake	Intake	412.20	Y	Lowest before vortex	Mike Medlin	803-385-5123
	Hydro Operations			**Hydro**	**395.10**	**Y**		Ed Bruce	704-382-5239
GREAT FALLS-DEARBORN RESREVOIR									
	Full Pond Elevation			**Full Pond**	**355.80**	**Y**			
	Critical Boat Access Levels			**Public Access**	**N/A**	**Y**			
	Hydro Operations			**Hydro**	**343.00**	**Y**		Ed Bruce	704-382-5239
CEDAR CREEK RESRVOIR									
	Full Pond Elevation			**Full Pond**	**284.40**	**Y**			
	Critical Boat Access Levels			**Public Access**	**280.40**	**Y**			
	Hydro Operations			**Hydro**	**264.70**	**Y**		Ed Bruce	704-382-5239
LAKE WATEREE									
	Full Pond Elevation			**Full Pond**	**225.50**				
	Critical Boat Access Levels			**Public Access**	**218.50**				
	Camden	Camden WTP	Lake	Intake	218.00	Y	Wet Well Limited	Tom Couch	803-432-0006
	Lugoff Elgin Water Authority	Lugoff Elgin WTP	Lake	Intake	214.00	Y		Michael Hancock	803-438-2991
	Hydro Operations			**Hydro**	**199.50**	**Y**		Ed Bruce	704-382-5239

Notes: 1. Critical boat access levels are defined as the level that keeps two Duke-owned access areas open on larger lakes, and one on smaller lakes.
2. Critical intake levels are defined in the shaded boxes

Latest Update: **December 28, 2005**

APPENDIX H

INFLOW DATA SERIES ANALYSIS

Catawba-Wateree Basin
Inflow Data Series Analysis
Years When Annual Inflow Volume is Less Than the Annual Average for the Period of Record

Year	Lake											No. of Lakes Below Annual Average Inflow Volume
	James	Rhodhiss	Hickory	Lookout Shoals	Norman[1]	Mountain Island	Wylie	Fishing Creek	Great Falls-Dearborn	Cedar Creek	Wateree	
1930				X		X			X		X	4
1931	X			X		X	X		X		X	6
1932				X		X	X		X		X	5
1933						X	X		X	X	X	5
1934						X	X			X	X	4
1935			X			X	X		X	X	X	6
1936						X	X			X	X	4
1937	X	X				X	X			X		5
1938				X		X	X			X		4
1939	X	X		X		X	X	X		X		7
1940	X	X	X			X	X	X	X		X	8
1941	X	X		X		X	X	X		X		7
1942		X	X	X		X	X	X		X		7
1943	X	X		X		X		X	X	X		7
1944	X	X		X		X			X	X		6
1945	X	X		X		X		X		X		6
1946	X	X		X		X		X		X		6
1947	X	X		X		X		X		X		6
1948				X		X				X		3
1949						X		X				2
1950		X		X		X	X	X		X	X	7
1951	X	X	X	X		X	X	X		X	X	9
1952	X	X	X	X		X			X	X		7
1953	X	X	X			X	X	X		X		7
1954	X	X	X			X	X				X	6
1955	X	X	X	X		X	X	X	X		X	9
1956	X	X	X	X		X	X	X			X	8
1957	X	X	X			X	X	X	X		X	8
1958	X		X			X		X	X			5
1959						X						1

Catawba-Wateree Basin
Inflow Data Series Analysis
Years When Annual Inflow Volume is Less Than the Annual Average for the Period of Record

Year	Lake											No. of Lakes Below Annual Average Inflow Volume
	James	Rhodhiss	Hickory	Lookout Shoals	Norman[1]	Mountain Island	Wylie	Fishing Creek	Great Falls-Dearborn	Cedar Creek	Wateree	
1960						X						1
1961			X			X		X		X	X	5
1962			X			X		X		X		4
1963	X	X		X		X	X	X		X		7
1964					X							1
1965	X		X			X		X		X	X	6
1966		X	X			X	X	X		X		6
1967	X	X		X	X	X	X	X			X	8
1968	X	X	X			X	X	X			X	7
1969			X		X			X			X	4
1970	X		X	X	X		X	X			X	7
1971			X		X						X	3
1972			X		X				X		X	4
1973					X						X	2
1974				X	X					X		3
1975					X				X		X	3
1976			X	X	X						X	4
1977			X	X	X						X	4
1978	X			X							X	3
1979					X						X	2
1980					X				X		X	3
1981	X	X		X		X	X	X	X		X	8
1982	X			X	X			X			X	5
1983				X	X			X	X	X		5
1984				X	X				X			3
1985	X	X	X	X	X			X	X		X	8
1986	X	X	X	X	X		X	X	X		X	9
1987	X	X		X	X				X		X	6
1988	X	X	X	X		X	X	X	X	X	X	10
1989			X	X	X				X			4

Catawba-Wateree Basin
Inflow Data Series Analysis
Years When Annual Inflow Volume is Less Than the Annual Average for the Period of Record

Year	Lake											No. of Lakes Below Annual Average Inflow Volume
	James	Rhodhiss	Hickory	Lookout Shoals	Norman[1]	Mountain Island	Wylie	Fishing Creek	Great Falls-Dearborn	Cedar Creek	Wateree	
1990				X	X				X		X	4
1991	X			X	X		X		X		X	6
1992				X	X		X		X		X	5
1993							X		X	X	X	4
1994					X		X	X		X	X	5
1995			X		X		X		X	X	X	6
1996					X		X	X		X	X	5
1997	X	X			X		X			X		5
1998				X	X		X			X		4
1999	X	X		X		X	X	X		X		7
2000	X	X		X		X		X		X	X	7
2001	X	X	X	X		X	X	X	X	X	X	10
2002	X	X	X	X		X	X	X		X	X	9
2003				X	X				X			3

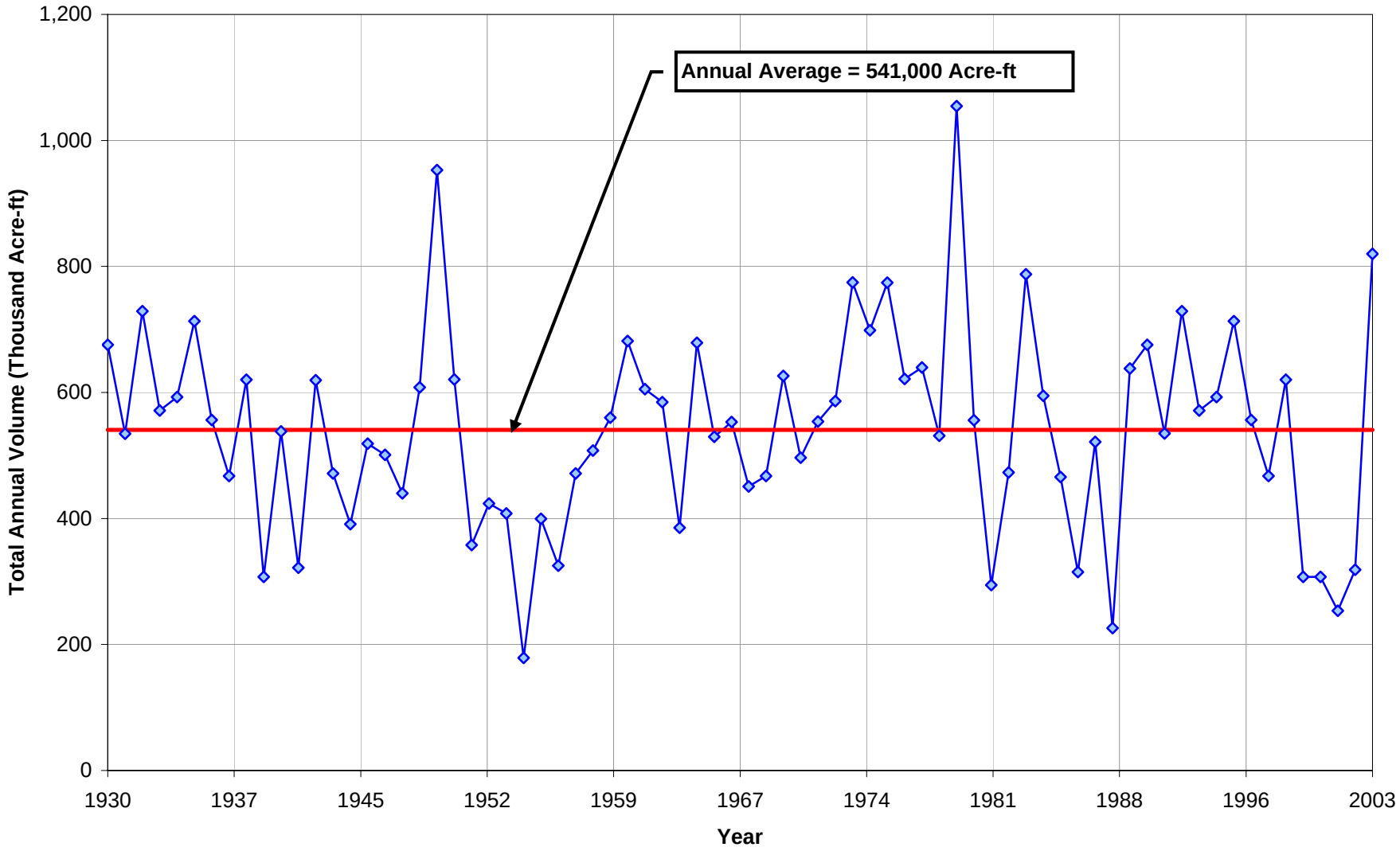
Notes

1 - Lake Norman first came online in 1963

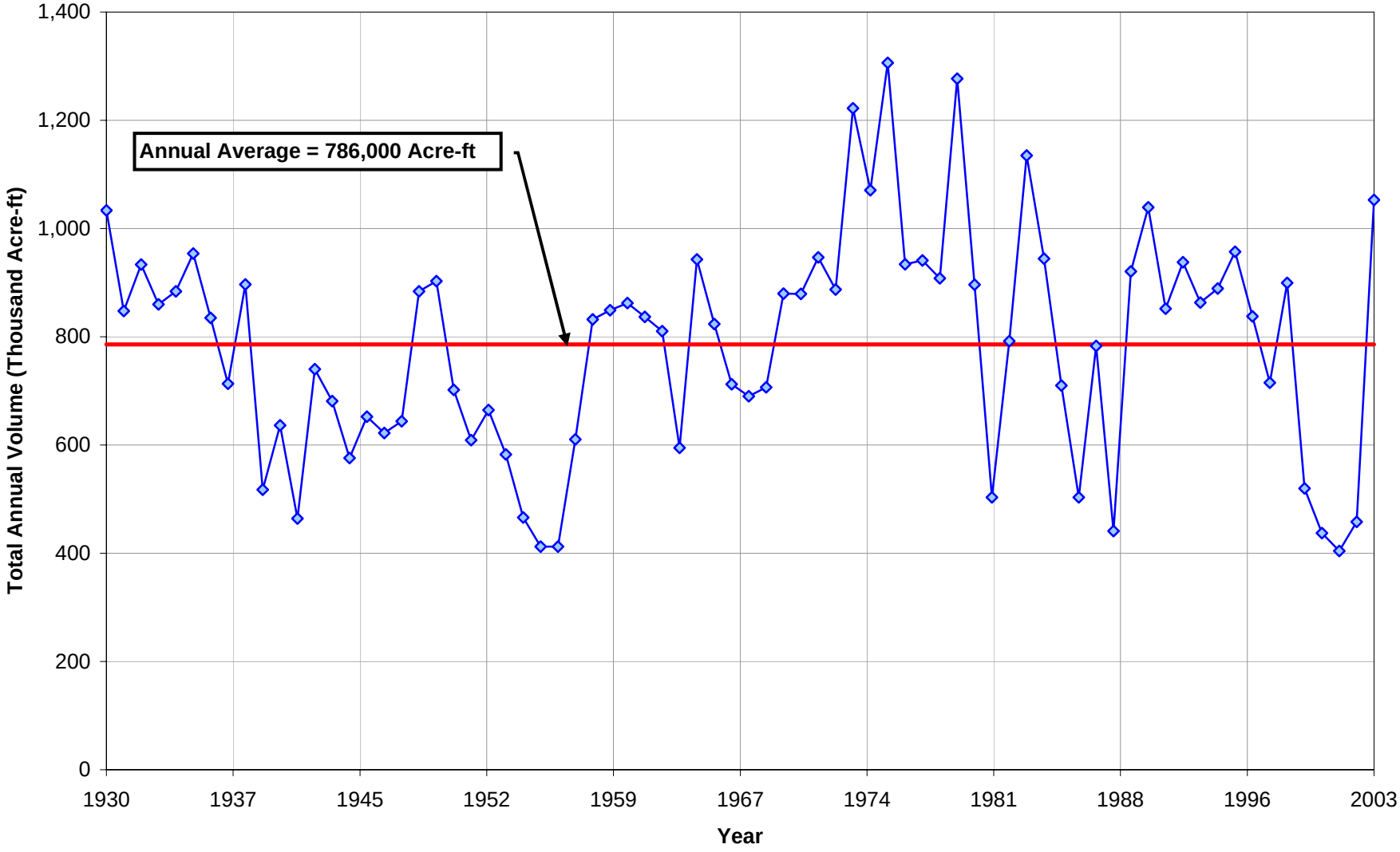
2 - Analysis based on information provided by Devine Tarbell, and Associates (December 3, 2004)

3 - Shaded areas indicate periods of "drought" selected for the Safe Yield Analysis, including beginning and ending years of likely normal or above average "wet" hydrologic conditions.

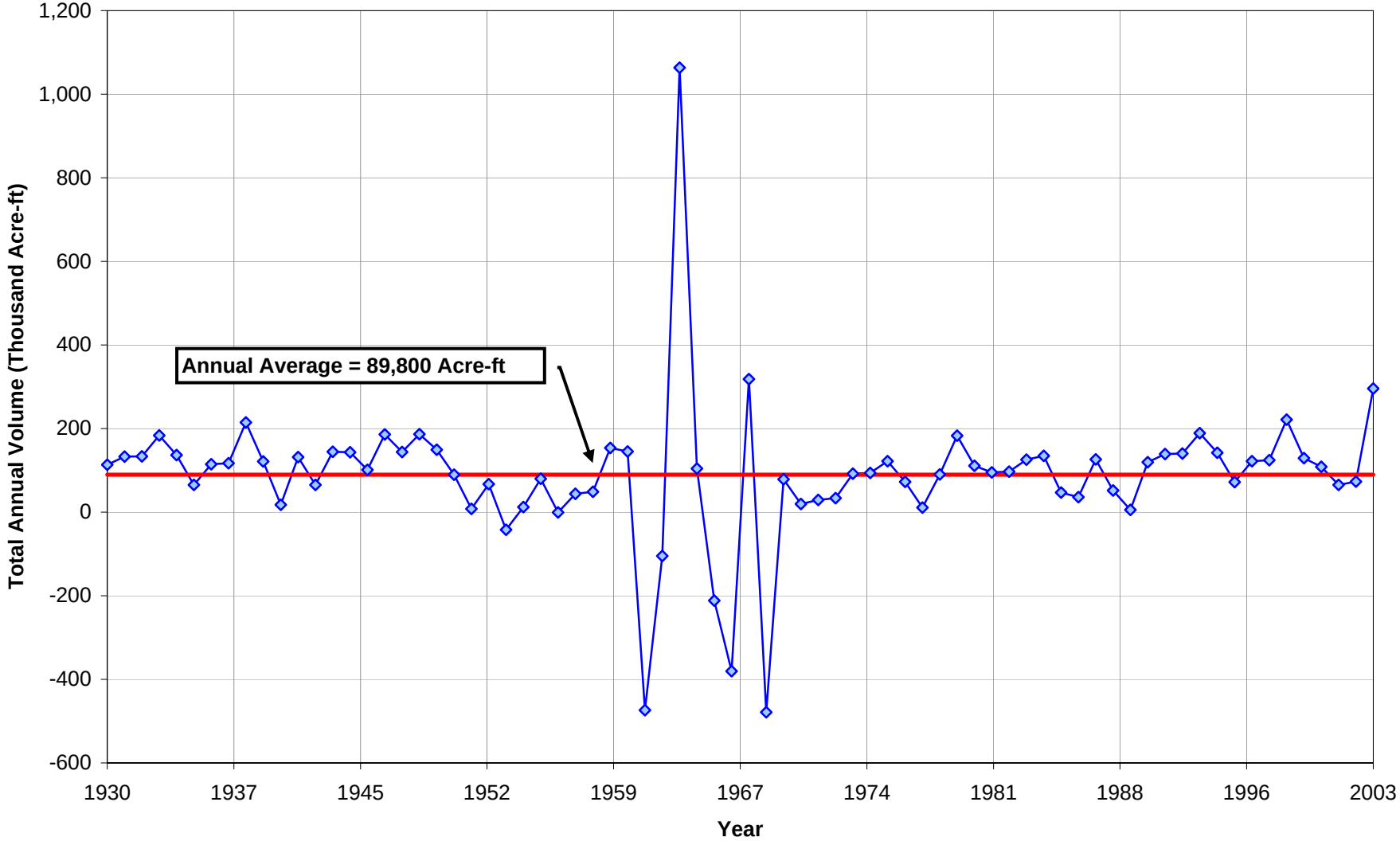
Annual Inflow Volumes for Lake James



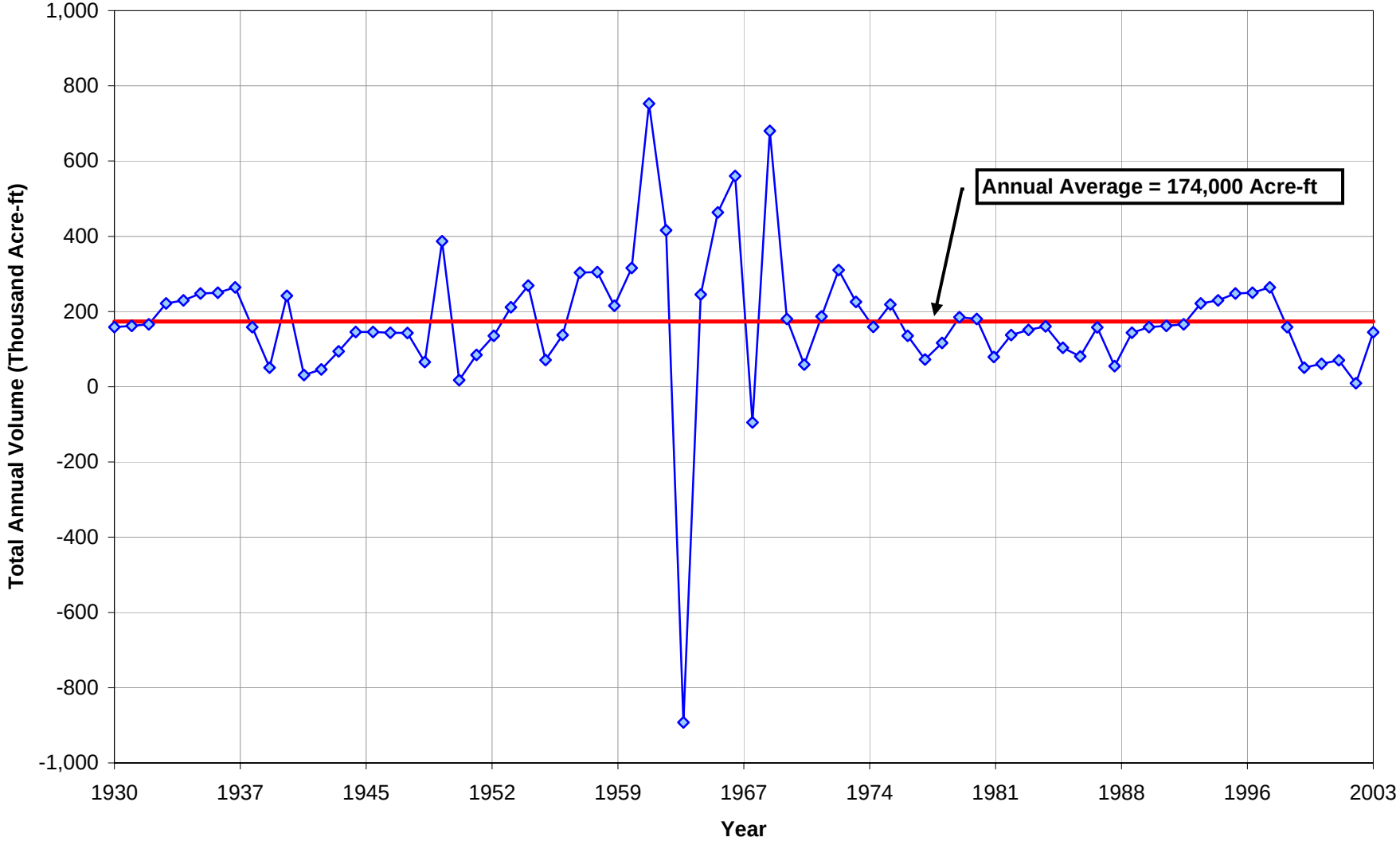
Annual Inflow Volumes for Lake Rhodhiss



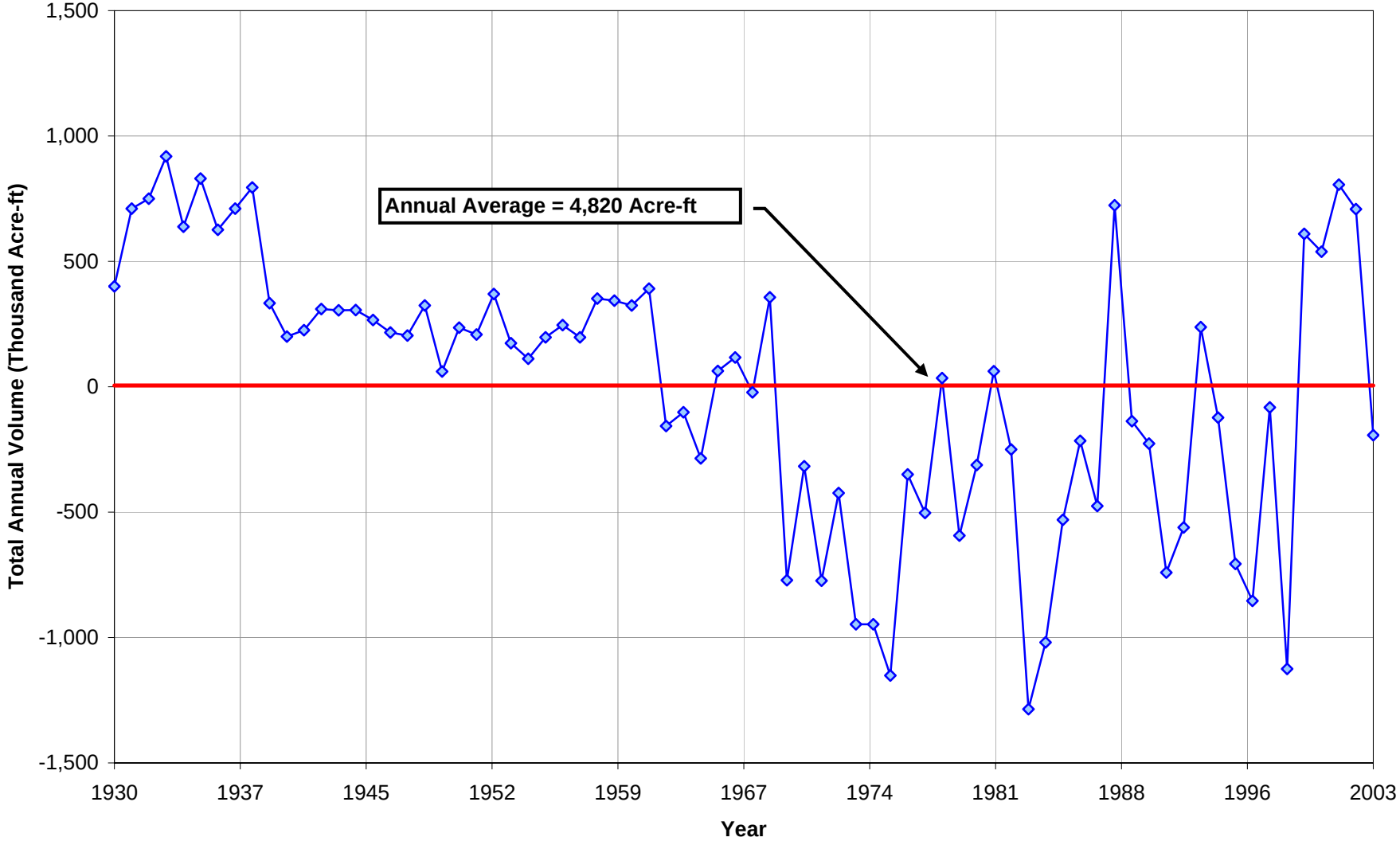
Annual Inflow Volumes for Lake Hickory



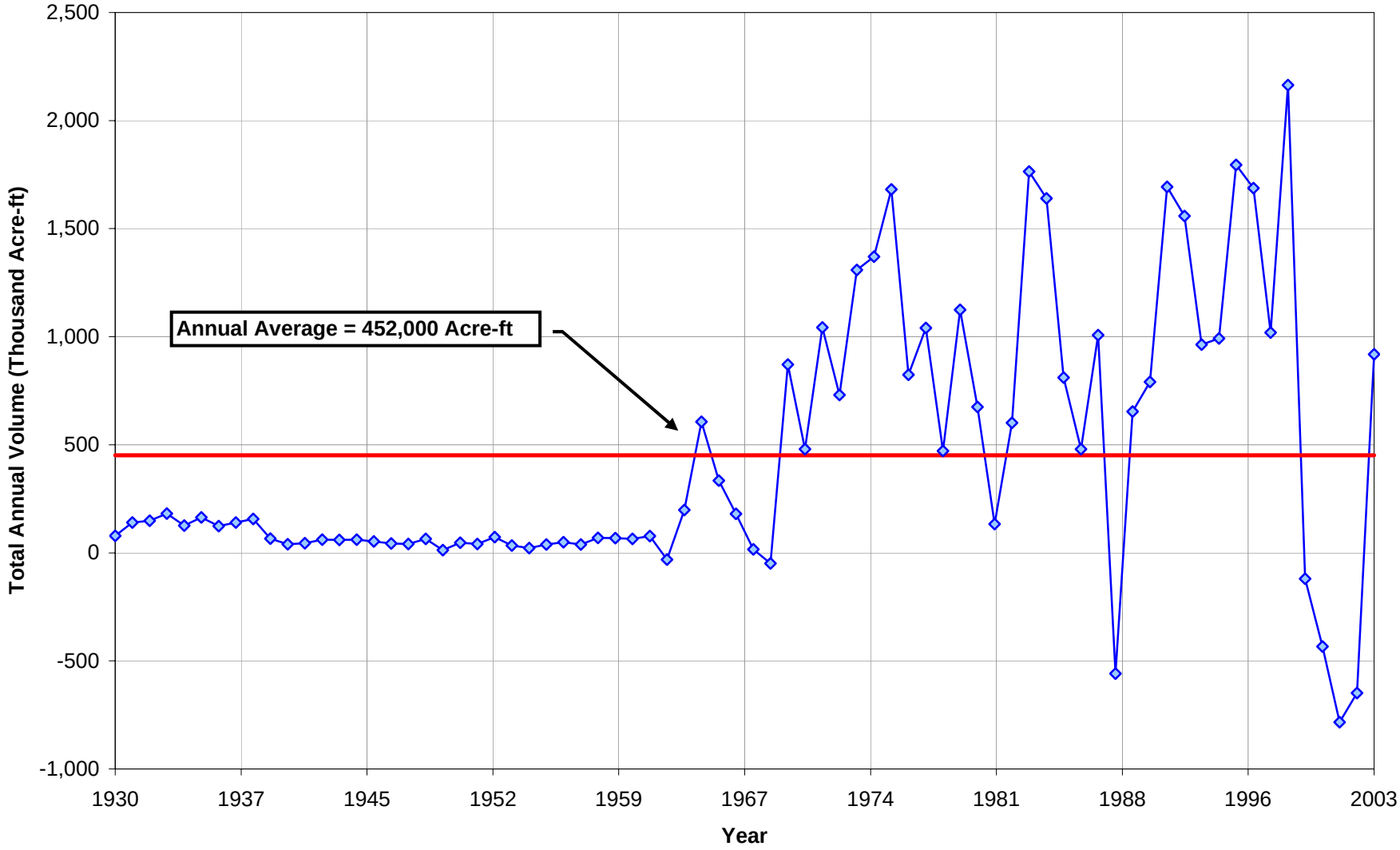
Annual Inflow Volumes for Lookout Shoals Lake



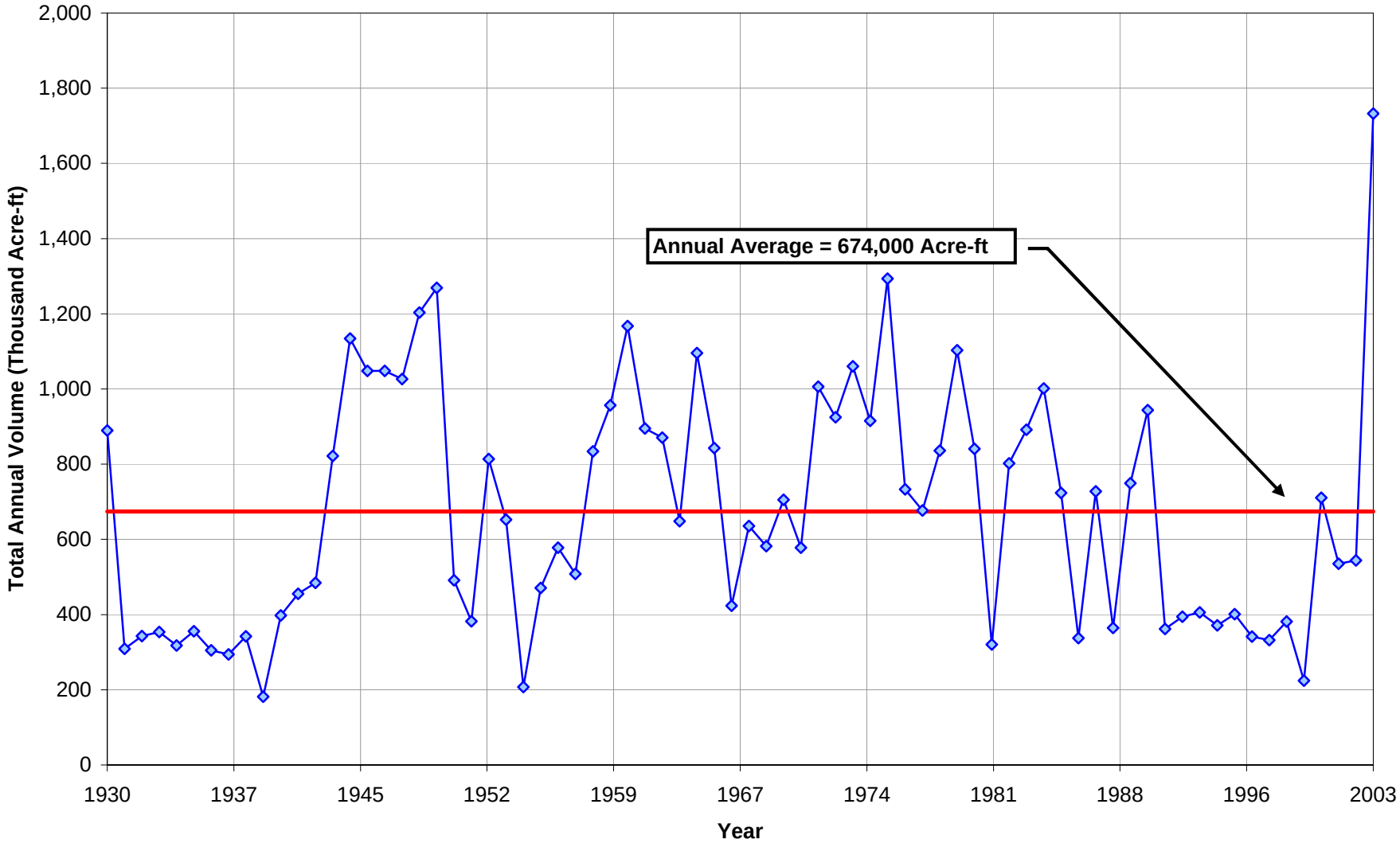
Annual Inflow Volumes for Lake Norman



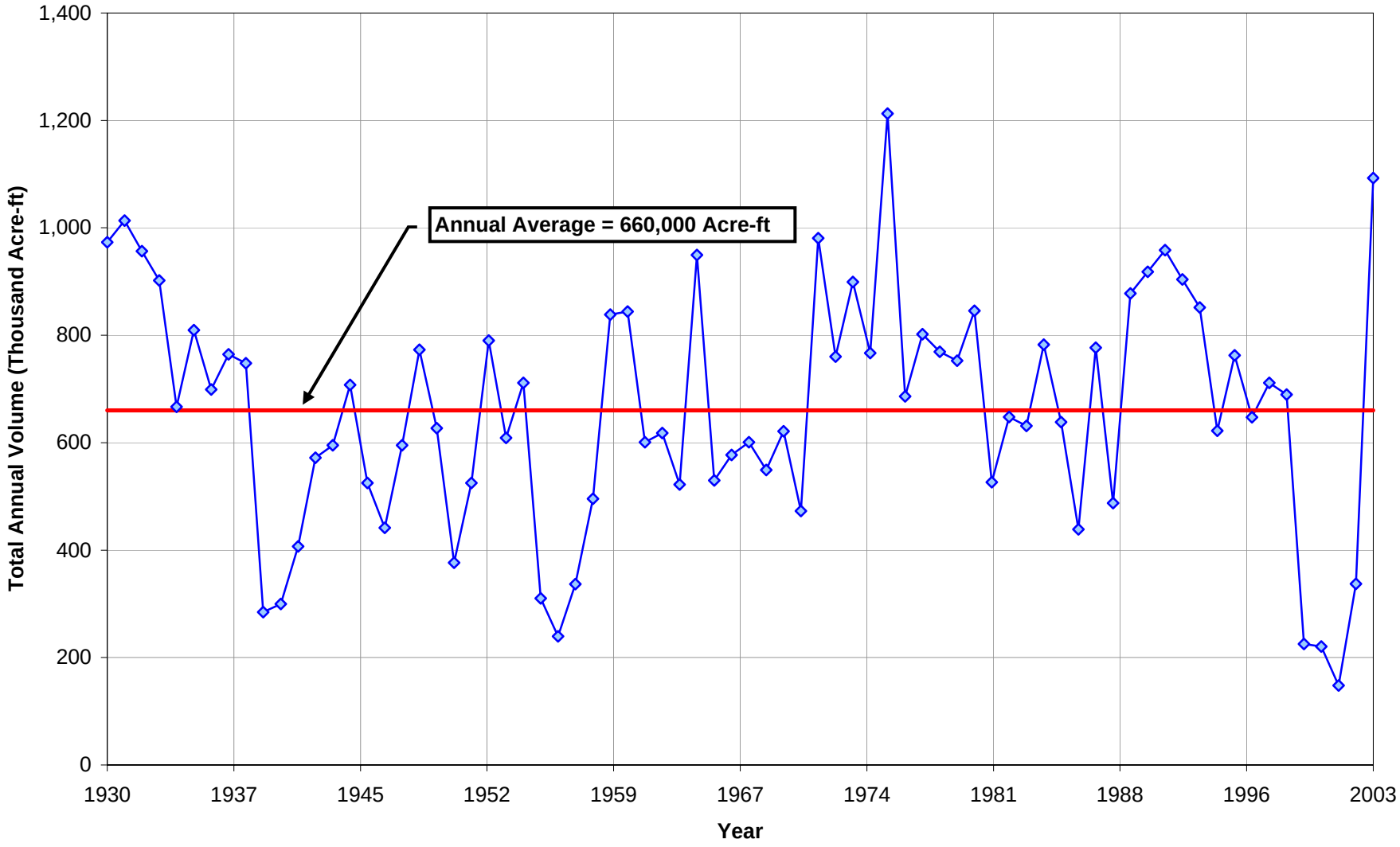
Annual Inflow Volumes for Mountain Island Lake



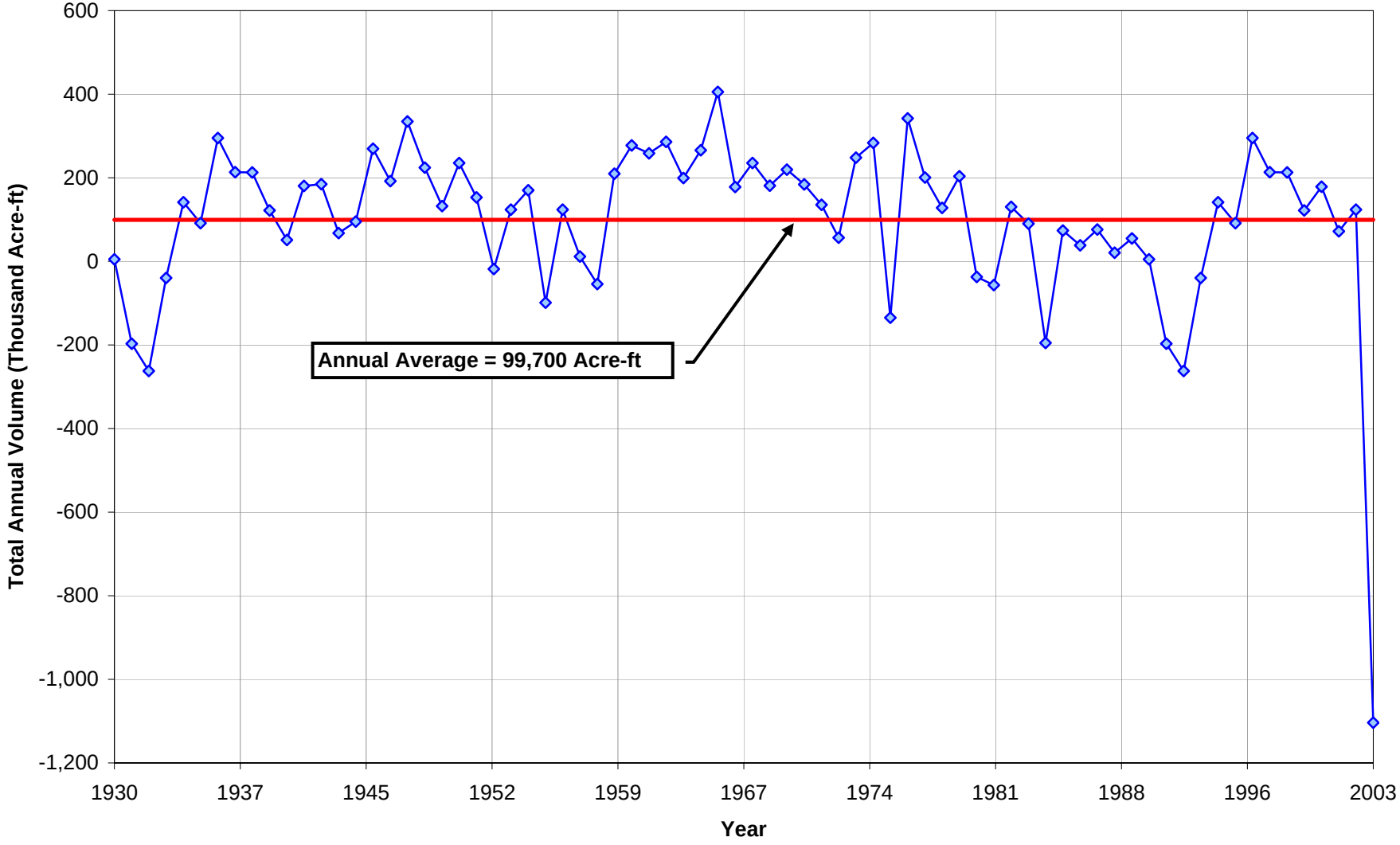
Annual Inflow Volumes for Lake Wylie



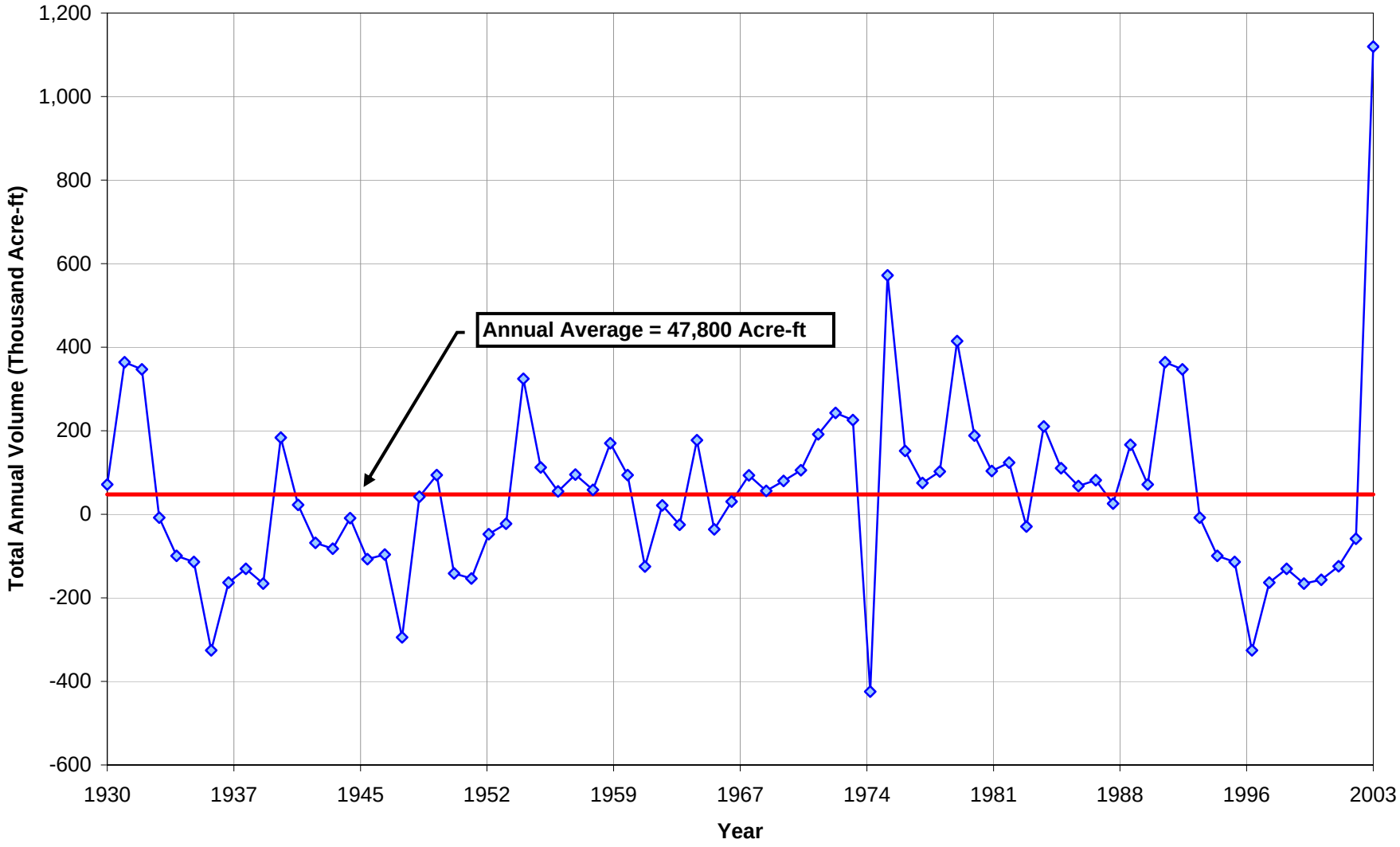
Annual Inflow Volumes for Fishing Creek Reservoir



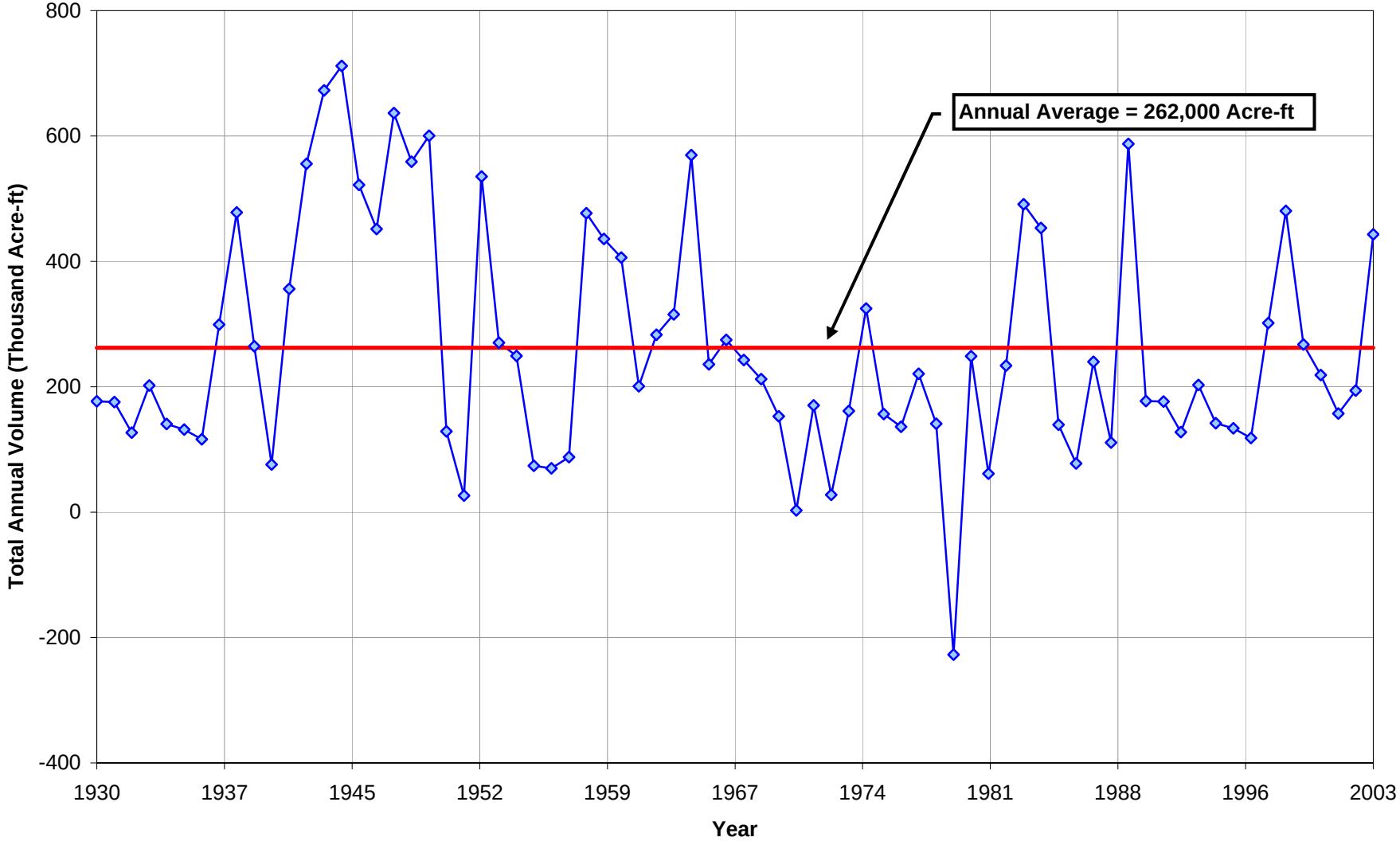
Annual Inflow Volumes for Great Falls-Dearborn Reservoir



Annual Inflow Volumes for Cedar Creek Reservoir



Annual Inflow Volumes for Lake Wateree



APPENDIX I

HYDROELECTRIC ENERGY GENERATION ANALYSIS

Catawba-Wateree Basin
Hydroelectric Energy Generation Analysis
Years When Annual Energy Generation is Less Than the Annual Average for the Period of Record

Year	Hydroelectric Power Stations (Lake)													No. of Stations Below Annual Average Energy Generation
	Bridgewater (James)	Rhodhiss	Oxford (Hickory)	Lookout Shoals	Cownas Ford (Norman)[1]	Mountain Island	Wylie	Fishing Creek	Great Falls	Dearborn	Rocky Creek	Cedar Creek	Wateree	
1930	X	X	X	X	X	X	X	X		X		X	X	10
1931	X	X	X	X	X	X	X	X		X	X	X	X	11
1932	X	X	X	X	X	X	X	X		X	X	X	X	11
1933					X		X	X		X	X	X	X	6
1934	X	X	X	X	X	X	X	X	X	X	X	X	X	12
1935					X		X	X	X	X	X	X	X	7
1936	X				X		X	X	X	X	X		X	7
1937					X				X		X			2
1938	X	X	X	X	X	X	X	X	X	X	X	X	X	12
1939	X	X	X	X	X	X	X	X	X	X	X	X	X	12
1940	X	X	X	X	X	X	X	X	X	X	X	X	X	12
1941	X	X	X	X	X	X	X	X	X	X	X	X	X	12
1942	X	X	X	X	X	X	X	X	X	X	X	X	X	12
1943	X	X	X	X	X	X	X	X	X	X	X	X		11
1944	X	X	X	X	X	X			X		X			7
1945	X	X	X	X	X	X	X	X	X	X	X	X	X	12
1946		X		X	X	X		X	X		X			6
1947	X	X	X	X	X	X	X	X	X	X	X	X	X	12
1948					X				X		X			2
1949					X						X			1
1950				X	X	X	X	X	X	X	X	X	X	9
1951	X	X	X	X	X	X	X	X	X	X	X	X	X	12
1952	X	X	X	X	X	X	X	X	X	X	X	X	X	12
1953	X	X	X	X	X	X	X	X	X	X	X	X	X	12
1954	X	X	X	X	X	X	X	X	X	X	X	X	X	12
1955	X	X	X	X	X	X	X	X	X	X	X	X	X	12
1956	X	X	X	X	X	X	X	X	X	X	X	X	X	12
1957					X				X		X			2
1958					X				X		X			2

Catawba-Wateree Basin
Hydroelectric Energy Generation Analysis
Years When Annual Energy Generation is Less Than the Annual Average for the Period of Record

Year	Hydroelectric Power Stations (Lake)													No. of Stations Below Annual Average Energy Generation
	Bridgewater (James)	Rhodhiss	Oxford (Hickory)	Lookout Shoals	Cownas Ford (Norman)[1]	Mountain Island	Wylie	Fishing Creek	Great Falls	Dearborn	Rocky Creek	Cedar Creek	Wateree	
1959					X				X		X			2
1960					X									0
1961					X				X					1
1962					X	X	X	X	X					4
1963	X	X	X	X	X	X	X	X	X	X	X	X	X	13
1964														0
1965														0
1966	X	X	X	X		X	X	X	X	X	X	X	X	12
1967	X	X	X	X		X	X	X	X	X	X	X	X	12
1968	X	X	X	X		X	X	X	X			X	X	10
1969						X	X							2
1970	X		X	X		X	X	X		X		X	X	9
1971														0
1972														0
1973											X			1
1974											X			1
1975														0
1976														0
1977														0
1978														0
1979														0
1980														0
1981	X	X	X	X		X	X	X	X	X	X	X	X	12
1982	X	X	X	X		X			X					6
1983														0
1984														0
1985	X	X	X	X		X	X	X		X	X	X	X	11
1986	X	X	X	X	X	X	X	X	X	X	X	X	X	13
1987		X	X							X				3

Catawba-Wateree Basin
Hydroelectric Energy Generation Analysis
Years When Annual Energy Generation is Less Than the Annual Average for the Period of Record

Year	Hydroelectric Power Stations (Lake)													No. of Stations Below Annual Average Energy Generation
	Bridgewater (James)	Rhodhiss	Oxford (Hickory)	Lookout Shoals	Cownas Ford (Norman)[1]	Mountain Island	Wylie	Fishing Creek	Great Falls	Dearborn	Rocky Creek	Cedar Creek	Wateree	
1988	X	X	X	X	X	X	X	X	X	X	X	X	X	13
1989														0
1990														0
1991										X				1
1992														0
1993										X				1
1994											X			1
1995										X				1
1996											X			1
1997	X	X	X			X						X		5
1998			X											1
1999	X	X	X	X	X	X	X	X	X	X	X	X	X	13
2000	X	X	X	X	X	X	X	X	X	X	X	X	X	13
2001	X	X	X	X	X	X	X	X	X	X	X	X	X	13
2002	X	X	X	X	X	X	X	X	X	X	X	X	X	13
2003									X					1

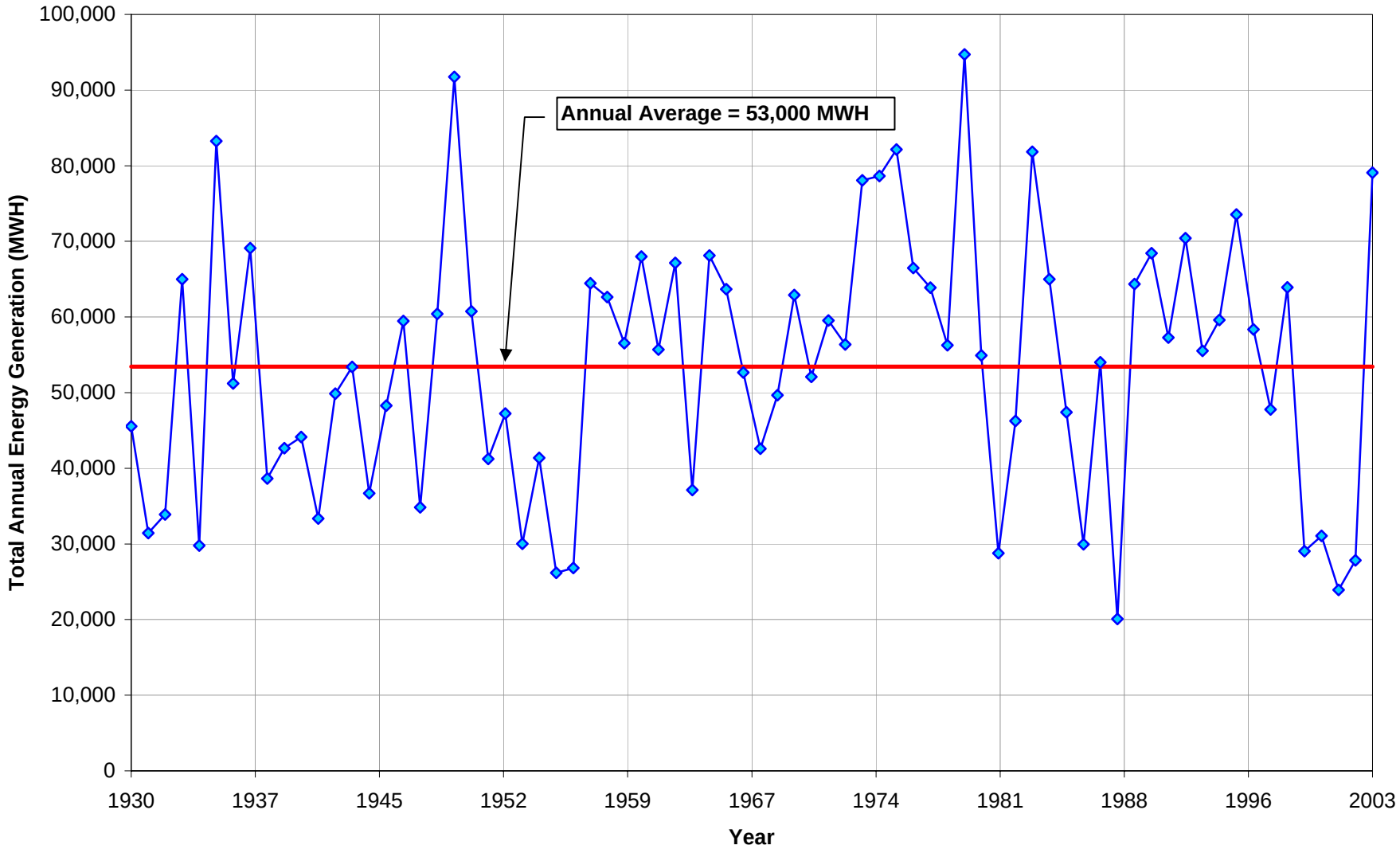
Notes

1 - Cowans Ford first came online in 1963.

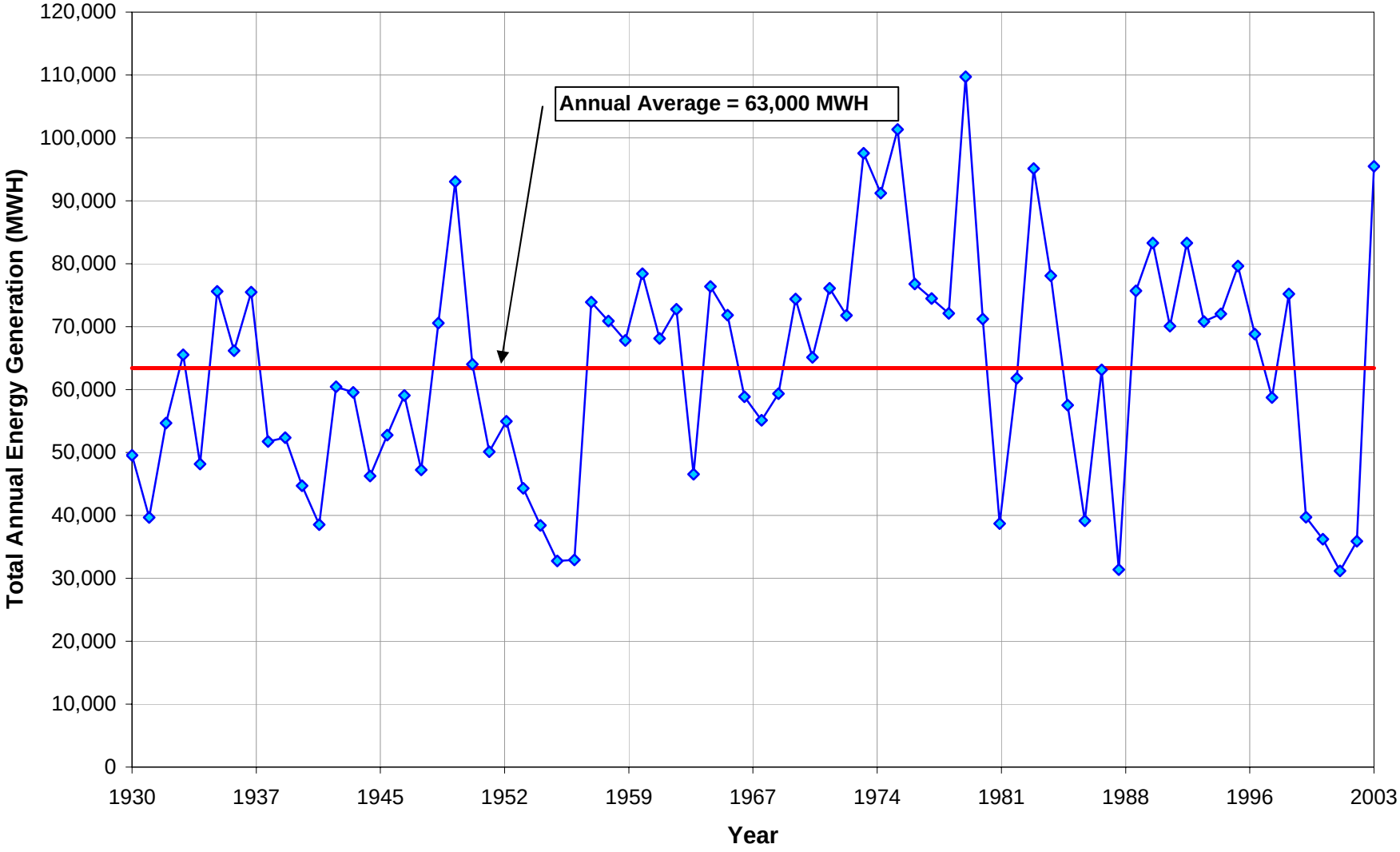
2 - Analysis is based on information provided by Devine, Tarbell, and Associates (December 3, 2005).

3 - Shaded areas indicate periods of "drought" selected for the Safe Yield Analysis, including beginning and ending years of likely normal or above average "wet" hydrologic conditions.

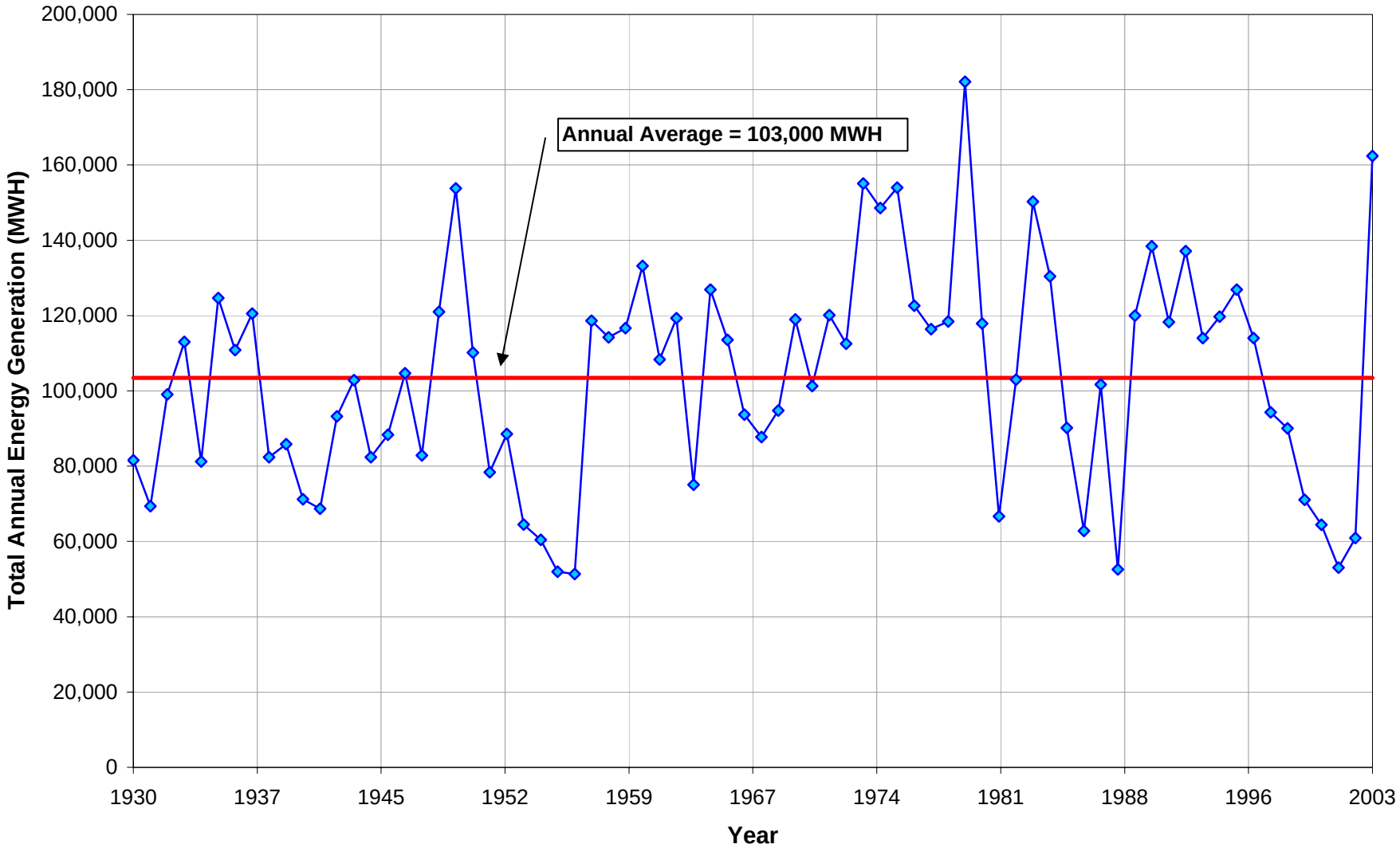
Annual Energy Generation for Bridgewater Hydroelectric Station



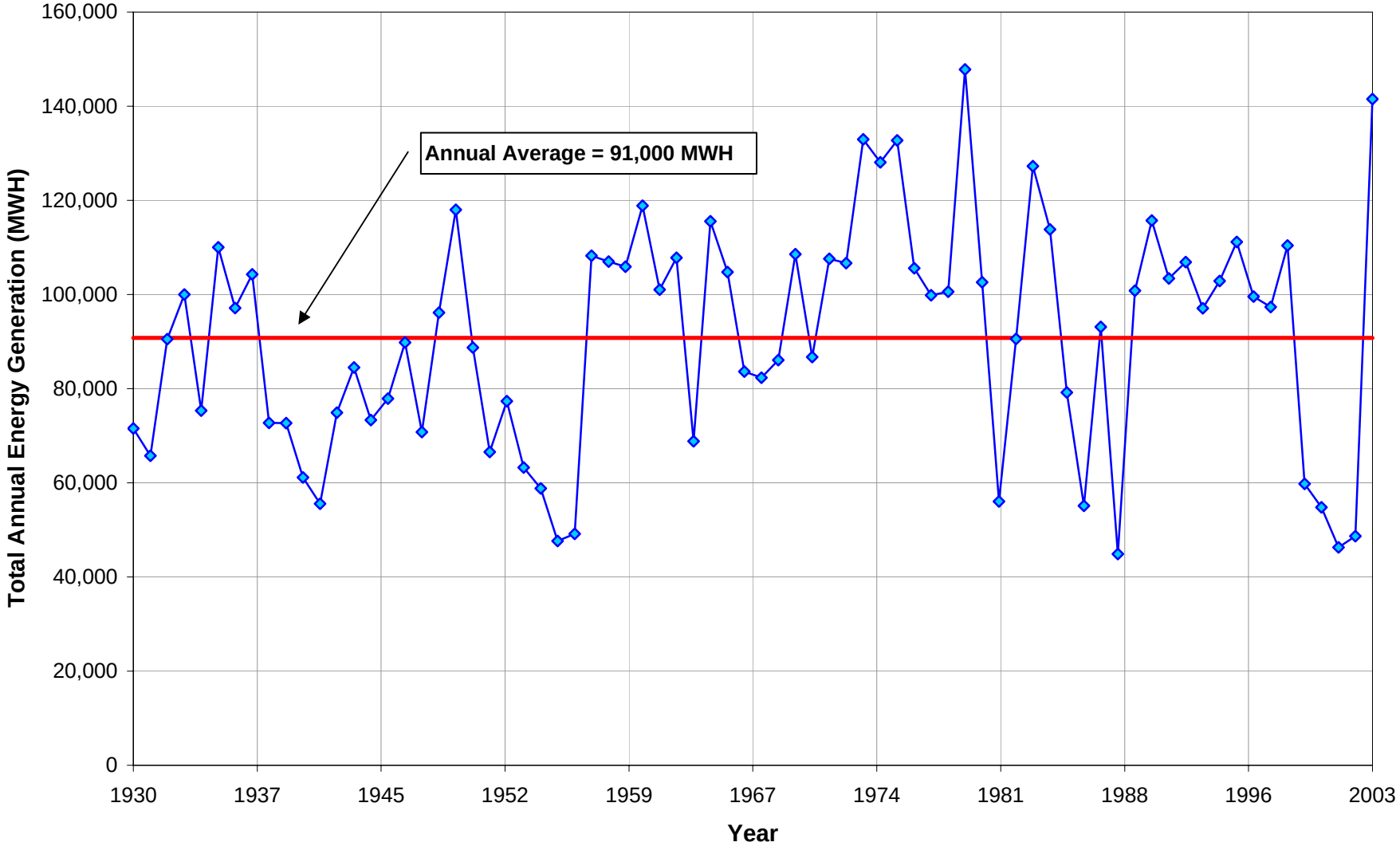
Annual Energy Generation for Rhodhiss Hydroelectric Station



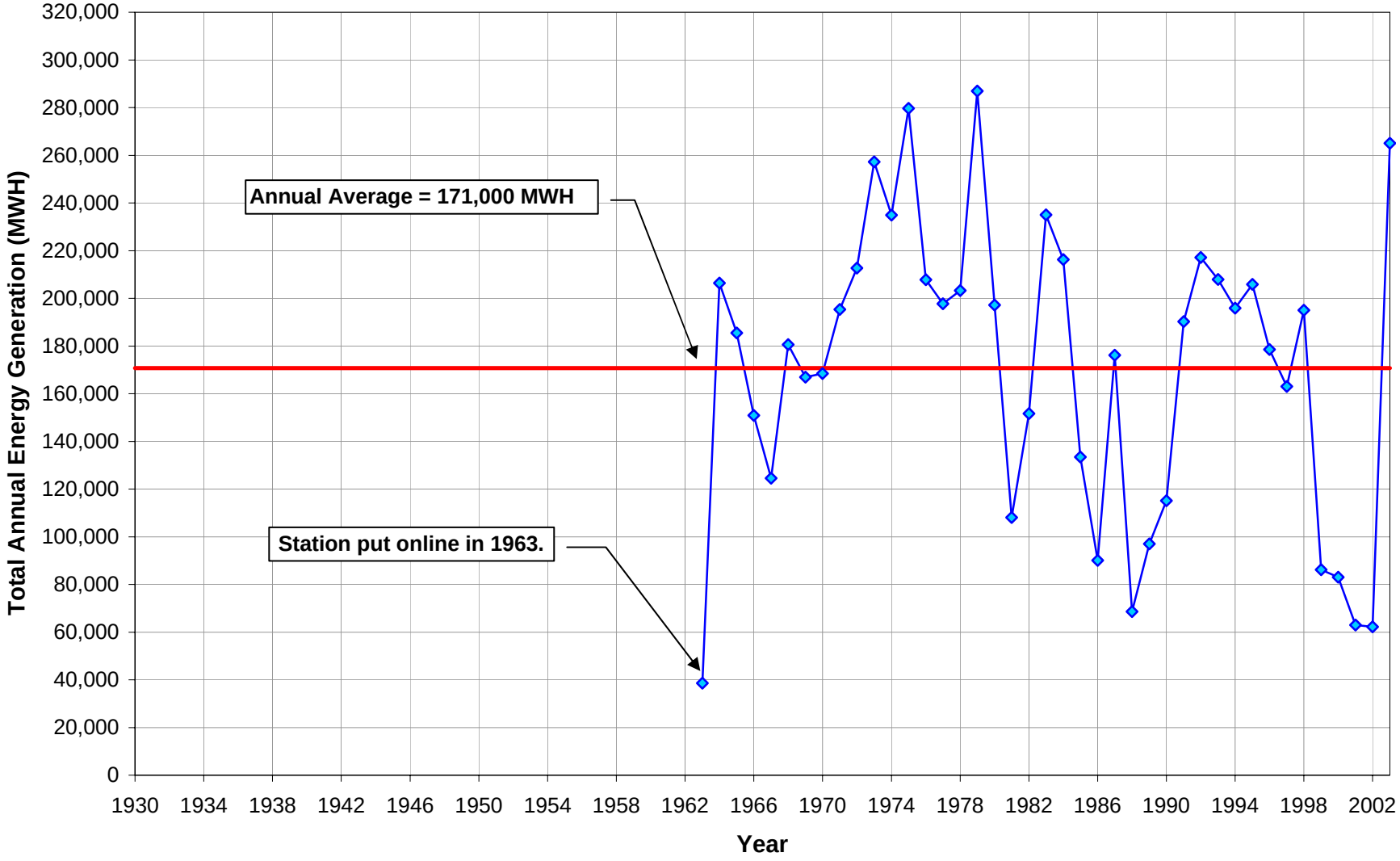
Annual Energy Generation for Oxford Hydroelectric Station



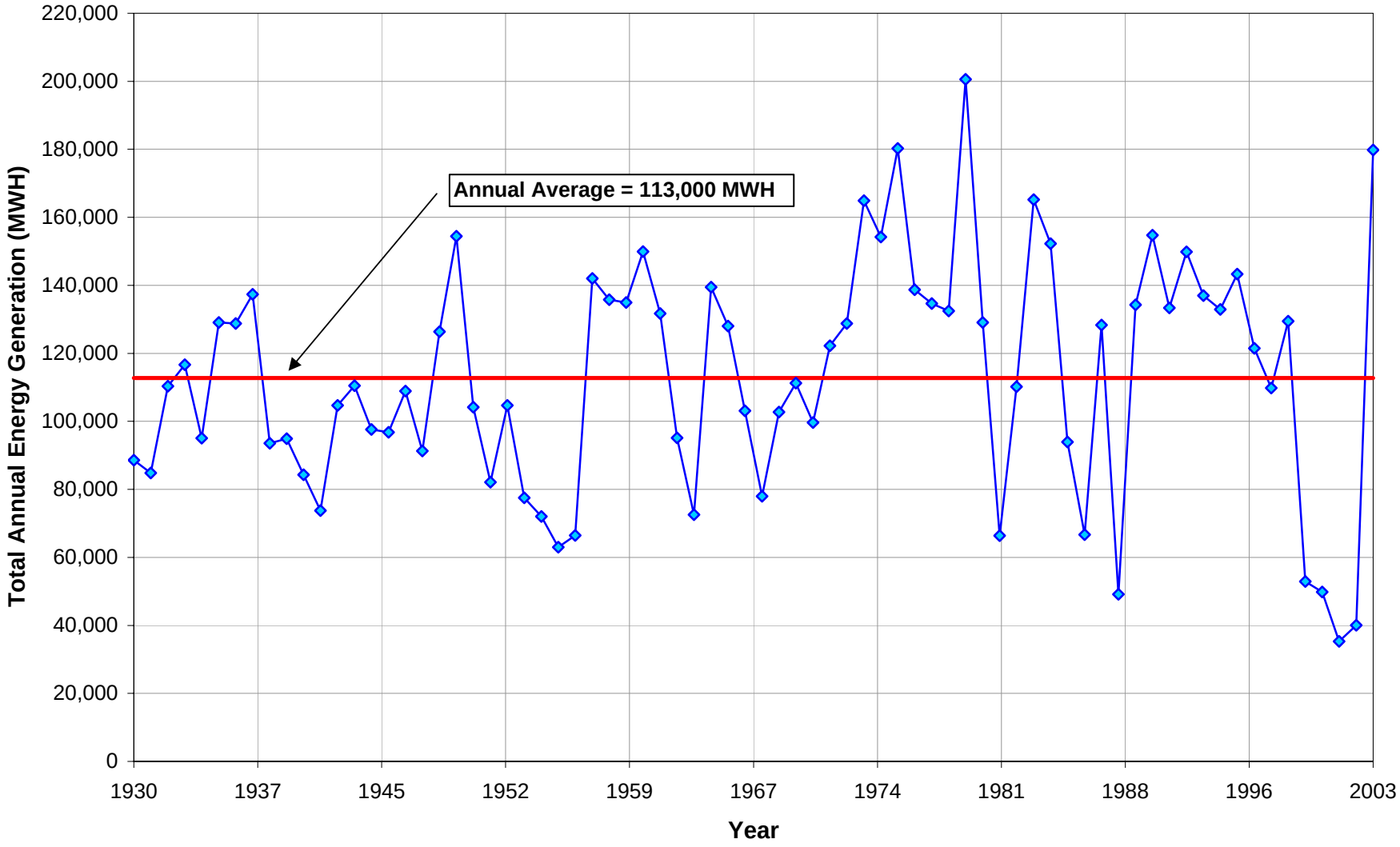
Annual Energy Generation for Lookout Shoals Hydroelectric Station



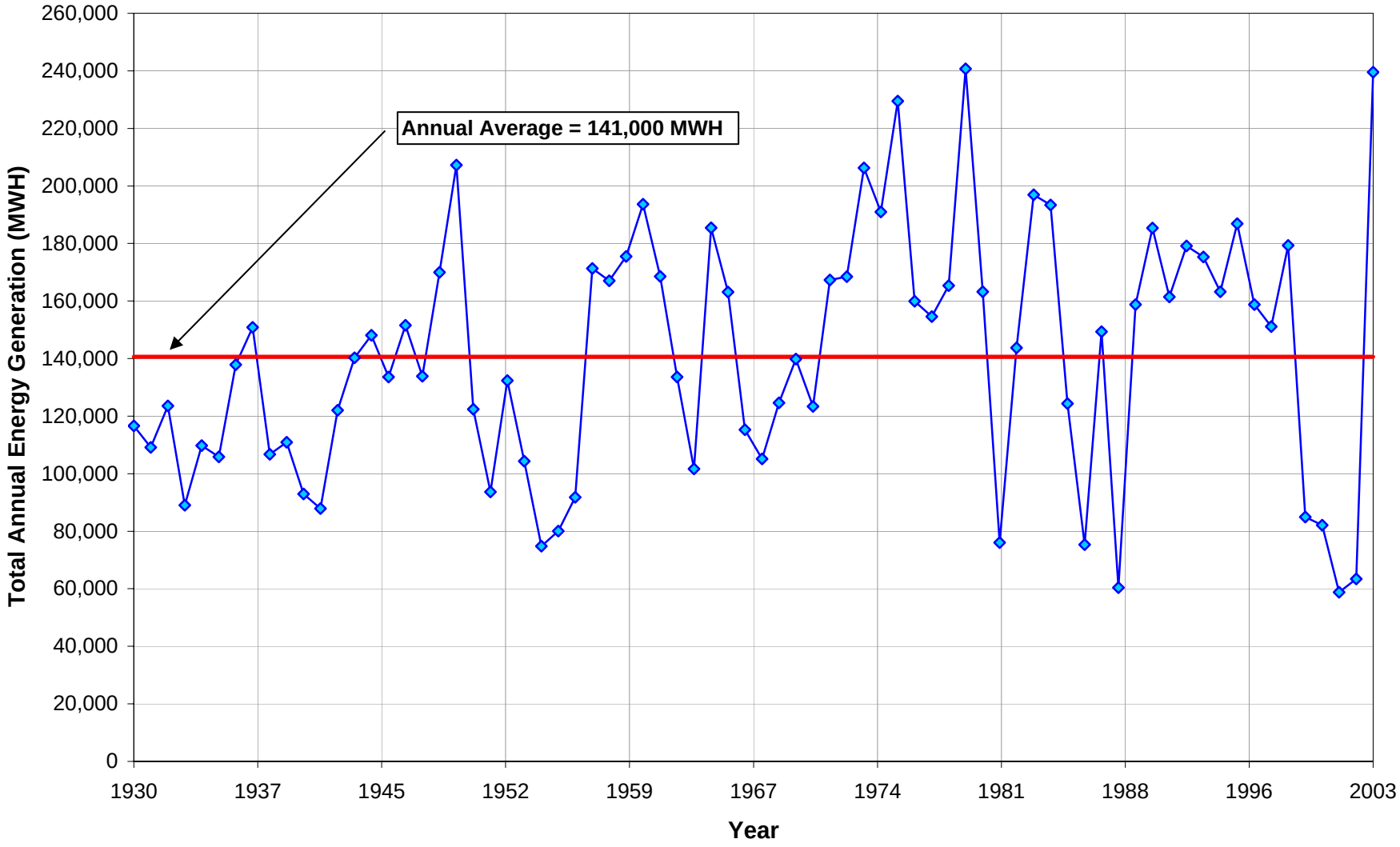
Annual Energy Generation for Cowans Ford Hydroelectric Station



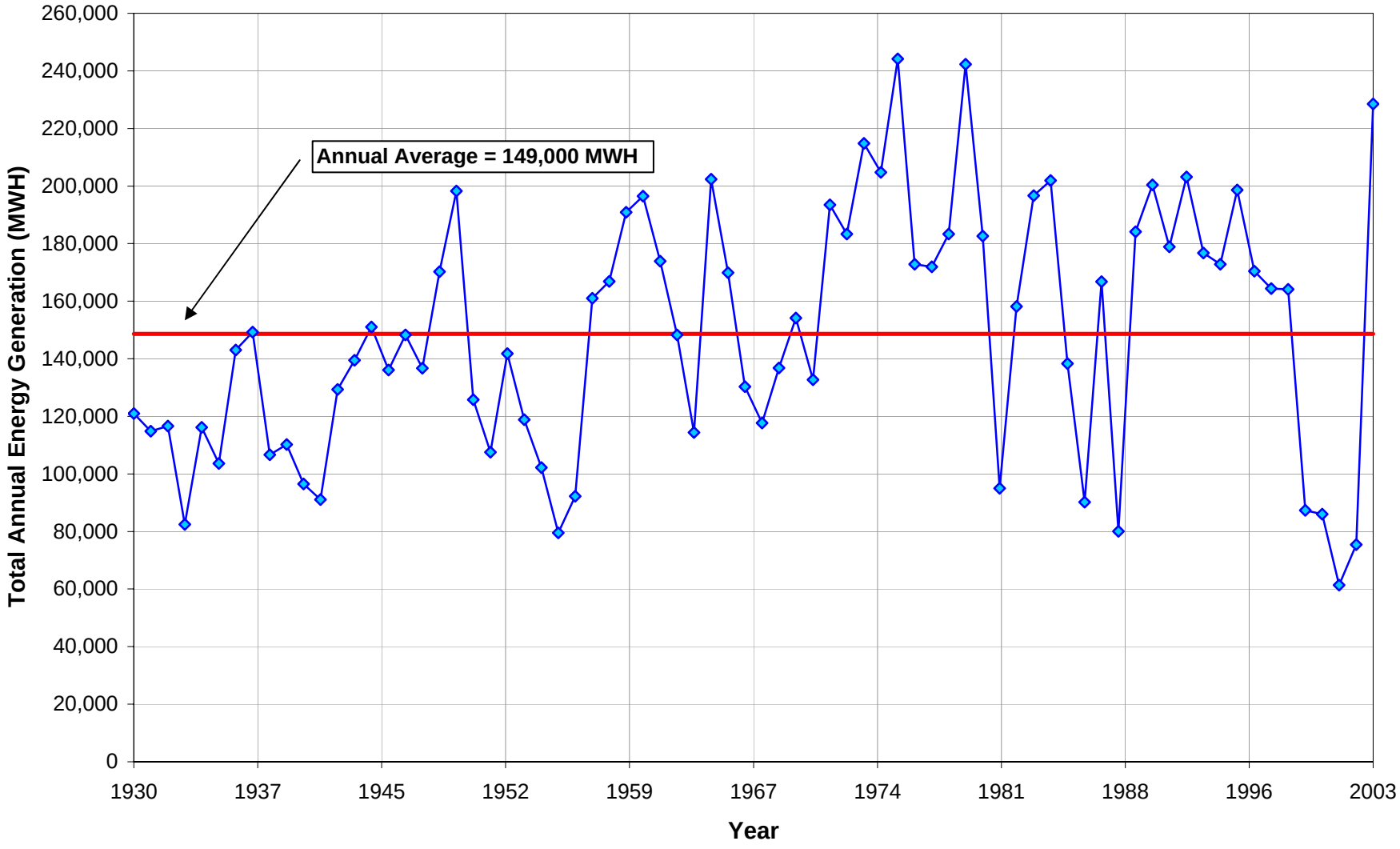
Annual Energy Generation for Mountain Island Hydroelectric Station



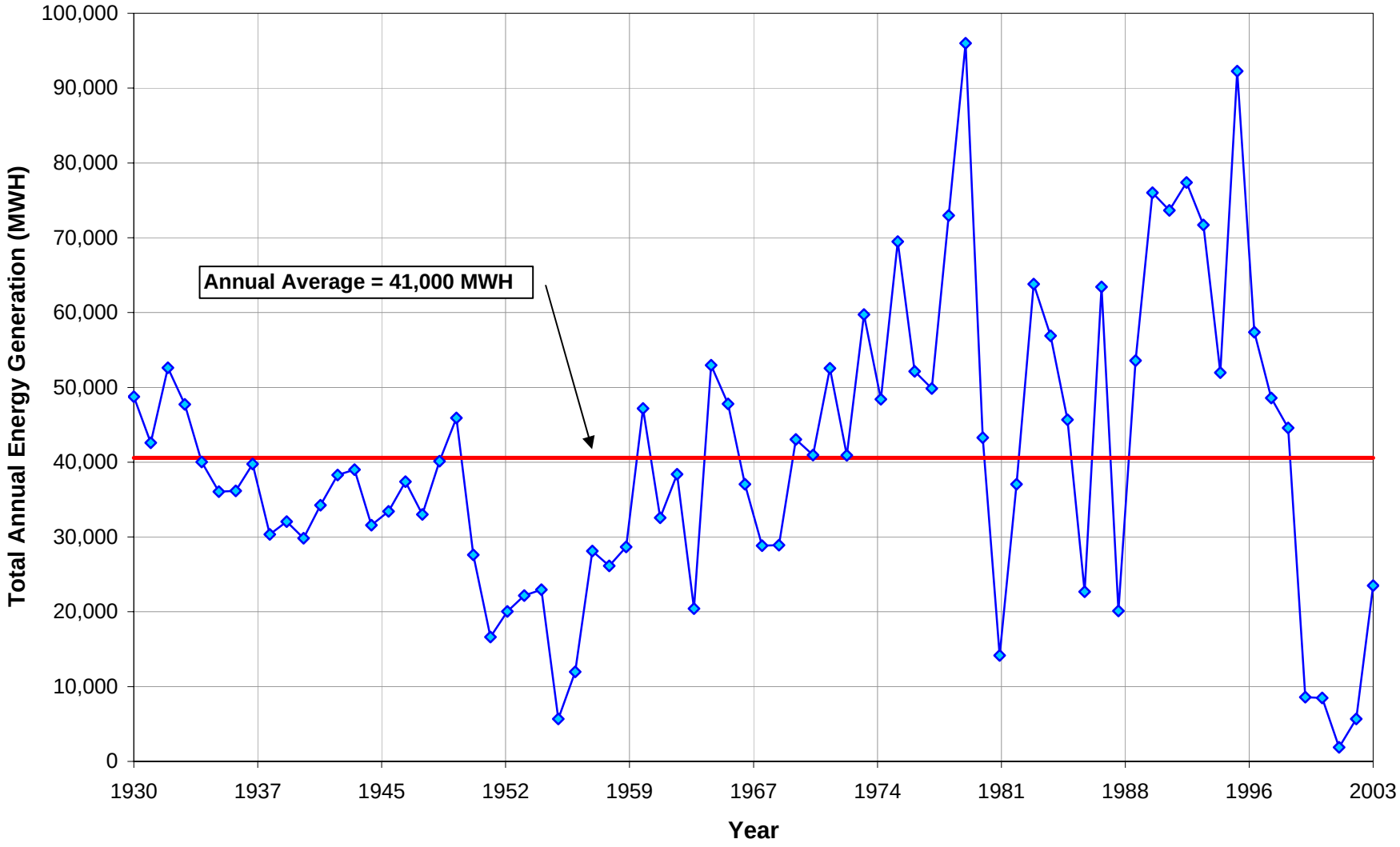
Annual Energy Generation for Wylie Hydroelectric Station



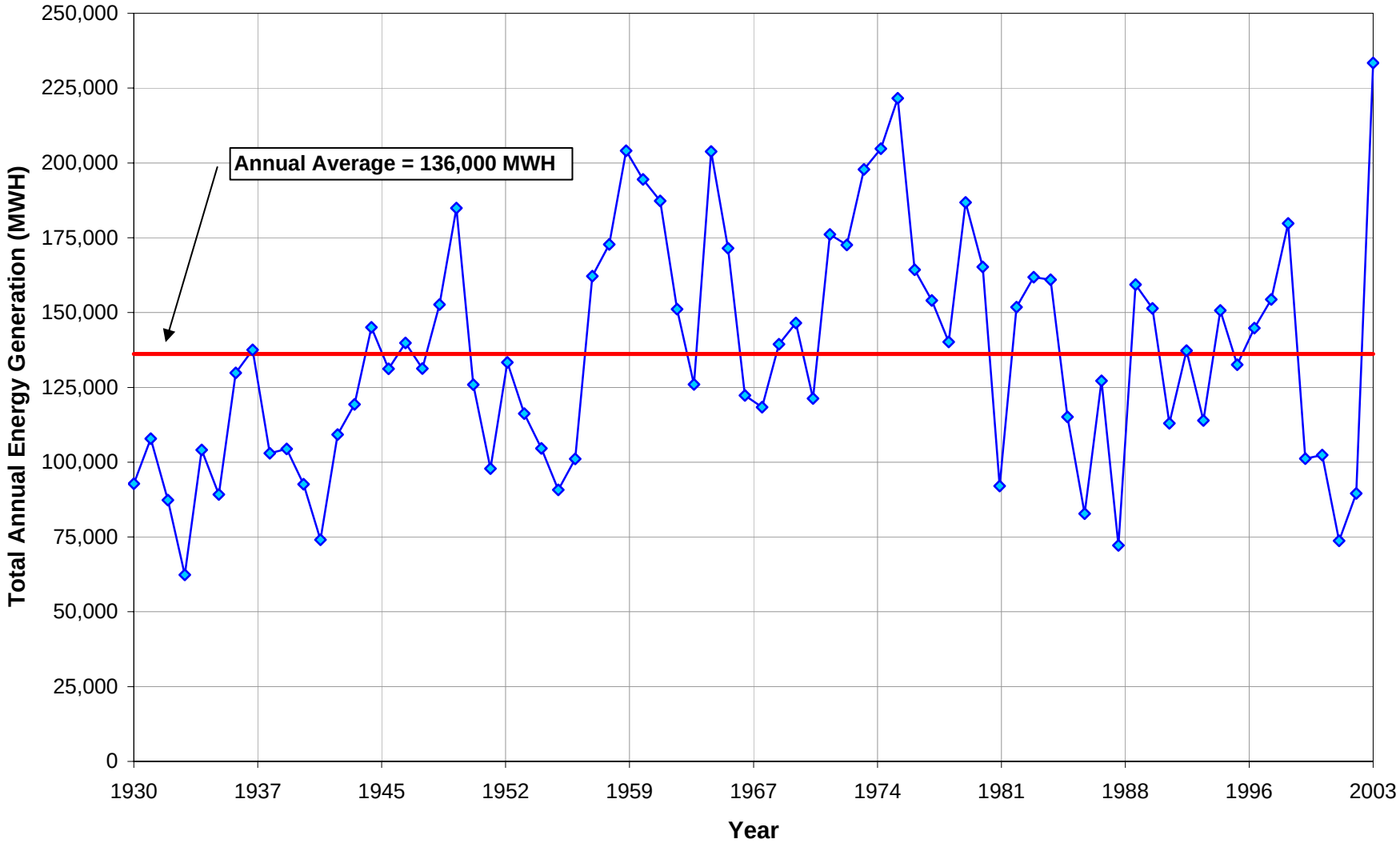
Annual Energy Generation for Fishing Creek Hydroelectric Station



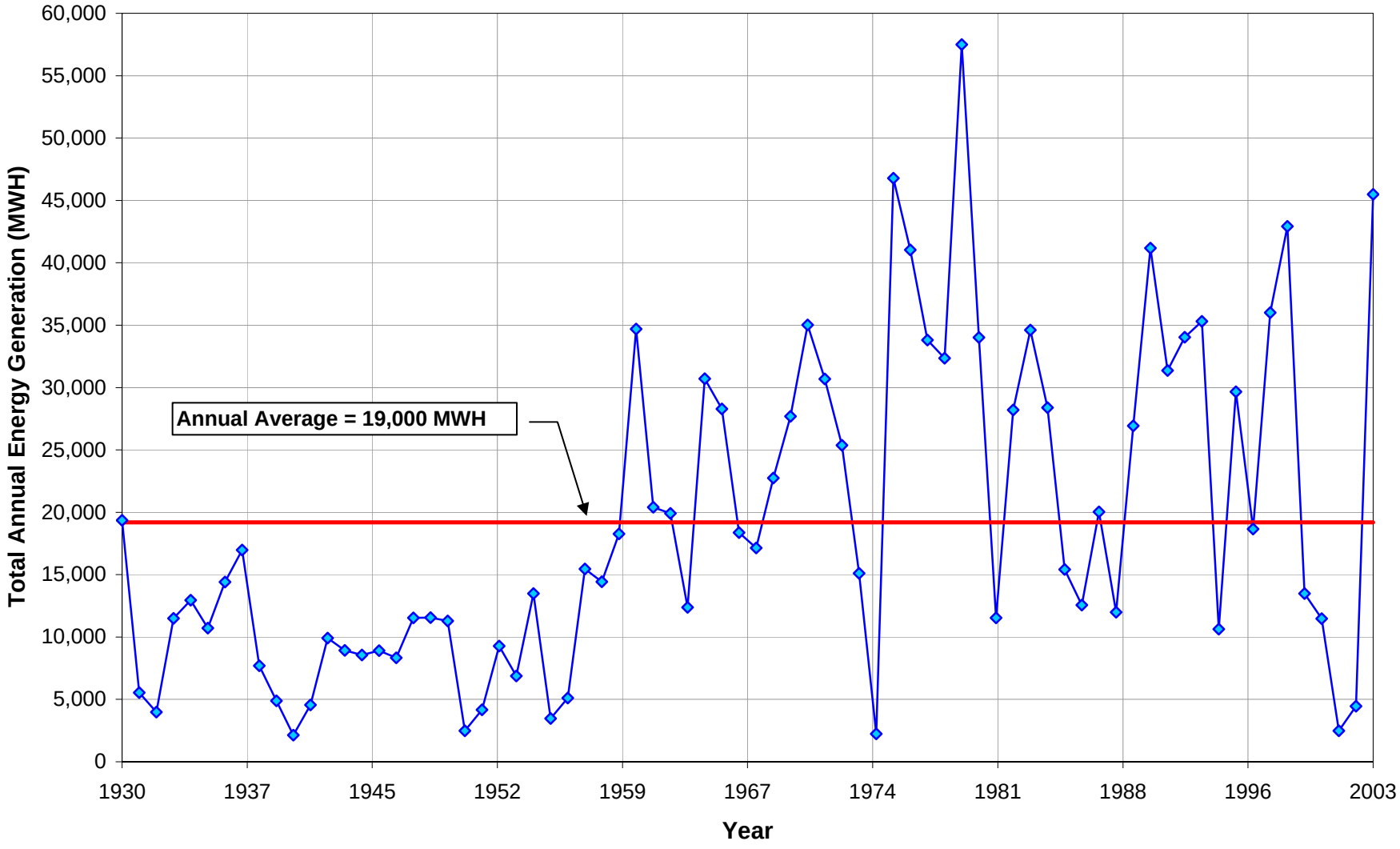
Annual Energy Generation for Great Falls Hydroelectric Station



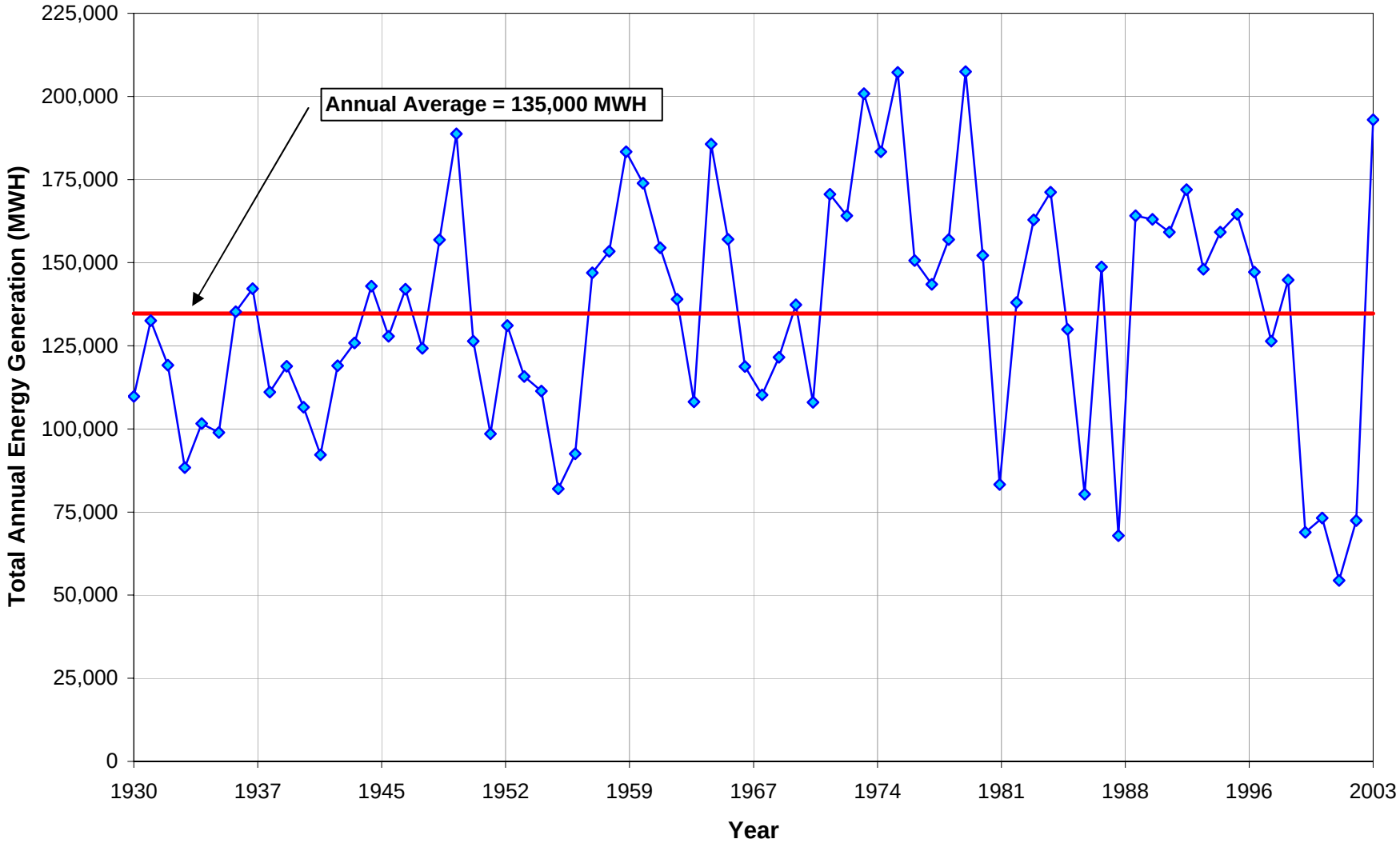
Annual Energy Generation for Dearborn Hydroelectric Station

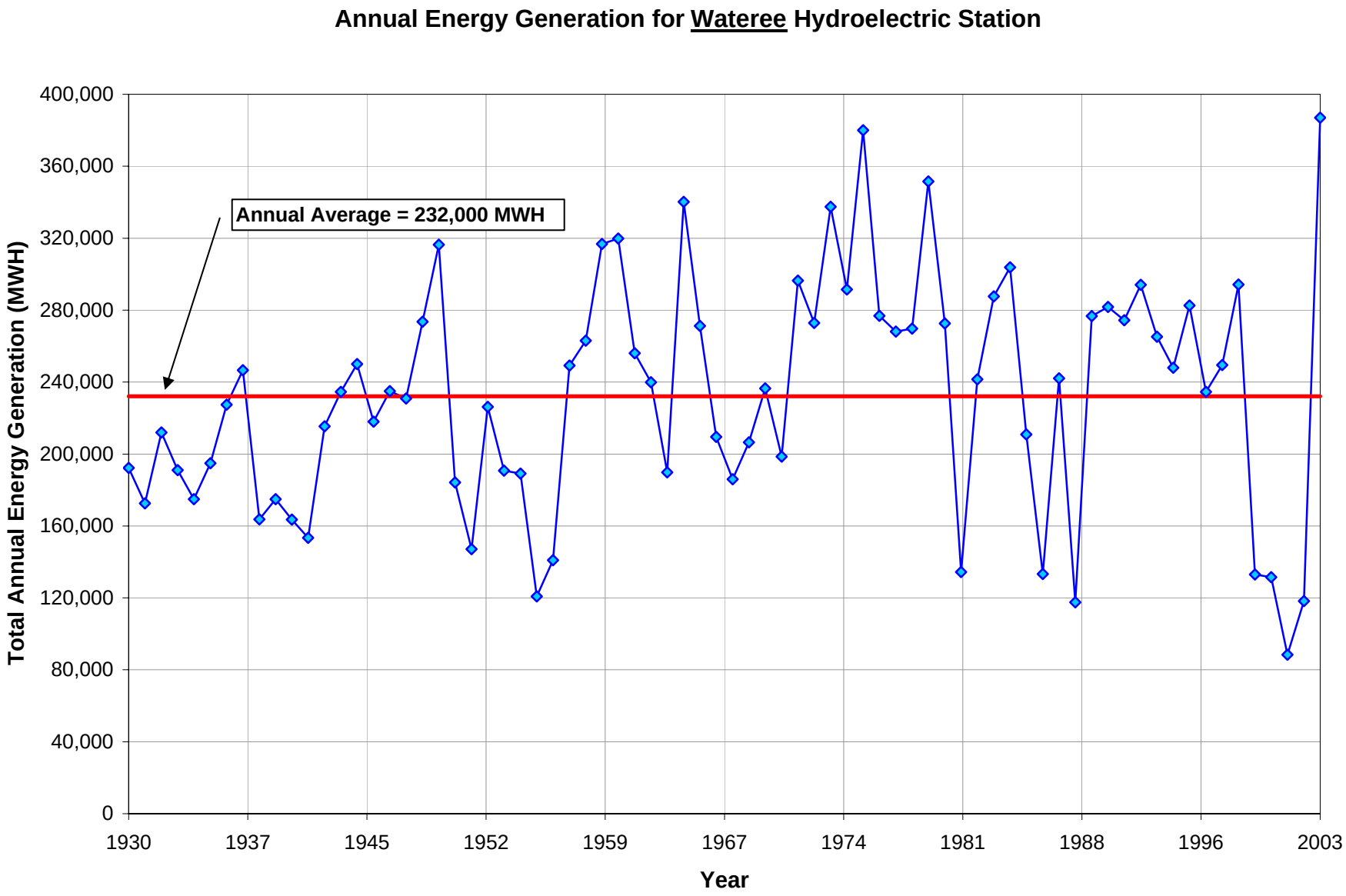


Annual Energy Generation for Rocky Creek Hydroelectric Station



Annual Energy Generation for Cedar Creek Hydroelectric Station




Annual Energy Generation for Wateree Hydroelectric Station
Annual Average = 232,000 MWH
Total Annual Energy Generation (MWH)
400,000
360,000
320,000
280,000
240,000
200,000
160,000
120,000
80,000
40,000
0
1930
1937
1945
1952
1959
1967
1974
1981
1988
1996
2003
Year

APPENDIX J

SAFE YIELD ANALYSIS

Appendix J – Graph Series 1

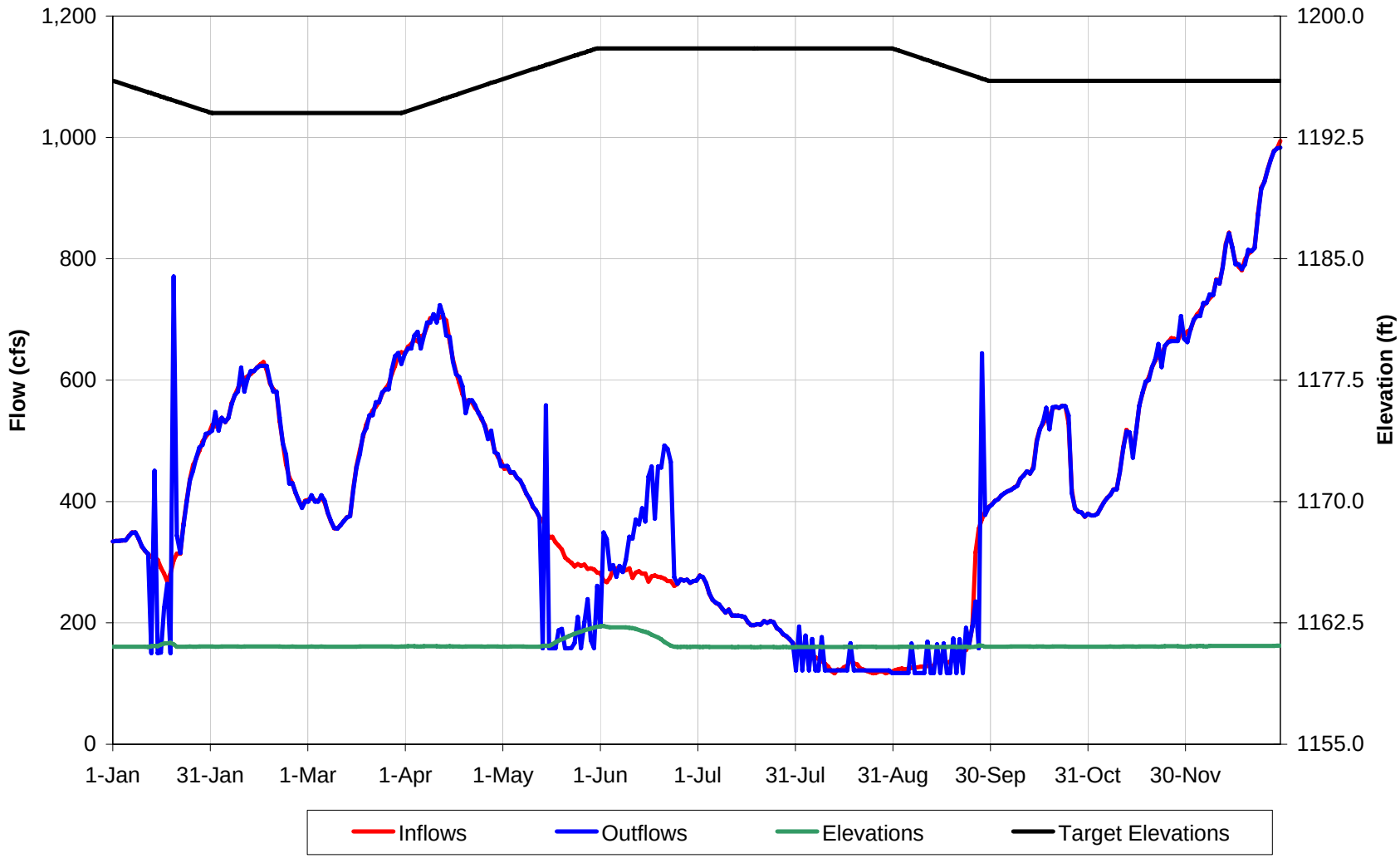
Baseline Operations
Critical Elevations Scenario
Low Inflow Period 5
2048 Flows
2002 Hydrology

Observations:

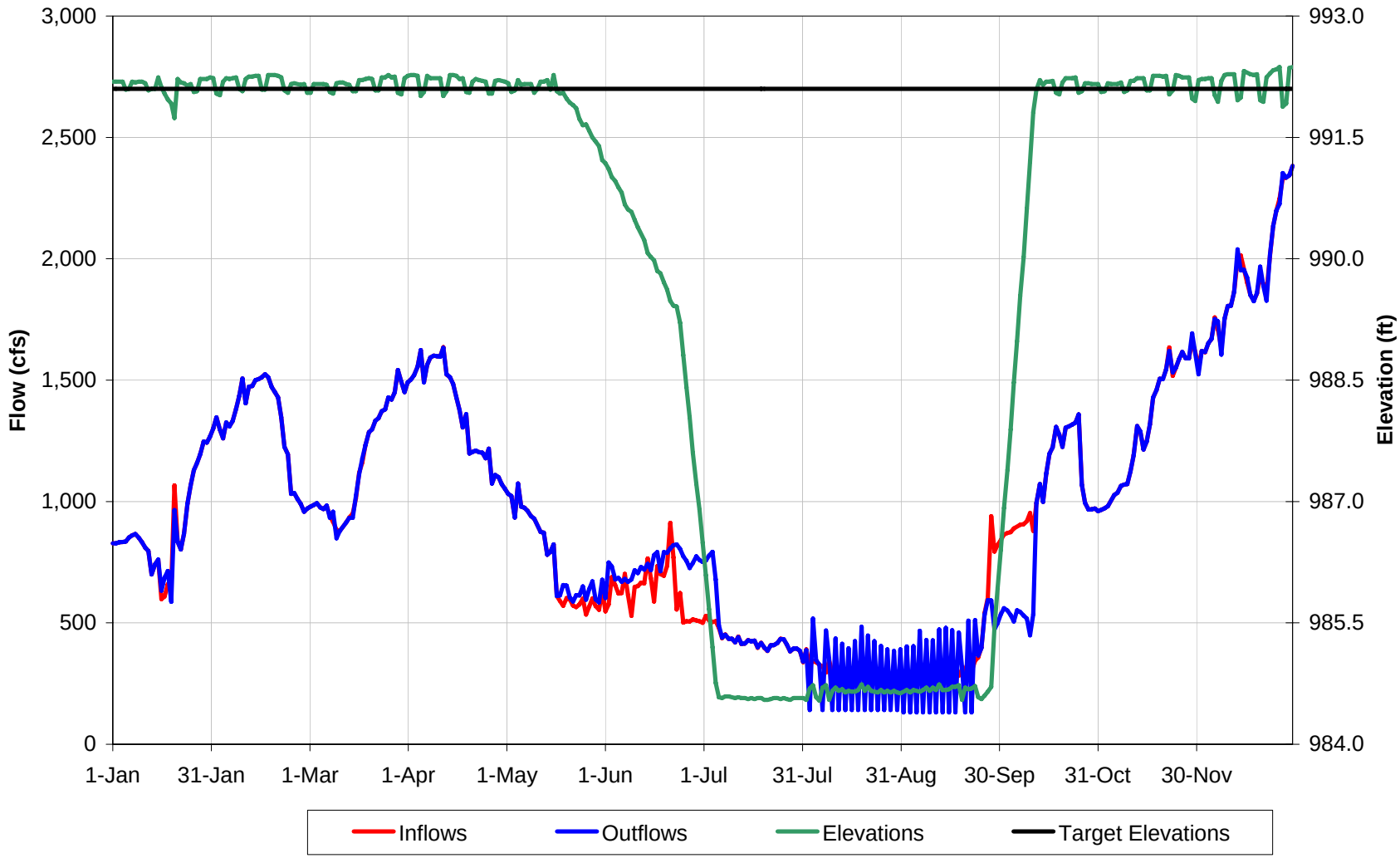
- Lake Norman and Mountain Island Lake violate critical intake elevations, while upstream reservoirs (James thru Lookout Shoals) are pending failure at their critical intake levels.

- Lake Wylie also dips near critical intake elevation as failure occurs upstream.

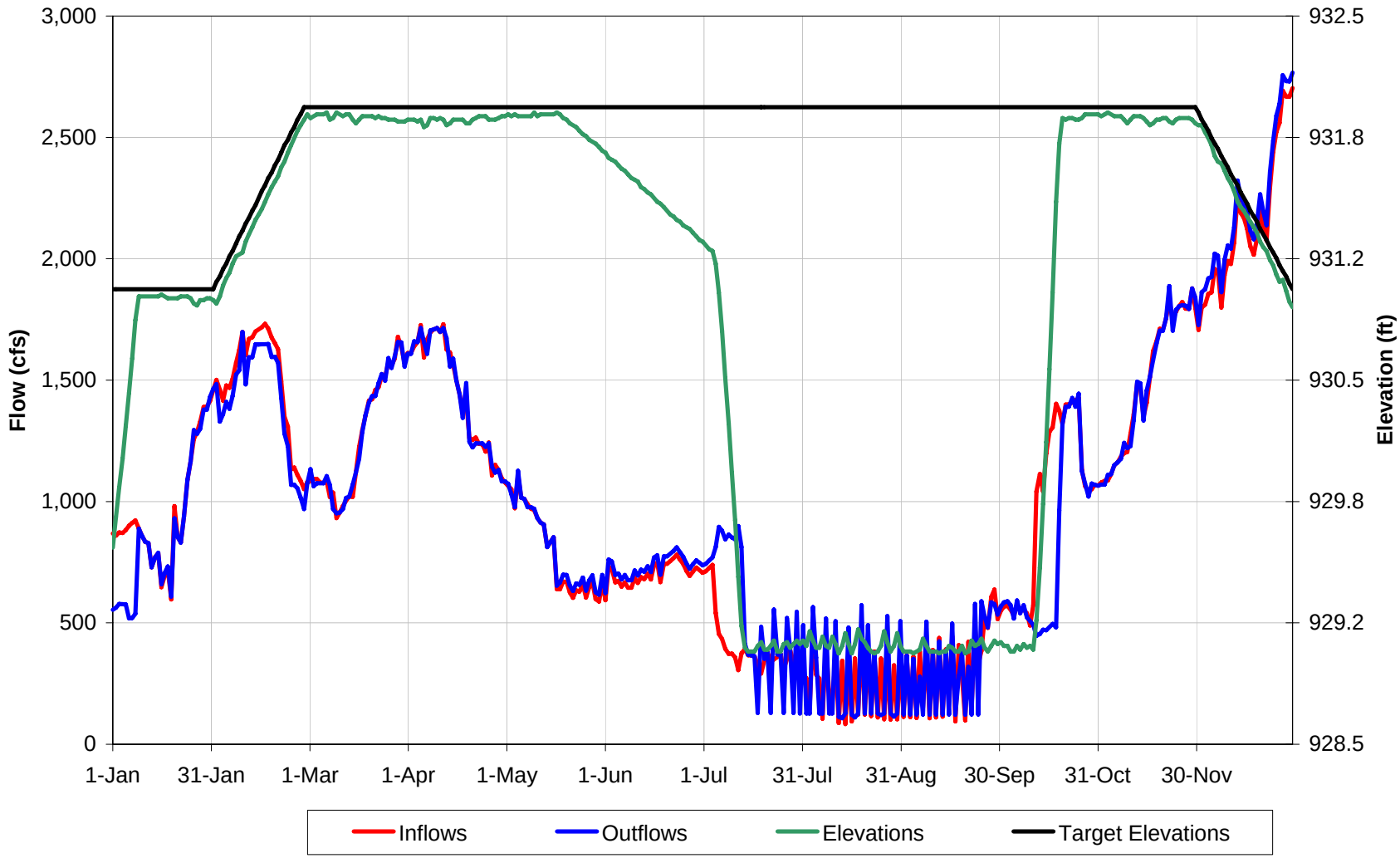
Baseline Operations Details
for Lake James Under 2048 Flows
Critical Elevation Scenario, 2002 Hydrology



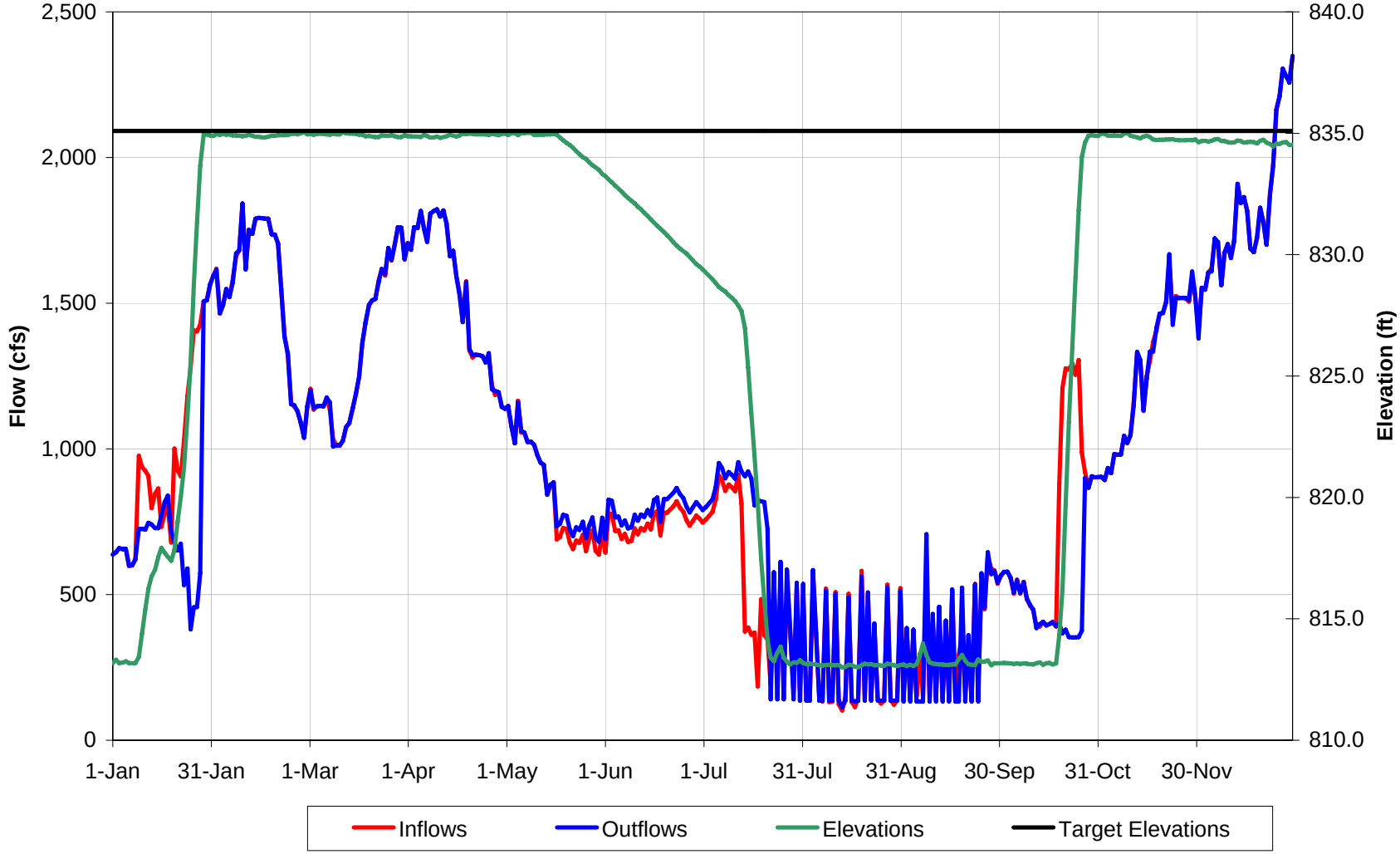
Baseline Operations Details
for Lake Rhodhiss Under 2048 Flows
Critical Elevation Scenario, 2002 Hydrology



Baseline Operations Details
for Lake Hickory Under 2048 Flows
Critical Elevation Scenario, 2002 Hydrology

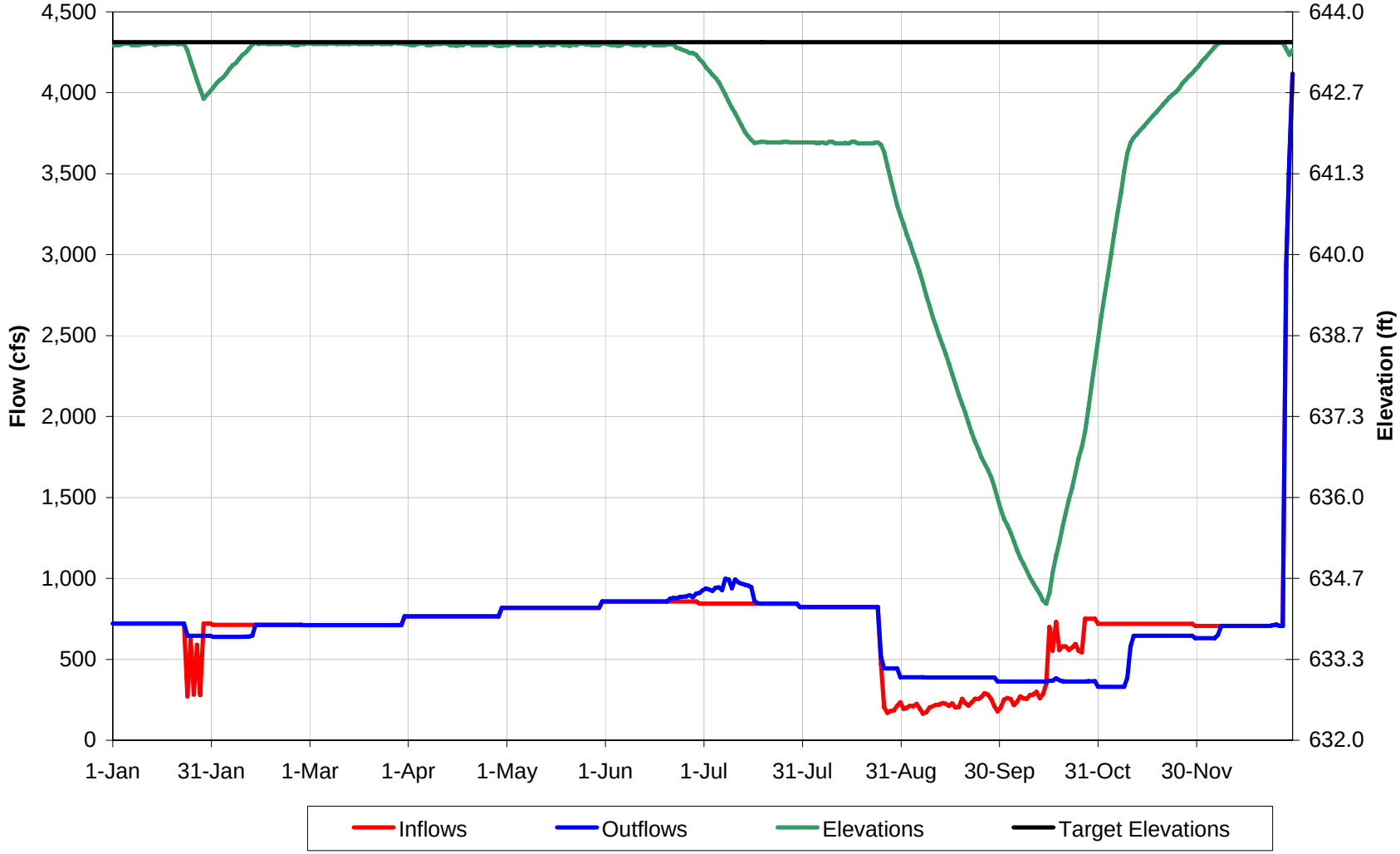


Baseline Operations Details
for Lookout Shoals Lake Under 2048 Flows
Critical Elevation Scenario, 2002 Hydrology

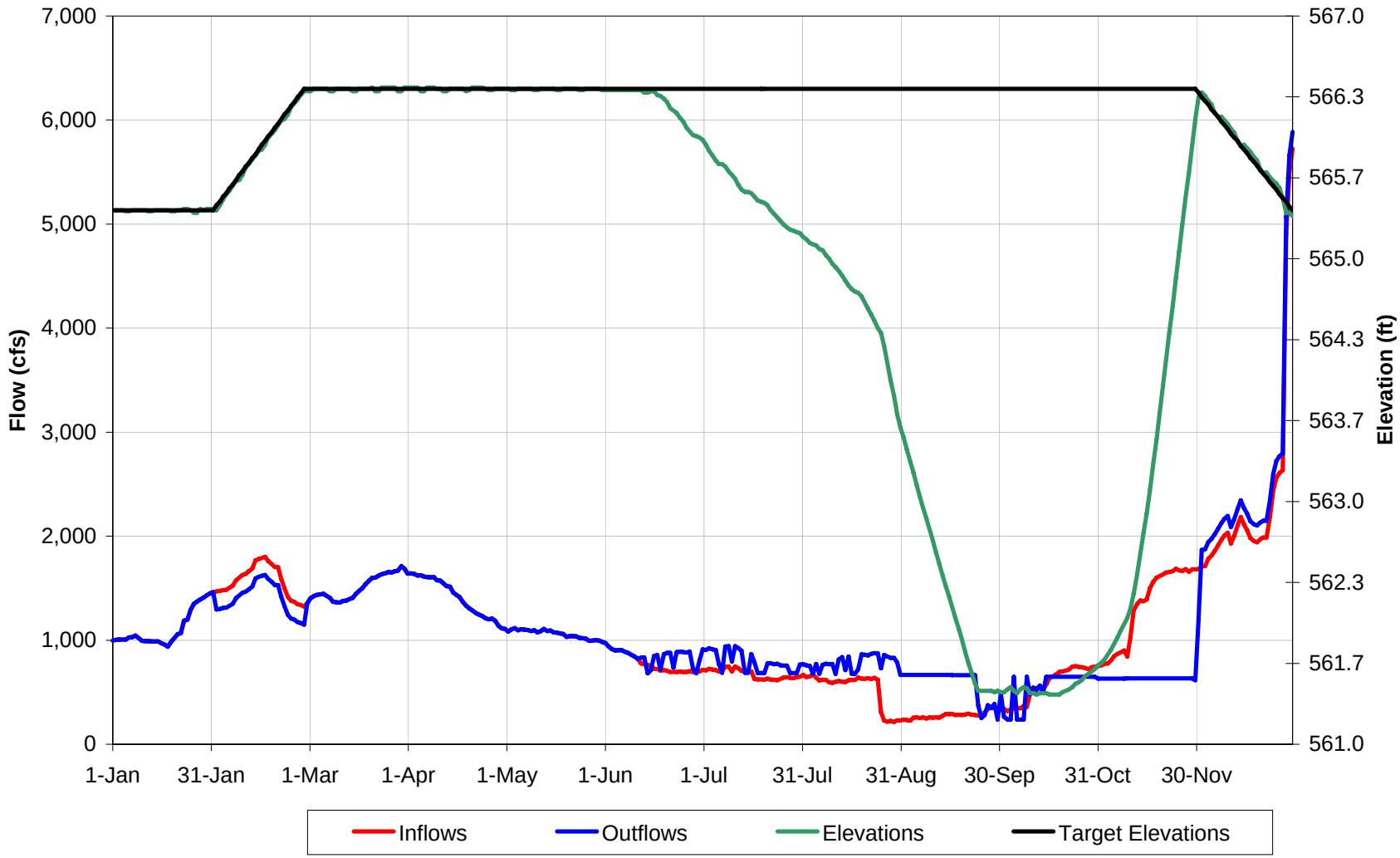


Baseline Operations Details
for Lake Norman Under 2048 Flows
Critical Elevation Scenario, 2002 Hydrology

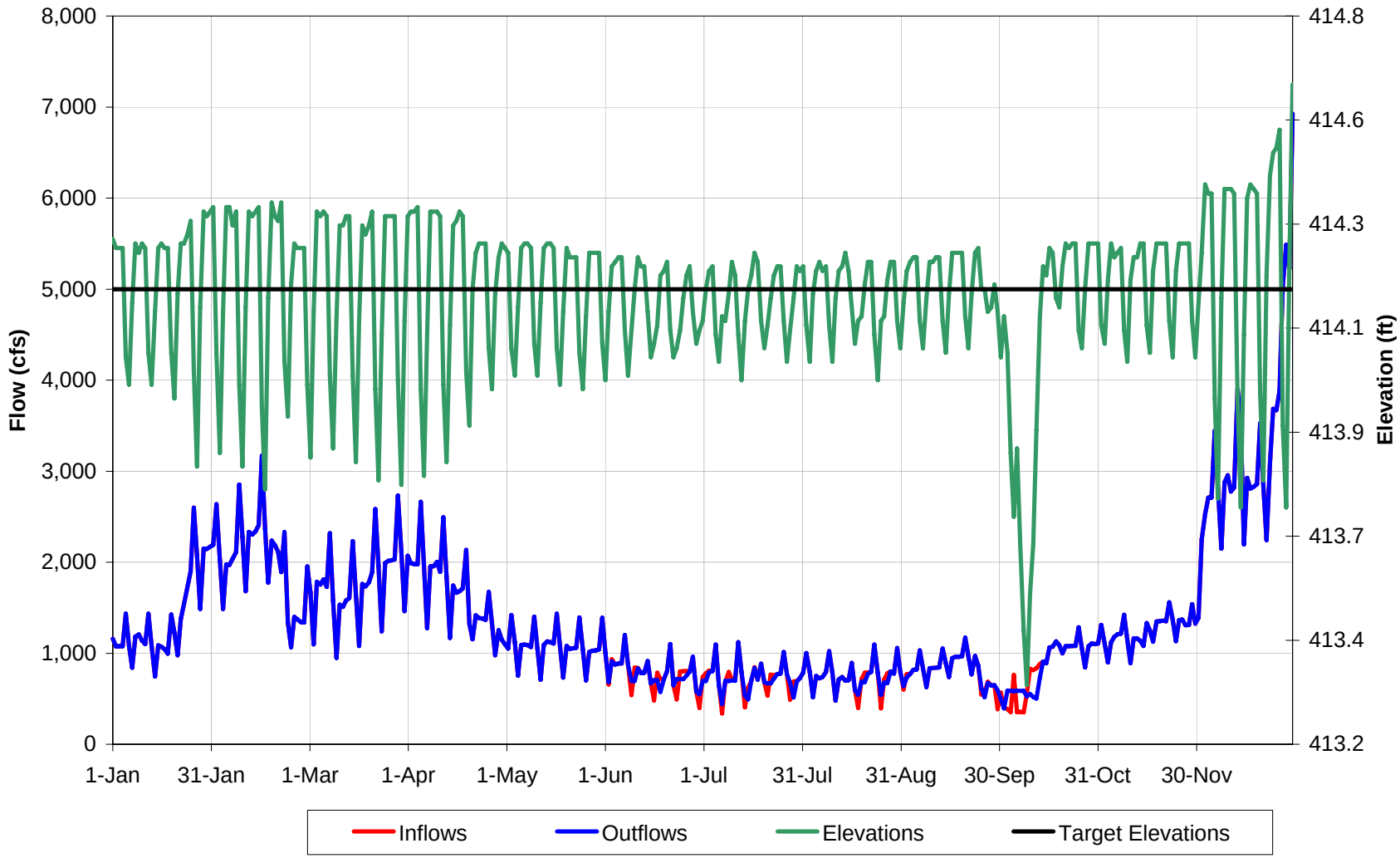
Baseline Operations Details
for Mountain Island Lake Under 2048 Flows
Critical Elevation Scenario, 2002 Hydrology



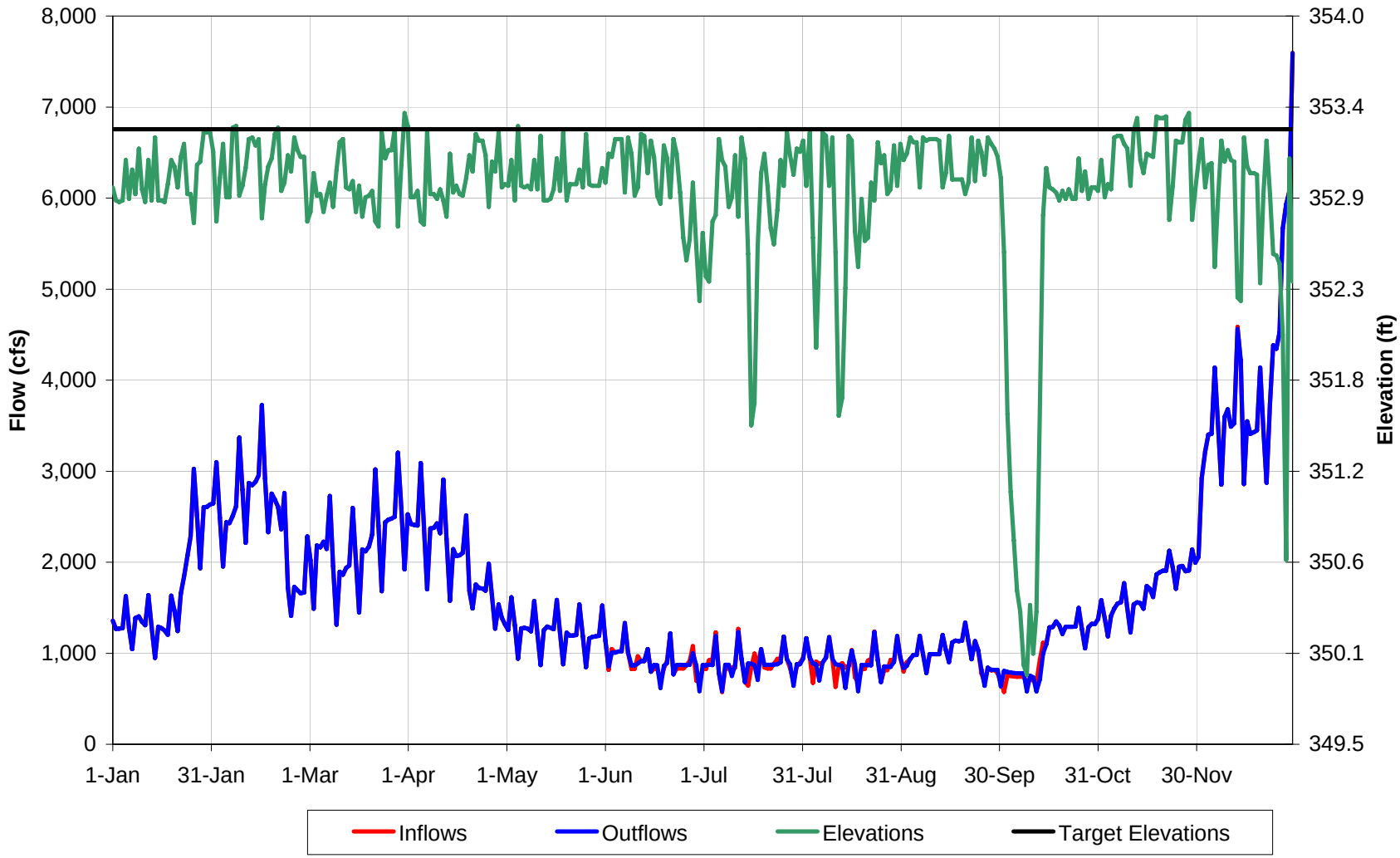
Baseline Operations Details
for Lake Wylie Under 2048 Flows
Critical Elevation Scenario, 2002 Hydrology



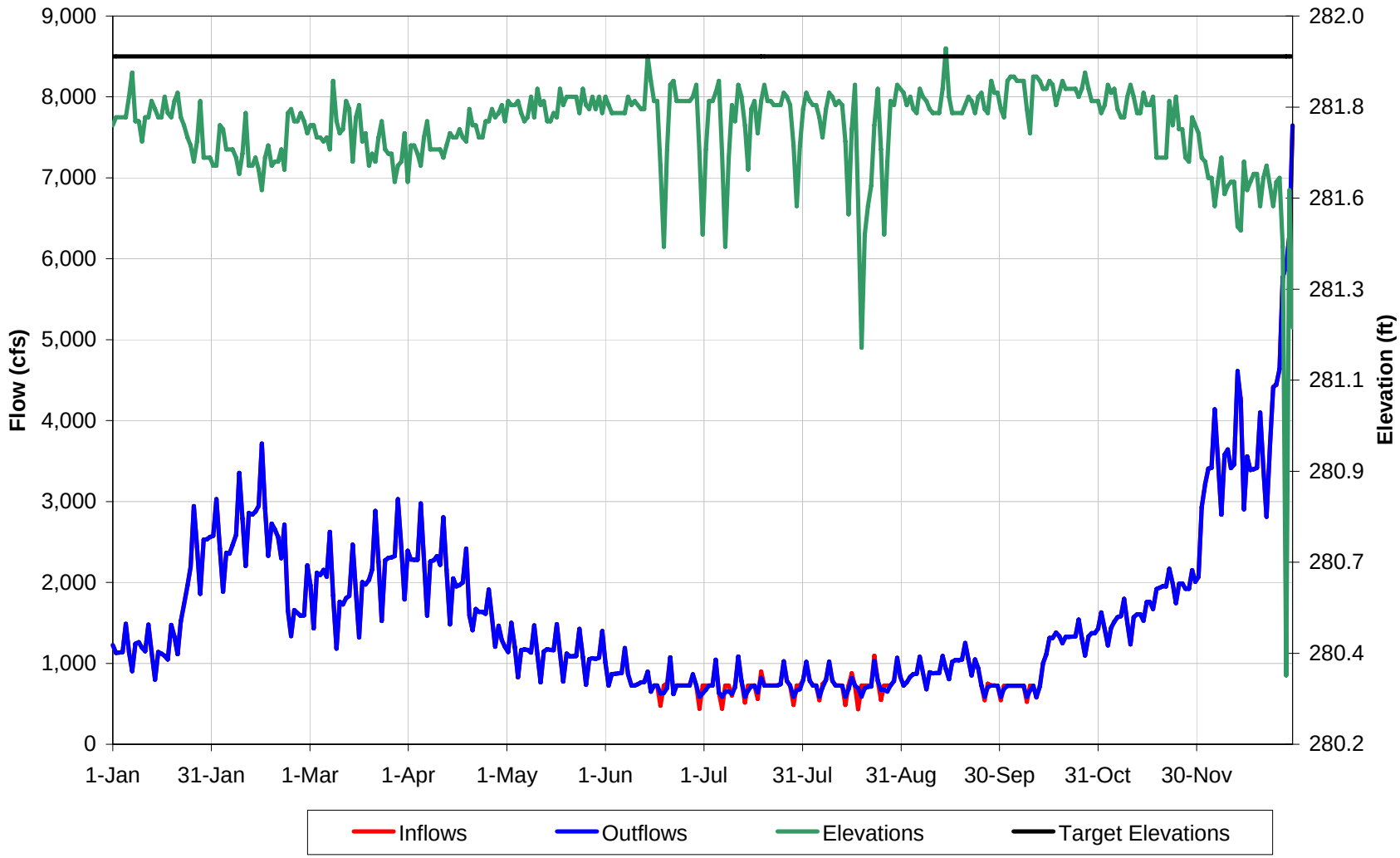
Baseline Operations Details
for Fishing Creek Reservoir Under 2048 Flows
Critical Elevation Scenario, 2002 Hydrology



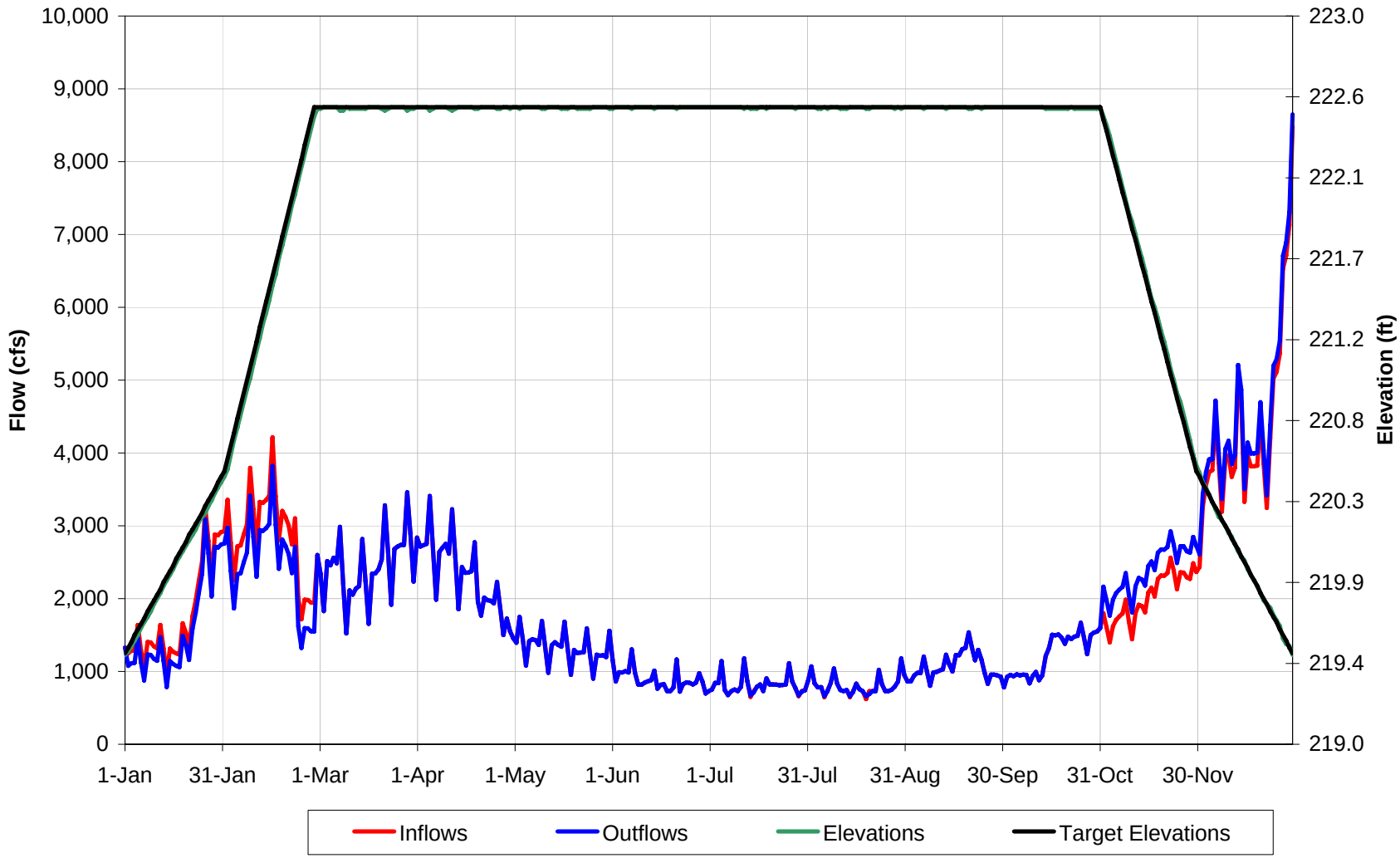
Baseline Operations Details
for Great Falls - Dearborn Reservoir Under 2048 Flows
Critical Elevation Scenario, 2002 Hydrology



Baseline Operations Details
for Rocky Creek - Cedar Creek Reservoir Under 2048 Flows
Critical Elevation Scenario, 2002 Hydrology



Baseline Operations Details
for Lake Wateree Under 2048 Flows
Critical Elevation Scenario, 2002 Hydrology



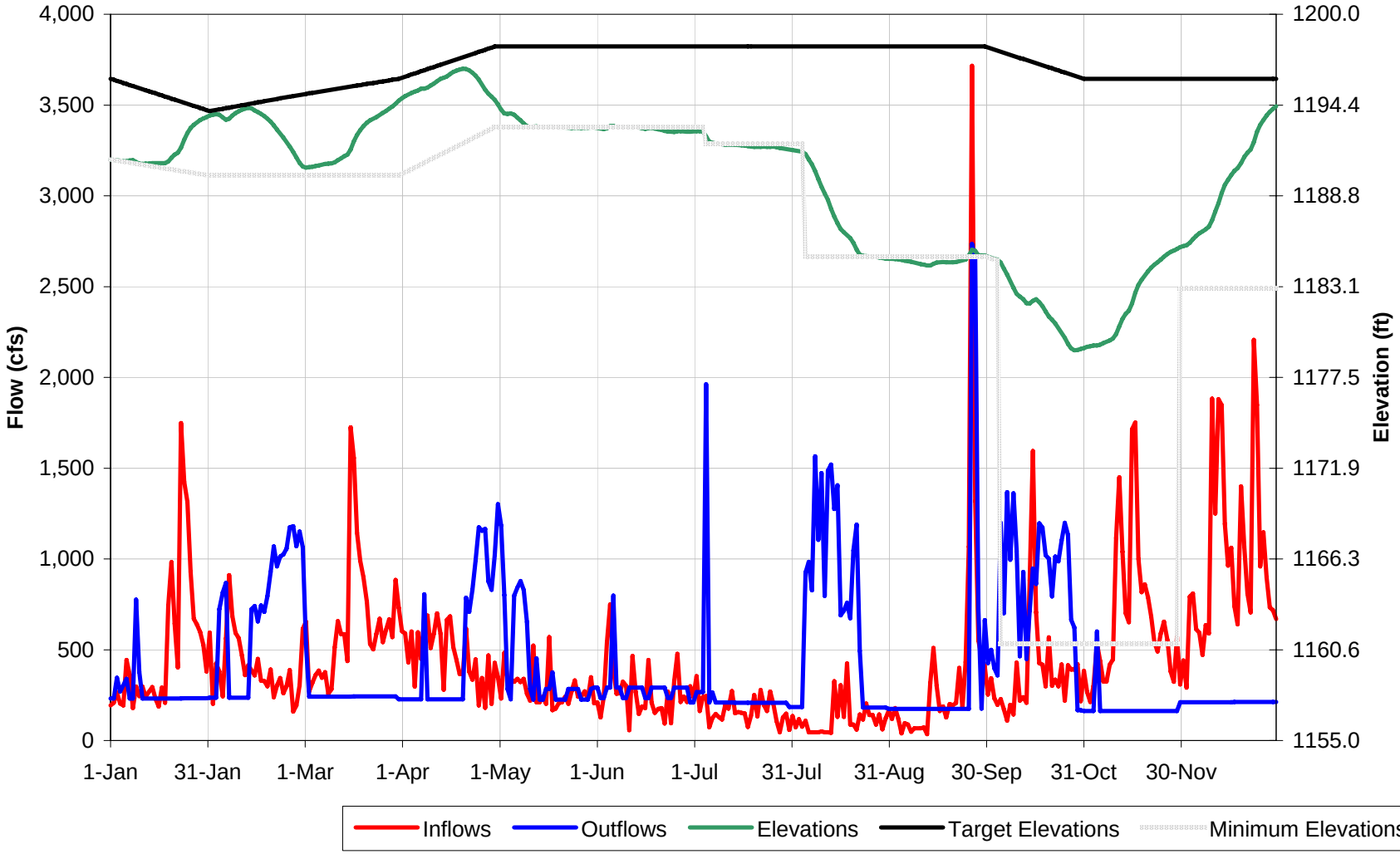
Appendix J – Graph Series 2

Mutual Gains Operations
Critical Elevations Scenario
Low Inflow Period 5
2045 Flows
2002 Hydrology

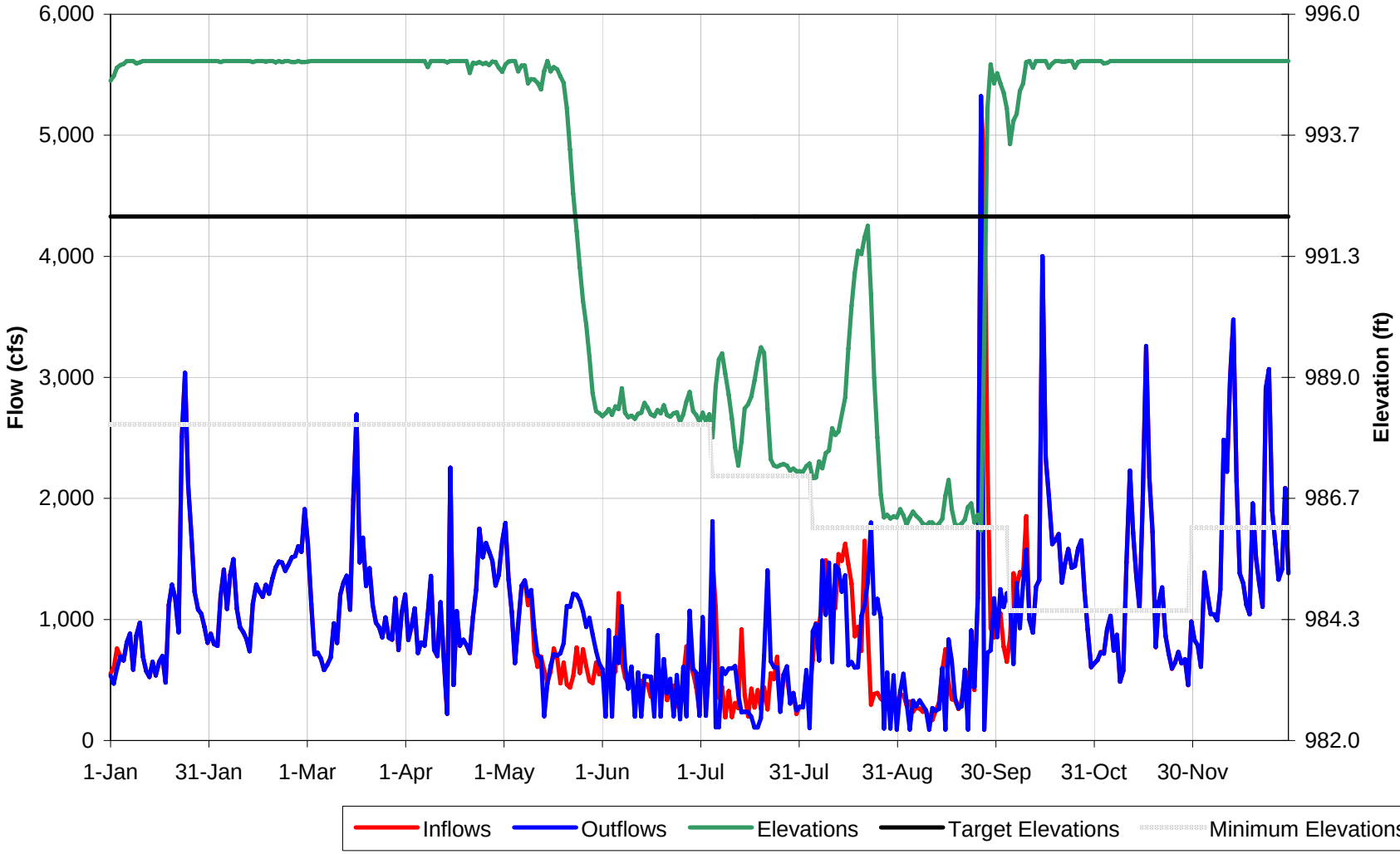
Observation:

- Lake Norman, Mountain Island Lake, and Lake Wylie violate critical intake elevations, while upstream reservoirs are pending failure.

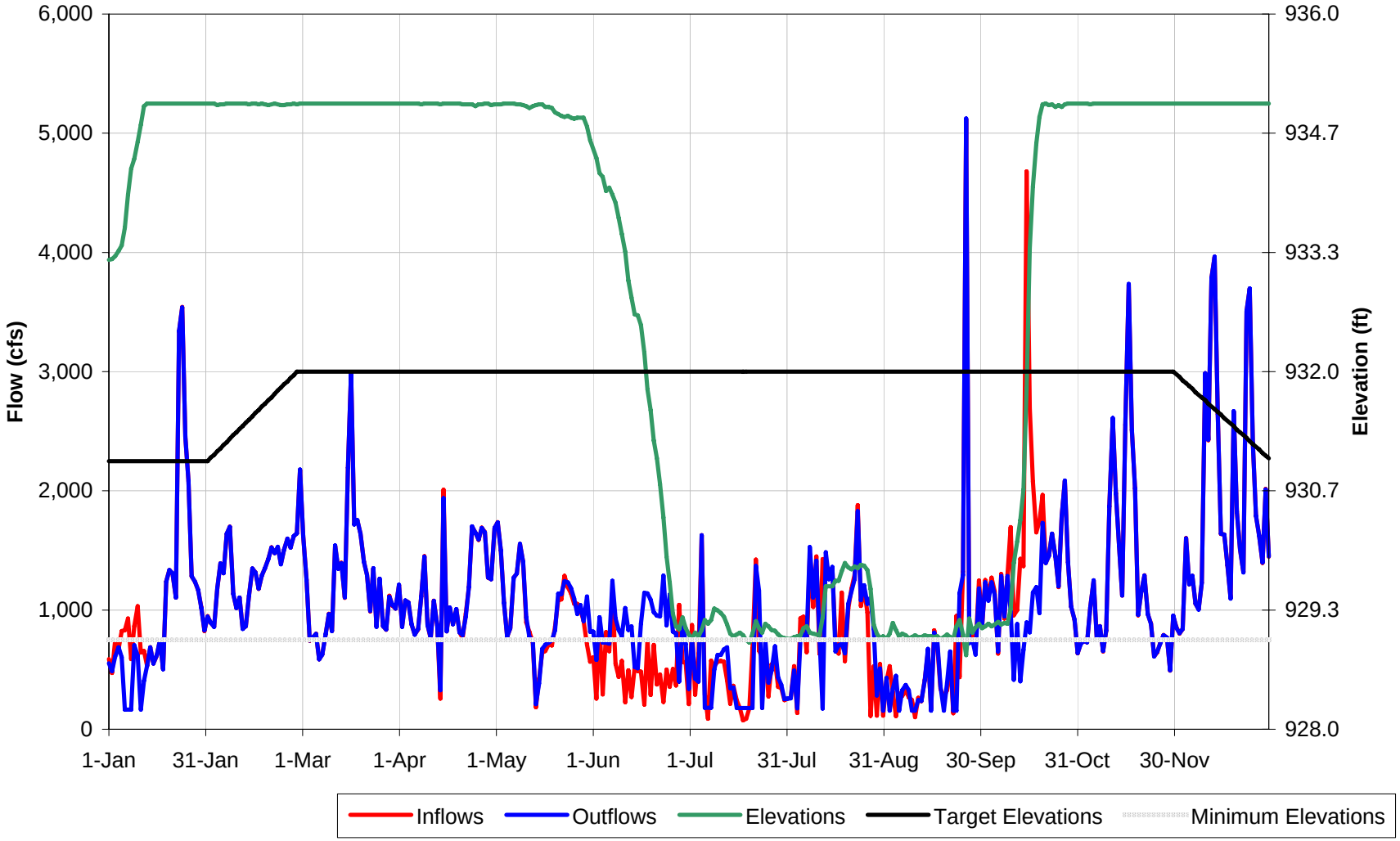
Mutual Gains Operations Details
for Lake James Under 2058 Flows
Critical Elevation Scenario, 2002 Hydrology



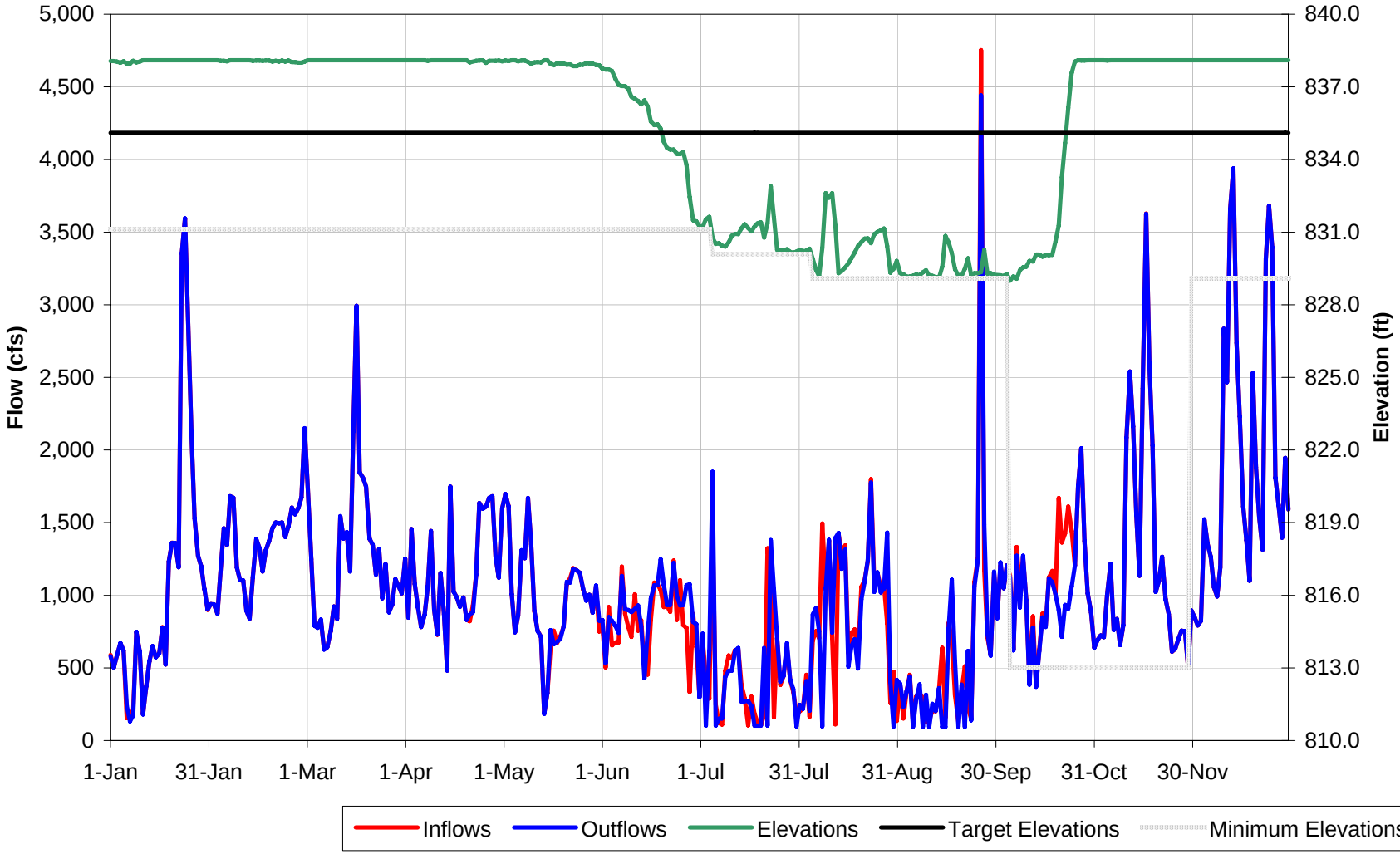
Mutual Gains Operations Details
for Lake Rhodhiss Under 2058 Flows
Critical Elevation Scenario, 2002 Hydrology



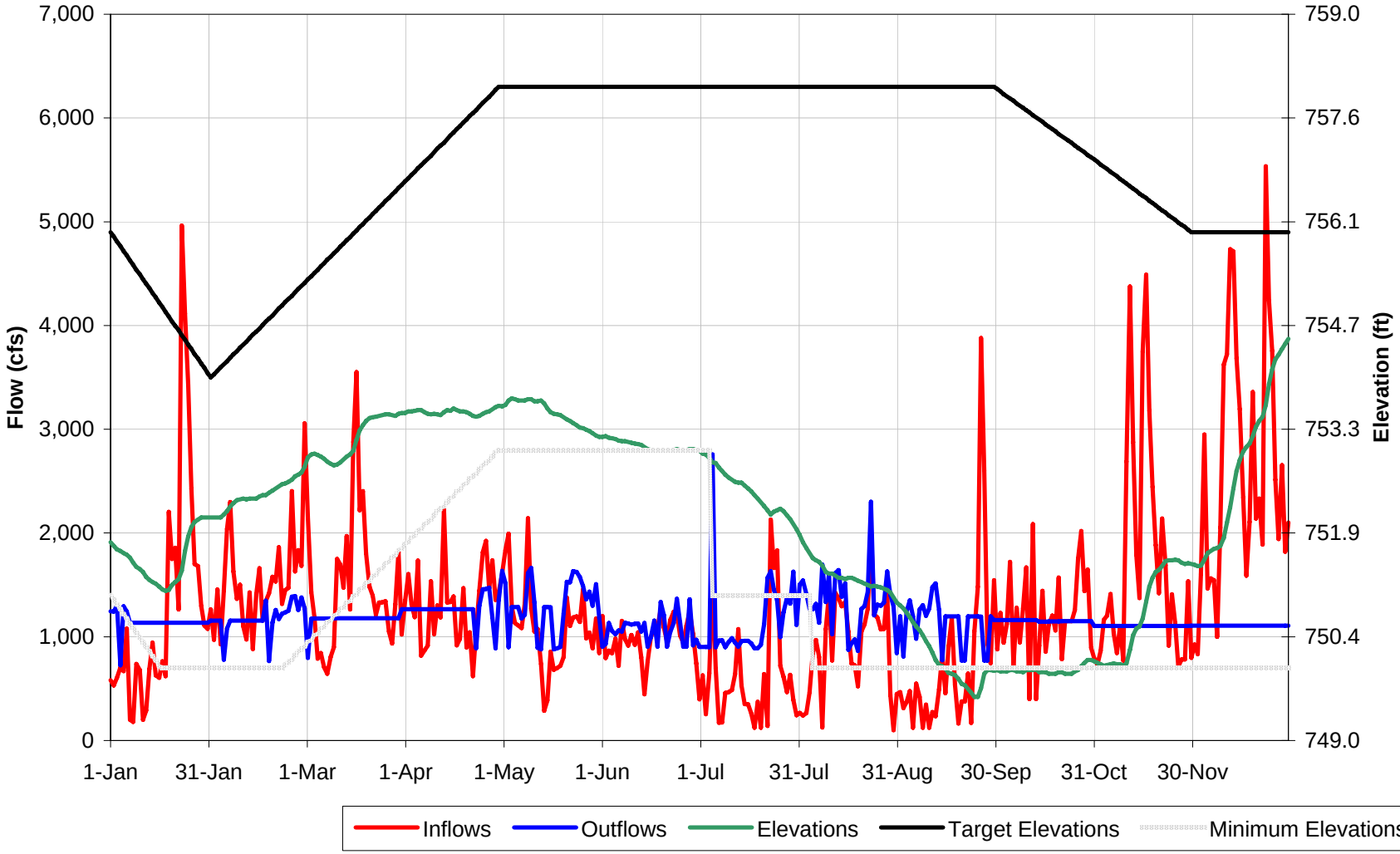
Mutual Gains Operations Details
for Lake Hickory Under 2058 Flows
Critical Elevation Scenario, 2002 Hydrology



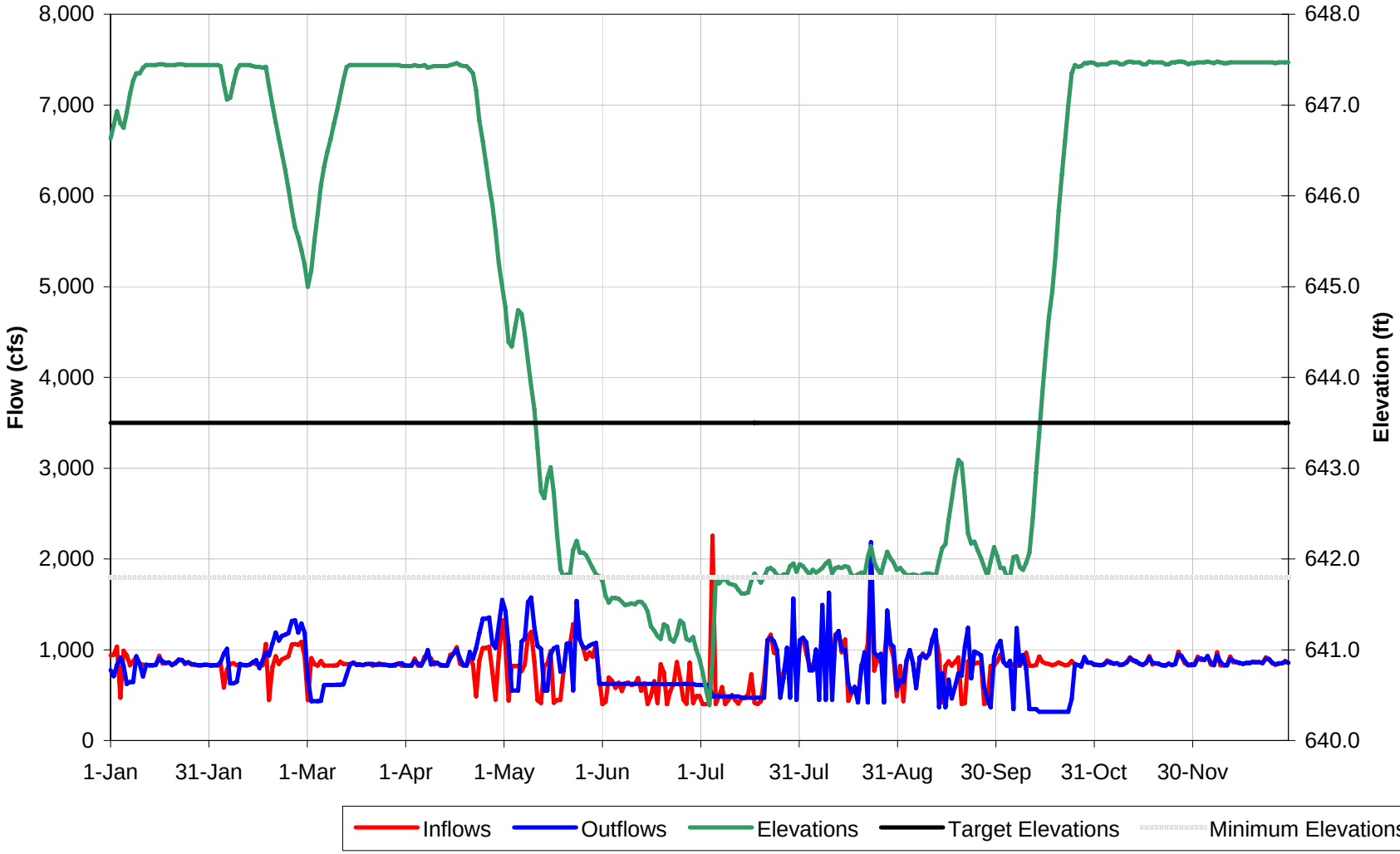
Mutual Gains Operations Details
for Lookout Shoals Reservoir Under 2058 Flows
Critical Elevation Scenario, 2002 Hydrology



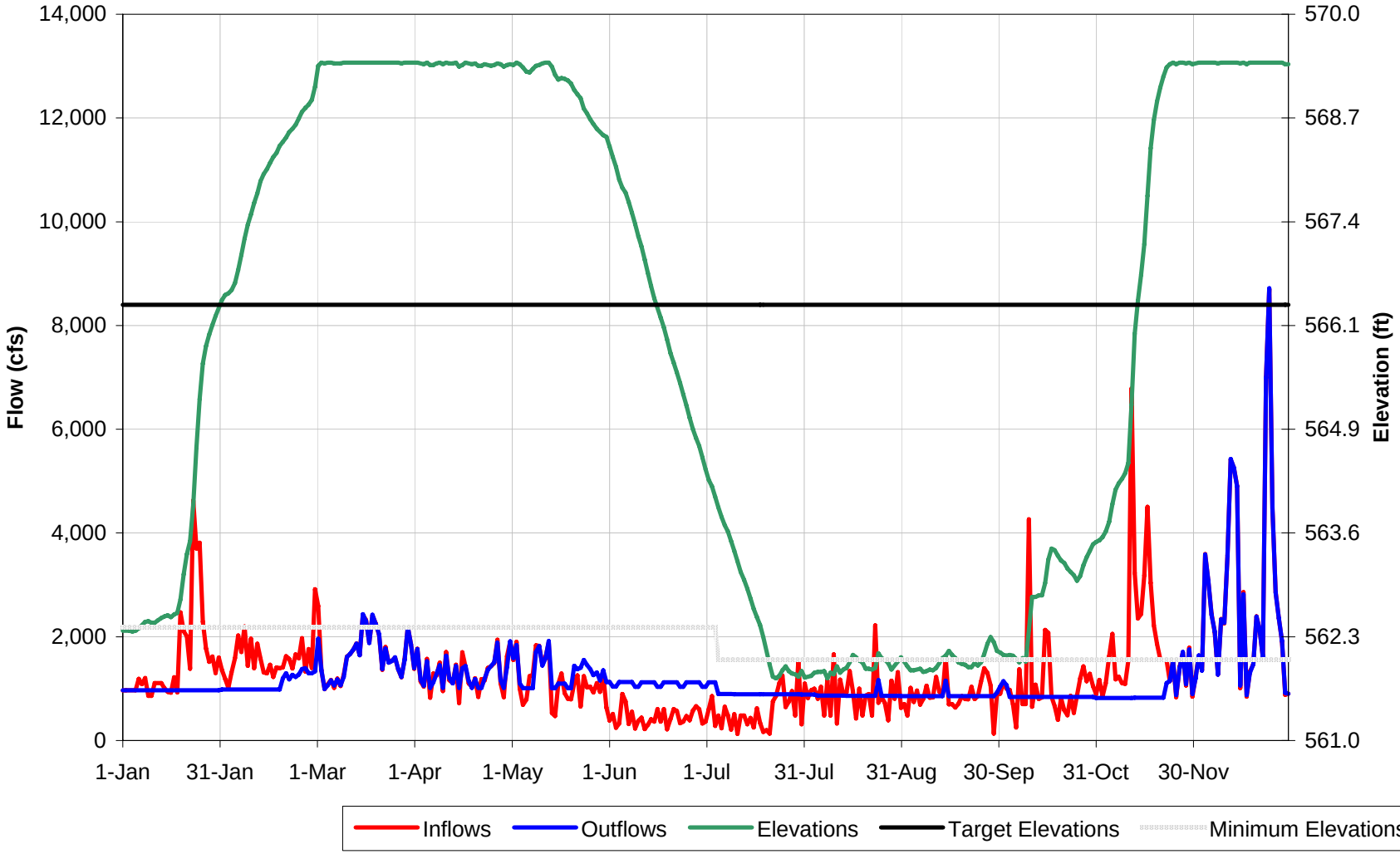
Mutual Gains Operations Details
for Lake Norman Under 2058 Flows
Critical Elevation Scenario, 2002 Hydrology



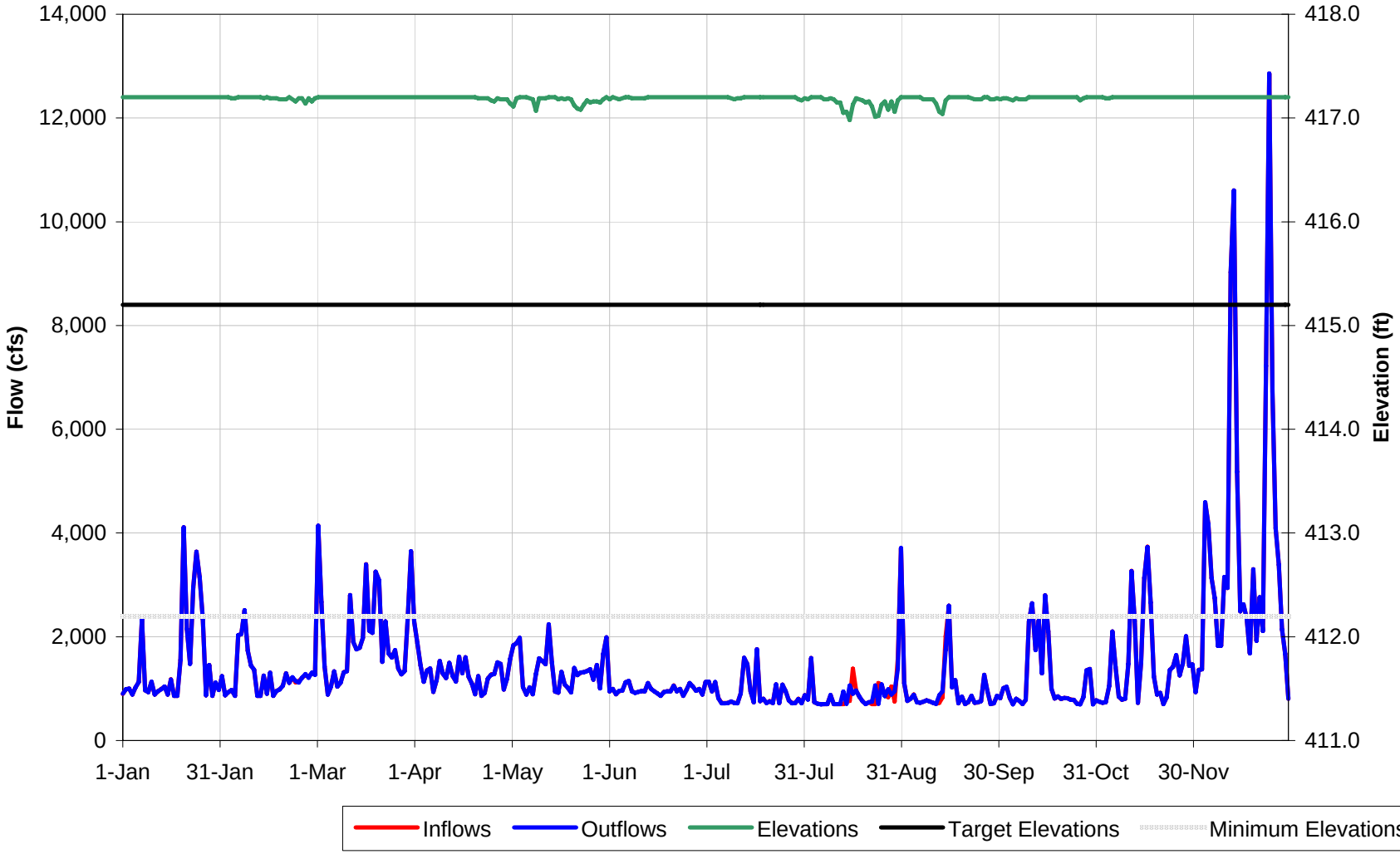
Mutual Gains Operations Details
for Mountain Island Lake Under 2058 Flows
Critical Elevation Scenario, 2002 Hydrology



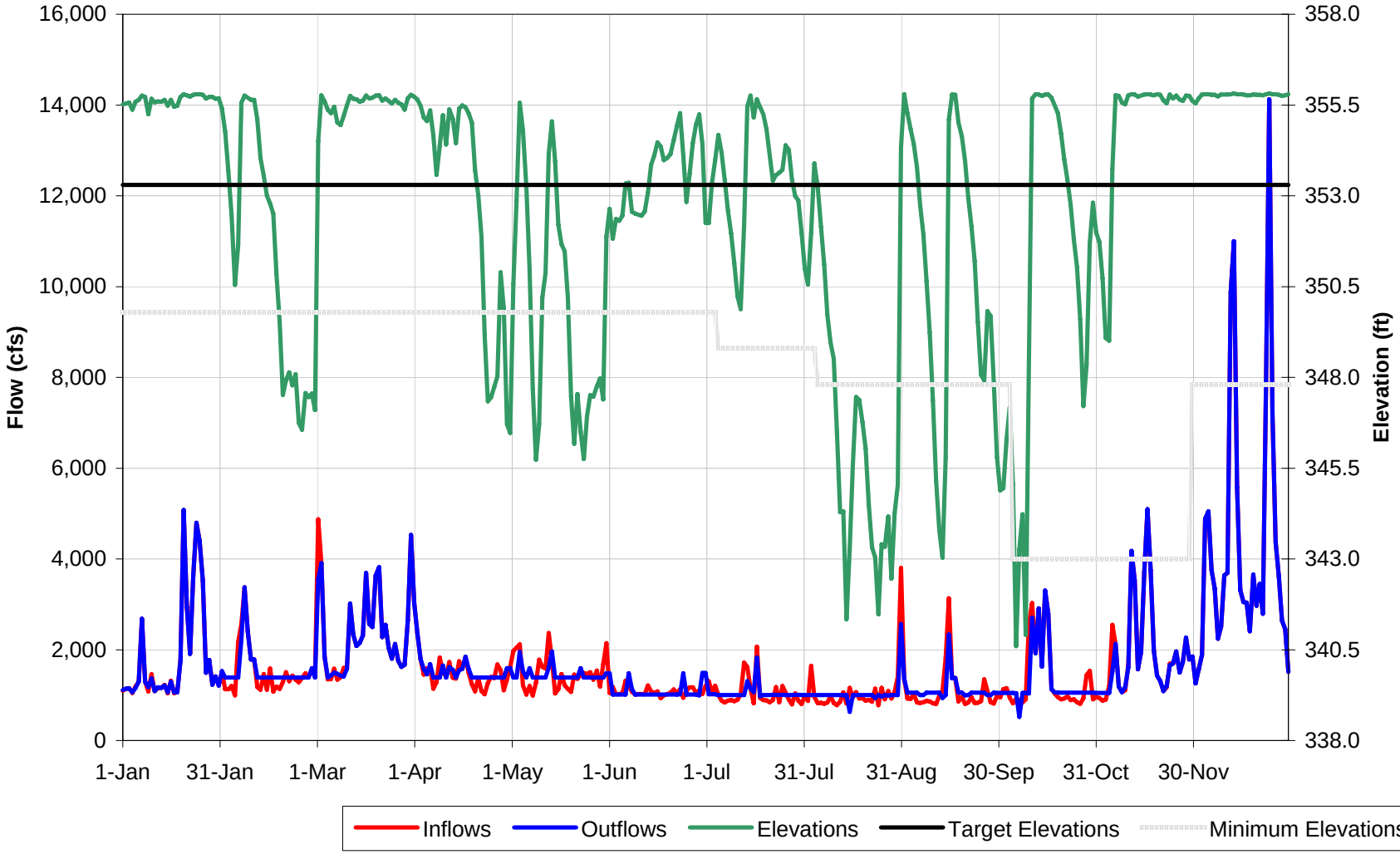
Mutual Gains Operations Details
for Lake Wylie Under 2058 Flows
Critical Elevation Scenario, 2002 Hydrology



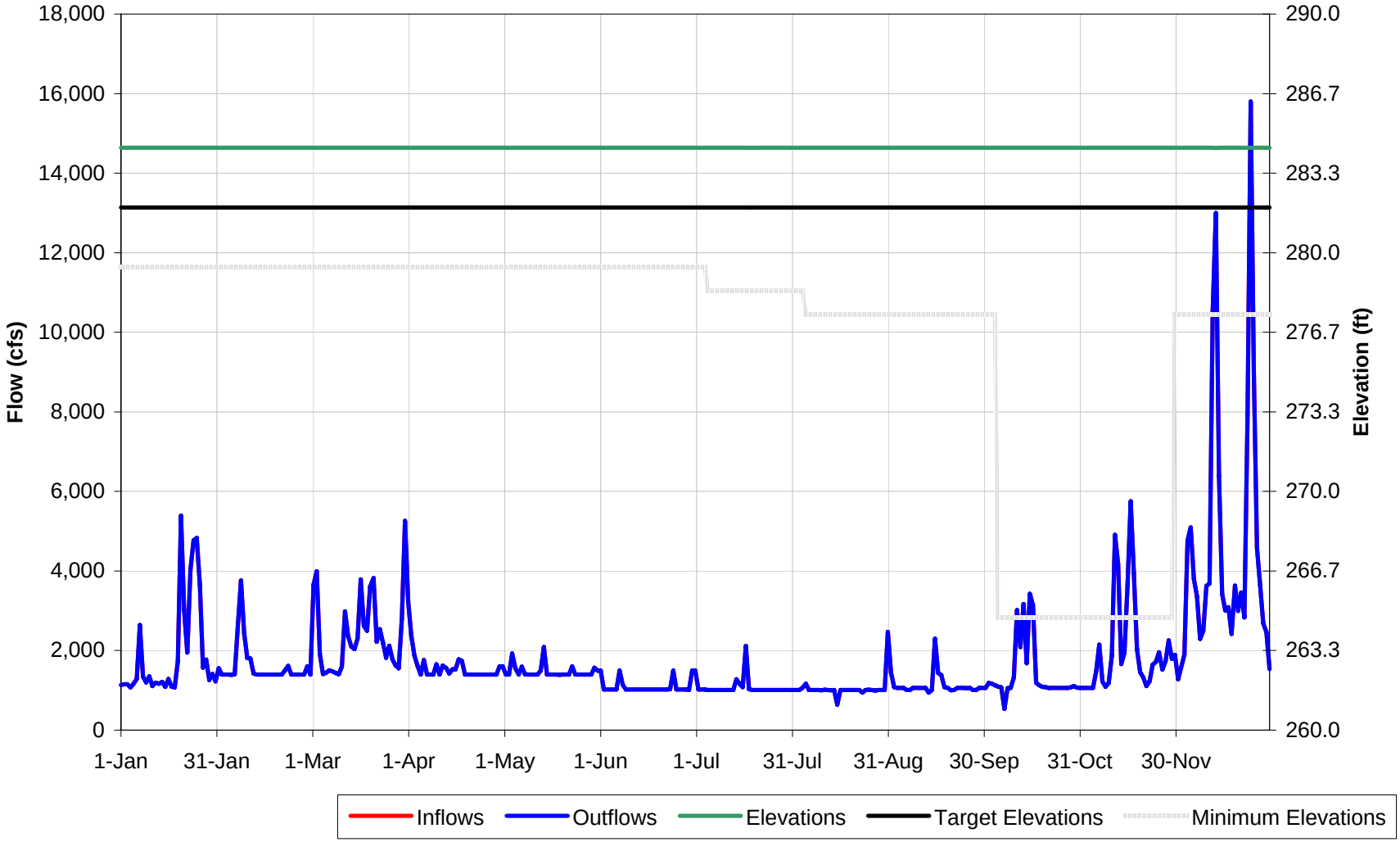
Mutual Gains Operations Details
for Fishing Creek Reservoir Under 2058 Flows
Critical Elevation Scenario, 2002 Hydrology



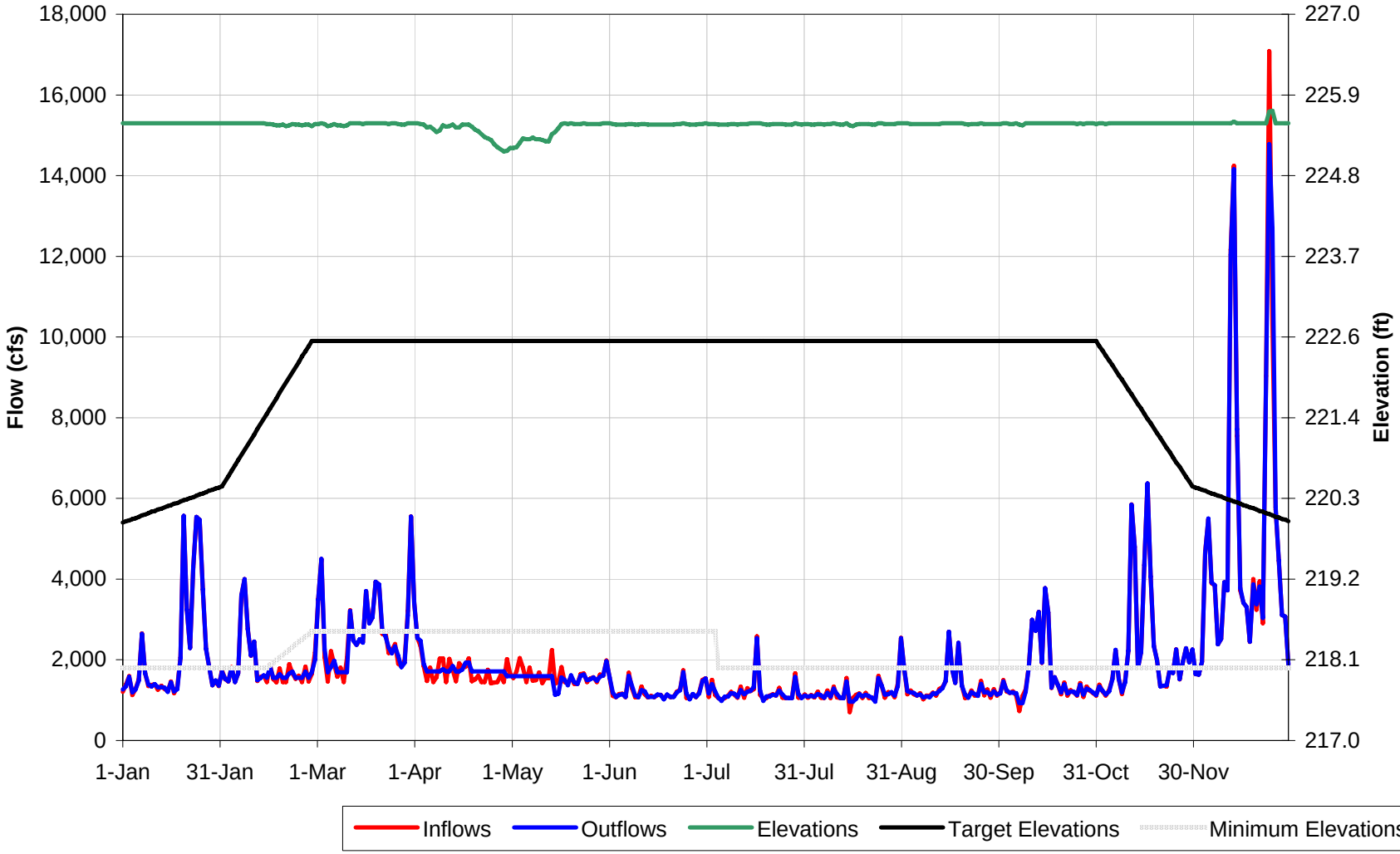
Mutual Gains Operations Details
for Great Falls - Dearborn Reservoir Under 2058 Flows
Critical Elevation Scenario, 2002 Hydrology



Mutual Gains Operations Details
for Rocky Creek - Cedar Creek Reservoir Under 2058 Flows
Critical Elevation Scenario, 2002 Hydrology



Mutual Gains Operations Details
for Lake Wateree Under 2058 Flows
Critical Elevation Scenario, 2002 Hydrology



APPENDIX K

WATER WITHDRAWAL MANAGEMENT SURVEY

Duke Power - Water Supply Study
Water Withdrawal Management Survey

PURPOSE

As part of Duke Power's (Duke's) effort to obtain a new license from the Federal Energy Regulatory Commission (FERC) for its 841 MW Catawba-Wateree Hydroelectric Project (FERC Project No. 2232), a Water Supply Study is being completed to evaluate key long-term regional water supply issues. As part of this study, Duke and a Water Supply Study Team comprised of HDR Engineering, public water supply systems, industrial water users and state resource agencies from North and South Carolina are surveying other lake owners regarding important issues for permitting and management of water withdrawals. This survey is being completed by numerous companies and institutions across the United States, with a focus on the Southeast. The information provided by your company or institution will be compiled into a dataset to be evaluated by the Water Supply Study Team and it will ultimately be used in a study team report that is shared with other teams of stakeholders and the FERC as part of Duke's license application process. If you desire a copy of the Survey Results Summary, you can indicate that on the last page of this survey and a summary will be provided to you. Your assistance in this study is much appreciated.

INSTRUCTIONS

1.) Please answer all questions to the best of your knowledge and return by ***February 14, 2005*** to: Mr. Kevin Mosteller, PE, HDR Engineering, Inc. of the Carolinas, 128 South Tryon Street, Suite 1400, Charlotte, NC 28202 or by email: kevin.mosteller@hdrinc.com

2.) If you should have any questions or comments, please contact Mr. Mosteller at 704.338.6802 (tel) or 704.338.6760 (fax) or by email.

3.) If a verbal interview is preferred in lieu of completing this written survey, please call Mr. Mosteller to arrange a meeting or phone call.

4.) Thank you again for your time and effort.

BACKGROUND

Company/Institution Name:

Reservoirs Owned:

FERC Project No. (if appl.)	Reservoir Name	State	River Basin Name / Approximate Avg. Annual Inflow to Reservoir (cfs)	Surface Area at Full Pond (acres)	Shoreline miles at Full Pond	Reservoir Drainage Area (Sq. mi.)	Total Hydro Capacity per Reservoir (MW)	Type and No. of Intakes Located on each Reservoir (Note 1)	Intake Size Range (permitted max. capacity-MGD)	Water Withdrawal Approvals Req'd.

Note 1 – Intake types are PWS (Public Water Supply), I (Industrial), P (Power Generation other than Hydro), AG (Agricultural / Irrigation) and O (Other). Do not include the hydro units as intakes.

Duke Power - Water Supply Study
Water Withdrawal Management Survey

LAKE USE PERMITTING

1. **For intakes listed in the table above, who owns the intakes?**

2. **What water withdrawal permits or approvals are required for new or expanded withdrawals (e.g. FERC, State, Local, water authority)?**

3. **Did any of the existing intake owners have intakes on the river at the lake's location before the lake was built?**

4. **Please describe the water withdrawal approval process for intakes located on the lakes listed?**

5. **What legal conveyance instrument (e.g. easement, permit, other) is used to approve the intakes and what is the term of that instrument (e.g. perpetual, life of hydro project license)?**

6. **Any significant differences in the lake use permitting process (i.e. the approval process the lake owner uses to approve of the intake) for existing intakes that need to expand verses newly proposed intakes?**

7. **Typically how long does it take to gain approval for intake construction from the point that a formal proposal is made to the lake owner until formal approval is given?**

FEES

8. **Do <u>all</u> or <u>some</u> owners of intakes located on the lake(s) pay fees to the lake owner for the water withdrawal? If so, briefly describe the fees, their purposes and approximate amounts. Also, if the intake was previously on the river segment that is now part of a lake, do fees differ?**

9. **Do owners of intakes located downstream of the lake(s) pay fees to the lake owner for releases of water to specifically support their needs? If so, briefly describe the fees, their purposes and approximate amounts.**

10. **When was the company's/institution's fee(s) first implemented? What were the drivers for fee implementation?**

11. **Approximately how much money is received annually from fees? Approximately how much money is received annually per average rate of water consumed (i.e. not returned to the supply reservoir)?**

12. **How are the proceeds generated from fees utilized; that is, are the fees generally lumped in with other corporate receipts, or are the fees set aside for a special purpose?**

13. **Is there a typical payment structure (e.g. metering, billing, etc.) that those who pay fees use to make their payments?**

14. **As specifically as possible, please describe the methodology used to calculate fees. Is the structure constant or variable depending on water withdrawal type or other factors (industrial verses municipal)? Are there references/websites/etc. we may use to obtain further detail?**

15. **Has the methodology described in Question 14 been applied since the fees' inception? If not, how has it changed, and why?**

16. **Is there a minimum withdrawal rate below which fees are not assessed? If yes, what is the minimum rate? If no, are "minor" water user withdrawals (i.e. < 1 MGD) subject to different requirements (e.g. fee structure, drought response plans)?**

17. **Are fees charged for water withdrawn during periods when water is being spilled at the supply reservoir's dam?**

18. **Do fees vary with reservoir levels? If so, are the fees assessed in this manner to actively encourage conservation during low water periods?**

19. **What type of reporting requirements do you have for water withdrawals that are assessed fees?**

20. **Have there been any significant fee collection issues once an agreement was in place?**

21. **Has the company/institution ever undergone litigation as a result of assessing fees? If so, please describe the circumstances and resolutions to the extent possible.**

DROUGHT MANAGEMENT

22. **Does your company/institution or other regulatory agency have any sort of "low inflow protocol" that is used during periods of drought or low water flow into the reservoir system that requires the lake owner and other users to take action? If so, please describe how the protocol works and how it is enforced. Are fees used as an enforcement tool?**

OTHER ISSUES

23. **Does the company/institution or other regulatory agency impose a cap on Inter-basin Transfers (IBT) (i.e. transferring water from the river basin that the supply reservoir is located within to another river basin)? Do water withdrawals pay higher fee rates (i.e. $/cfs) for water that is lost from the supply reservoir for an IBT versus water that is consumed by users within the river basin in which the supply reservoir is located?**

24. **How and who determines where and how deep a proposed intake must be located?**

Duke Power - Water Supply Study
Water Withdrawal Management Survey

25. **What design and operational limits are typically placed on intakes (e.g. maximum instantaneous withdrawal rate, average annual withdrawal rate, etc.) and who determines these limits?**

26. **Do the lake owner and other stakeholders have a formal or informal process of collaboration on common interests such as: Aquatic weed management, water quality improvements, water conservation improvements, making long-term supply/demand projections? If so, please describe the process.**

If Duke Power or the Water Supply Study Team would like more information, may we contact someone within your organization to ask additional questions or arrange a meeting?

YES ☐
NO ☐

If YES, please complete the contact information below:

Name	
Telephone No.	
E-mail address	
Physical Address	

If you would like a copy of the Survey Results Summary, please check the box below.

☐

Thank you very much for your time.

APPENDIX L

LOW INFLOW PROTOCOL

Attachment G -
Low Inflow Protocol (LIP) for the Catawba-Wateree Project

PURPOSE

The purpose of this Low Inflow Protocol (LIP) is to establish procedures for reductions in water use during periods of low inflow to the Catawba-Wateree Project (the Project). The LIP was developed on the basis that all parties with interests in water quantity will share the responsibility to establish priorities and to conserve the limited water supply.

OVERVIEW

This Low Inflow Protocol provides trigger points and procedures for how the Catawba-Wateree Project will be operated by the Licensee, as well as water withdrawal reduction measures and goals for other water users during periods of low inflow (i.e., periods when there is not enough water flowing into the Project reservoirs to meet the normal water demands while maintaining Remaining Usable Storage in the reservoir system at or above a seasonal target level).

The Licensee will provide flow from hydro generation and other means to support electric customer needs and the instream flow needs of the Project. During periods of normal inflow, reservoir levels will be maintained within prescribed Normal Operating Ranges. During times that inflow is not adequate to meet all of the normal demands for water and maintain reservoir levels as normally targeted, the Licensee will progressively reduce hydro generation. If hydrologic conditions worsen until trigger points outlined herein are reached, the Licensee will declare a Stage 0 - Low Inflow Watch and begin meeting with the applicable agencies and water users to discuss this LIP. If hydrologic conditions continue to worsen, the Licensee will declare various stages of a Low Inflow Condition (LIC-as defined in the Procedure section of this document). Each progressive stage of the LIC will call for greater reductions in hydro station releases and water withdrawals, and allow additional use of the available water storage inventory.

The goal of this staged Low Inflow Protocol is to take the actions needed in the Catawba-Wateree River Basin to delay the point at which the Project's available water storage inventory is fully depleted. While there are no human actions that can guarantee that the Catawba-Wateree River Basin will never experience operability limitations at water intake structures due to low reservoir levels or low streamflows, this Low Inflow Protocol is intended to provide additional time to allow precipitation to restore streamflow, reservoir levels, and groundwater levels to normal ranges. The amount of additional time that is gained during the LIP depends primarily on the diagnostic accuracy of the trigger points, the amount of regulatory flexibility the Licensee has to operate the Project, and the effectiveness of the Licensee and other water users in working together to implement their required actions and achieve significant water use reductions in a timely manner.

To ensure continuous improvement regarding the LIP and its implementation throughout the term of the New License, the LIP will be re-evaluated and modified periodically. These re-evaluations and modifications will be as determined by the Catawba-Wateree Drought Management Advisory Group (CW-DMAG).

KEY FACTS AND DEFINITIONS

1. Human Health and Safety and the Integrity of the Public Water Supply and Electric Systems are of Utmost Importance – Nothing in this protocol will limit the Licensee's ability to take any and all lawful actions necessary at its hydro projects to protect human health and safety, protect its equipment from major damage, protect the equipment of the Large Water Intake Owners from major damage, and ensure the stability of the regional electric grid. It is recognized that the Licensee may take the steps that are necessary to protect these things without prior consultation or notification.

2. Full Pond Elevation – Also referred to simply as "full pond", this is the level of a reservoir that corresponds to the point at which water would first begin to spill from the reservoir's dam(s) if the Licensee took no action. This level corresponds to the lowest point along the top of the spillway (including flashboards) for reservoirs without flood gates, and to the lowest point along the top of the flood gates for reservoirs that do have flood gates. To avoid confusion among the many reservoirs the Licensee operates, the Licensee has adopted the practice of referring to the Full Pond Elevation for all of its reservoirs as equal to 100.0-feet (ft.) relative. The Full Pond Elevations for the Catawba-Wateree Project reservoirs are as follows:

Reservoir	Full Pond Elevation (ft. above Mean Sea Level)
Lake James	1200.0
Lake Rhodhiss	995.1
Lake Hickory	935.0
Lookout Shoals Lake	838.1
Lake Norman	760.0
Mountain Island Lake	647.5
Lake Wylie	569.4
Fishing Creek Reservoir	417.2
Great Falls Reservoir	355.8
Cedar Creek Reservoir	284.4
Lake Wateree	225.5

3. Net Inflow – The cumulative inflow into a reservoir, expressed in acre-feet (ac-ft) per month. Net inflow is the sum of tributary stream flow, inflow from upstream hydro development releases (where applicable), groundwater inflow, precipitation falling on the reservoir surface, land surface runoff, and on-reservoir point-source return flows, less the sum of on-reservoir water withdrawals, groundwater recharge, hydro development flow releases, evaporation, and other factors.

4. Normal Minimum Elevation – The level of a reservoir (measured in feet above Mean Sea Level (msl) or feet relative to the full pond contour with 100.0 ft corresponding to full pond) that defines the bottom of the reservoir's Normal Operating Range for a given day of the year. If Net Inflows to the reservoir are within some reasonable

tolerance of the average or expected amounts, hydro project equipment is operating properly, and no protocols for abnormal conditions have been implemented, reservoir level excursions below the Normal Minimum Elevation should not occur.

5. Normal Maximum Elevation – The level of a reservoir (measured in feet above Mean Sea Level (msl) or feet relative to the full pond contour with 100.0 feet corresponding to full pond) that defines the top of the reservoir's Normal Operating Range for a given day of the year. If net inflows to the reservoir are within some reasonable tolerance of the average or expected amounts, hydro project equipment is operating properly and no protocols for abnormal conditions have been implemented, reservoir level excursions above the Normal Maximum Elevation should not occur.

6. Normal Target Elevation - The level of a reservoir (measured in feet above Mean Sea Level (msl) or feet relative to the full pond contour with 100.0 ft corresponding to full pond) that the Licensee will endeavor in good faith to achieve, unless operating in this Low Inflow Protocol, the Maintenance and Emergency Protocol, the Spring Reservoir Level Stabilization Program (Lakes James, Norman, Wyllie and Wateree only), or a Spring Stable Flow Period (Lake Wateree only). Since inflows vary significantly and outflow demands also vary, the Licensee will not always be able to maintain actual reservoir level at the Normal Target Elevation. The Normal Target Elevation falls within the Normal Operating Range, but it is not always the average of the Normal Minimum and Normal Maximum Elevations.

7. Normal Operating Range for Reservoir Levels – The band of reservoir levels within which the Licensee normally attempts to maintain a given reservoir that it operates on a given day. Each reservoir has its own specific Normal Operating Range, bounded by a Normal Maximum Elevation and a Normal Minimum Elevation. If net inflows to the reservoir are within some reasonable tolerance of the average or expected amounts, hydro project equipment is operating properly, and no protocols for abnormal conditions have been implemented, reservoir level excursions outside of the Normal Operating Range should not occur.

8. Large Water Intake – Any water intake (e.g., public water supply, industrial, agricultural, power plant, etc.) having a maximum instantaneous capacity greater than or equal to one million gallons per day (mgd) that withdraws water from the Catawba-Wateree River Basin.

9. Public Water Supply – Any water delivery system owned and/or operated by any governmental or private entity that utilizes waters from the Catawba-Wateree River Basin for public interest including drinking water; residential, commercial, industrial, and institutional uses; irrigation, and/or other public uses.

10. Critical Reservoir Elevation – The highest level of water in a reservoir (measured in feet above Mean Sea Level or feet relative to the full pond contour with 100.0 ft. corresponding to full pond) below which any large public water supply intake, large industrial intake, or regional power plant intake located on the reservoir will not operate at its Licensee-approved capacity. The Critical Reservoir Elevations, as of the revision date of this AIP, are defined below:

Reservoir	Critical Reservoir Elevation (ft. relative to local datum)	Type of Limit
Lake James	61.0	Power Production
Lake Rhodhiss	89.4	Municipal Intake
Lake Hickory	94.0	Municipal Intake
Lookout Shoals Lake	74.9	Municipal Intake
Lake Norman	90.0	Power Production
Mountain Island Lake	94.3	Power Production
Lake Wylie	92.6	Industrial Intake
Fishing Creek Reservoir	95.0	Municipal Intake
Great Falls Reservoir	87.2	Power Production
Cedar Creek Reservoir	80.3	Power Production
Lake Wateree	92.5	Municipal Intake

11. Total Usable Storage (TUS) – The sum of the Project's volume of water expressed in acre-feet (ac-ft) contained between each reservoir's Critical Reservoir Elevation and the Full Pond Elevation.
12. Remaining Usable Storage (RUS) - The sum of the Project's volume of water expressed in acre-feet (ac-ft) contained between each reservoir's Critical Reservoir Elevation and the actual reservoir elevation at any given point in time.
13. Storage Index (SI) – The ratio, expressed in percent, of Remaining Usable Storage to Total Usable Storage at any given point in time.
14. Target Storage Index (TSI) – The ratio of Remaining Usable Storage to Total Usable Storage based on the Project reservoirs being at their Normal Target Elevations. The following table lists the Target Storage Index for the first day of each month:

Month	Target Storage Index For 1st Day of Month (%)*
Jan	61
Feb	51
Mar	61
Apr	66
May	75
Jun	75
Jul	75
Aug	75
Sep	75
Oct	75

Month	Target Storage Index For 1st Day of Month (%)*
Nov	69
Dec	62

* Target Storage Indices for other days of the month are determined by linear interpolation.

15. U.S. Drought Monitor - A synthesis of multiple indices, outlooks, and news accounts that represents a consensus of federal and academic scientists concerning the drought status of all parts of the United States. Typically, the U.S. Drought Monitor indicates intensity of drought as D0-Abnormally Dry, D1-Moderate, D2-Severe, D3-Extreme, and D4-Exceptional. The website address is http://www.drought.unl.edu/dm/monitor.html. The following federal agencies are responsible for maintaining the U.S. Drought Monitor:

    - Joint Agricultural Weather Facility (U.S. Department of Agriculture and Department of Commerce/National Oceanic and Atmospheric Administration)
    - Climate Prediction Center (U.S. Department of Commerce/NOAA/National Weather Service)
    - National Climatic Data Center (DOC/NOAA)

16. U.S. Drought Monitor Three-Month Numeric Average – If the U.S. Drought Monitor has a reading of D0-D4 as of the last day of the previous month for any part of the Catawba-Wateree River Basin that drains to Lake Wateree, the Basin will be assigned a numeric value for the current month. The numeric value will equal the highest Drought Monitor designation (e.g., D0 = 0, D4 = 4) as of the last day of the previous month that existed for any part of the Catawba-Wateree River Basin that drains to Lake Wateree. A normal condition in the Basin, defined as the absence of a Drought Monitor designation, would be assigned a numeric value of negative one (-1). A running average numeric value of the current month and the previous two months will be monitored and designated as the U.S. Drought Monitor Three-Month Numeric Average.

17. Critical Flows – The minimum flow releases from the hydro developments that may be necessary to:

    d. prevent long-term or irreversible damage to aquatic communities consistent with the resource management goals and objectives for the affected stream reaches;

    e. provide some basic level of operability for Large Water Intakes located on regulated river reaches; and,

    f. provide some basic level of water quality maintenance in the affected stream reaches.

    For the purposes of this LIP, the Critical Flows are as follows:

    a. Linville River, below the Bridgewater Development: 75 cubic feet per second (cfs).

    b. Catawba River Bypassed Reach below the Bridgewater Development: 25 cfs.

c. Oxford Regulated River Reach below the Oxford Development: 100 cfs.

d. Lookout Shoals Regulated River Reach below the Lookout Shoals Development: 80 cfs.

e. Wylie Regulated River Reach below the Wylie Development: 700 cfs.

f. Great Falls Bypassed Reaches (Long and Short) at the Great Falls-Dearborn Development: 450 cfs and 80 cfs respectively.

g. Wateree Regulated River Reach below the Wateree Development: 800 cfs.

h. Leakage flows at the remaining Project structures. Leakage flows are defined as the flow of water through wicket gates when the hydro units are not operating and seepage though the Project structures at each development.

18. Recreation Flow Reductions - Since all recreation flow releases must be made by either releasing water through hydroelectric generation or through flow releases that bypass hydro generation equipment, reductions in Project Flow Requirements will impact recreation flow releases.

19. Organizational Abbreviations – Organizational abbreviations include the NC Department of Environment and Natural Resources (NCDENR), North Carolina Wildlife Resources Commission (NCWRC), South Carolina Department of Natural Resources (SCDNR), South Carolina Department of Health and Environmental Control (SCDHEC), and the United States Geological Survey (USGS).

20. Catawba-Wateree Drought Management Advisory Group (CW-DMAG) – The CW-DMAG will be tasked with working with the Licensee when the LIP is initiated. This team will also meet as necessary to foster a basin-wide response to a Low Inflow Condition (see Procedure section of this LIP). Members of the CW-DMAG agree to comply with the conditions of this LIP. Membership on the CW-DMAG is open to the following organizations, of which each organization may have up to two members:

    a. NCDENR (including - Division of Water Resources and the Division of Water Quality)
    b. NCWRC
    c. SCDNR
    d. SCDHEC
    e. USGS
    f. Each Owner of a Large Water Intake located on one of the Catawba-Wateree Project reservoirs or the main stem of the Catawba-Wateree River
    g. Each Owner of a Large Water Intake located on any tributary stream within the Catawba-Wateree River Basin that ultimately drains to Lake Wateree
    h. Licensee (CW-DMAG Coordinator)

    The CW-DMAG will meet annually during the month of May, regardless of the Low Inflow Condition status, to review prior year activities, discuss data input from Large Intake Owners, and discuss other issues relevant to the LIP. The Licensee will maintain an active roster of the CW-DMAG and update the roster as needed.

21. Revising the LIP - During the term of the New License, the CW-DMAG will be tasked with reviewing and updating the LIP. In order to ensure continuous improvement of the LIP and its implementation throughout the New License term, the LIP will be re-evaluated and modified periodically. These re-evaluations and modifications will be considered at least once every five (5) years. Modifications must be approved by a

consensus of the participating CW-DMAG members. If the participating members cannot reach consensus, then the procedures identified in the Final Agreement for dispute resolution will be used for resolving the dispute. Approved modifications will be incorporated through revision of this LIP and the Licensee will file the revised LIP with FERC. In addition, if any modifications of the LIP require amendment of the New License, the Licensee will file a license amendment request for FERC approval. During this process the CW-DMAG may appoint an ad hoc committee to address issues and revisions relevant to the LIP. Issues such as sediment fill impact on reservoir storage volume calculations, and substitution of a regional drought monitor for the U.S. Drought Monitor, if developed in the future, are examples of items that may be re-evaluated.

The Licensee will prepare meeting summaries of all CW-DMAG meetings and will make these meeting summaries available to the public by posting on its website.

22. Water Withdrawal Data Collection and Reporting – All owners of Large Water Intakes located on Project reservoirs will, on an annual basis, report daily and average monthly metered water withdrawals (in MGD) to the Licensee. The Licensee will maintain a database of this information including the Licensee's own non-hydro water use records (i.e., water uses due to thermal power generation). These annual withdrawal summaries will be due by January 31 of each year for the preceding calendar year.

23. Reclaimed Water – Wastewater that has been treated to reclaimed water standards and is re-used for a designated purpose (e.g. industrial process, irrigation). Reclaimed Water will not be subject to the water use restrictions outlined in this LIP.

24. Drought Response Plan Updates – All Large Water Intake Owners will review and update their Drought Response Plans (or develop a plan if they do not have one) to ensure compliance and coordination with this LIP, including the authority to enforce the provisions outlined herein.

25. Relationship Between the LIP and the Maintenance & Emergency Protocol (MEP) – The MEP outlines the response the Licensee will take under certain emergency and equipment failure and maintenance situations to continue practical and safe operation of the Project, to mitigate any related impacts to license conditions, and to communicate with resource agencies and the affected parties. Under the MEP, temporary modifications of minimum flow releases and the reservoir level Normal Operating Ranges are allowed. Lowering levels of Project reservoirs caused by situations addressed under the MEP will not invoke implementation of this Low Inflow Protocol (LIP). Also, if the LIP has already been implemented at the time that a situation covered by the MEP is initiated, the Licensee will typically suspend implementation of the LIP until the MEP situation has been eliminated. The Licensee may, however, choose to continue with the LIP if desirable.

26. Consensus – Consensus is reached when all CW-DMAG members can 'live with' the outcome or proposal being made. The concept of consensus is more fully described in the Catawba – Wateree Hydroelectric Project Relicensing – Stakeholder Teams Charter (dated October, 2005).

27. Monitored USGS Streamflow Gages - USGS streamflow gage #'s 02145000 (South Fork Catawba River at Lowell, NC), 02137727 (Catawba River near Pleasant Gardens, NC), 02140991 (Johns River at Arneys Store, NC), and 02147500 (Rocky Creek at Great Falls, SC)

ASSUMPTIONS

1. Instream Flows for Recreation – The New License for the Catawba-Wateree Project includes the prescribed recreational flow releases as listed in Section 3.0 of this AIP.
2. Instream Flows for Aquatic Habitat – The New License for the Catawba-Wateree Project includes the instream flow requirements for aquatic habitat as listed in Section 4.0 of this AIP, including flow requirements in bypassed reaches.
3. Actions to Support Water User Needs – The New License for the Catawba-Wateree Project includes actions to support water user needs as listed in Section 5.0 of this AIP.
4. Project Flow Requirements – These flow requirements include Instream Flows for Aquatic Habitat and the portion of Instream Flows for Recreation that is greater than the Instream Flows for Aquatic Habitat as identified in Sections 3.0 and 4.0 of this AIP for normal conditions (i.e., conditions outside of this LIP or the Maintenance and Emergency Protocol).
5. Public Information System – The Licensee will maintain public information readily available on its website and toll-free telephone system as identified in Section 8.0 of this AIP.
6. Normal Operating Ranges for Reservoir Levels – The New License for the Catawba-Wateree Project includes the Normal Operating Ranges for reservoir levels (i.e., Normal Minimum, Normal Maximum, and Normal Target Elevations) as listed in Section 2.0 of this AIP.

PROCEDURE

During periods of normal inflow, reservoir levels will be maintained within prescribed Normal Operating Ranges. During times that inflow is not adequate to meet all of the normal demands for water and maintain reservoir levels as normally targeted, the Licensee will progressively reduce hydro generation while meeting Project Flow Requirements. During a Low Inflow Watch or a Low Inflow Condition (LIC) (as defined below), the Licensee and other water users will follow the protocol set forth below for the Catawba-Wateree Project regarding communications and adjustments to hydro releases, bypassed flow releases, minimum reservoir elevations, and other water demands. The adjustments set forth below will be made on a monthly basis and are designed to equitably allocate the impacts of reduced water availability in accordance with the purpose statement of this LIP.

Trigger points that demonstrate worsening hydrologic conditions will define various stages of the Low Inflow Condition. A summary of trigger points for various stages is provided in the table below. The specific triggers required to enter successive stages are defined in the procedure for each stage.

Summary of LIP Trigger Points

Stage	Storage Index [1]		Drought Monitor [2] (3-month average)		Monitored USGS [3] Streamflow Gages
0[4]	90% < SI < TSI		0 = DM		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%

[1] The ratio of Remaining Useable Storage to Total Usable Storage at a given point in time.

[2] The three-month numeric average of the published U.S. Drought Monitor.

[3] The sum of the rolling sixth-month average for the monitored streamflow gages as a percentage of the period of record rolling average for the same six-month period for the monitored streamflow gages.

[4] Stage 0 is triggered when any two of the three trigger points are reached.

Stage 0 - Low Inflow Watch:

The Licensee will monitor the Storage Index, the U.S. Drought Monitor, and the Monitored USGS Streamflow Gages on at least a monthly basis and will declare a Stage 0 - Low Inflow Watch if any two of the following conditions occur:

a. On the first day of the month, Storage Index is below the Target Storage Index, but greater than 90% of the Target Storage Index, while providing the Project Flow Requirements for the previous month.

b. The U.S. Drought Monitor Three-Month Numeric Average has a value greater than or equal to 0.

c. The sum of the actual rolling six-month average streamflows at the Monitored USGS Streamflow Gages is equal to or less than 85% of the sum of the period of record rolling average streamflows for the same six-month period.

When a Low Inflow Watch has been declared:

a. The Licensee will activate the CW-DMAG, including the initiation of monthly meetings or conference calls to occur on the second Tuesday of each month. These monthly discussions will focus on:

- Proper communication channels between the CW-DMAG members.
- Information reporting consistency for CW-DMAG members, including a storage index history and forecast (at least a 90-day look back and look ahead) from the Licensee, a water use history and forecast (at least a 90-day look back and look ahead) from each water user on the CW-DMAG, streamflow gage and groundwater monitoring status from the state agencies and USGS, and state-wide drought response status from the state agencies.
- Refresher training on this LIP.
- Overview discussions from each CW-DMAG member concerning their role and plans for responding if a Low Inflow Condition is subsequently declared.

b. In addition, the Licensee will reduce the prescribed recreation flow releases at the Wylie Development from 6,000 cfs to 3,000 cfs.

<u>Stage 1 Actions:</u>

1. The Licensee will declare a Stage 1 LIC and notify the CW-DMAG if:

   a. On the first day of the month, Storage Index is at or below 90% of the Target Storage Index, but greater than 75% of the Target Storage Index, while providing the Project Flow Requirements for the previous month.

   and either of the following conditions exists:

   b. The U.S. Drought Monitor Three-Month Numeric Average has a value greater than or equal to 1.

   c. The sum of the actual rolling six-month average streamflows at the Monitored USGS Streamflow Gages is equal to or less than 78% of the sum of the period of record rolling average streamflows for the same six-month period.

2. The Licensee will complete the following activities within 5 days after the Stage 1 LIC declaration:

   a. Reduce the Project Flow Requirements by 60% of the difference between the Project Flow Requirements and the Critical Flows. These reduced Project Flow Requirements are referred to as Stage 1 Minimum Project Flows.

   b. Reduce the Normal Minimum Elevations by one foot at each reservoir, except two feet at Lake James and Lake Norman, but not to levels at any reservoir below the Critical Reservoir Elevations. These elevations are referred to as the Stage 1 Minimum Elevations.

c. Update its Web site and Interactive Voice Response (IVR) messages to account for the impacts of the LIP on reservoir levels, usability of the Licensee's public access areas, and recreation flow schedules.

d. Provide bi-weekly (once every two weeks) information updates to owners of Large Water Intakes about reservoir levels, meteorological forecasts, and inflow of water into the system.

3. Owners of Public Water Supply intakes and other intakes with a capacity greater than 100,000 gallons per day used for irrigation will complete the following activities within 14 days after the Stage 1 LIC declaration:

   a. Notify their water customers of the Low Inflow Condition through public outreach and communication efforts.

   b. Request that their water customers implement voluntary water use restrictions, in accordance with their drought response plans, which may include:

      - Reduction of lawn and landscape irrigation to no more than two days per week (i.e. residential, multi-family, parks, streetscapes, schools, etc).
      - Reduction of residential vehicle washing.

      At this level, the goal is to reduce water usage by approximately 3-5% from the amount that would otherwise be expected. The baseline for this comparison will be generated by each entity and will be based on existing conditions (i.e. drought conditions). For the purposes of determining 'the amount that would otherwise be expected', each entity may give consideration to one or more of the following:

      - Historical maximum daily, weekly, and monthly flows during drought conditions.
      - Increased customer base (e.g. population growth, service area expansion) since the historical flow comparison.
      - Changes in major water users (e.g. industrial shifts) since the historical flow comparison.
      - Climatic conditions for the comparison period.
      - Changes in water use since the historical flow comparison.
      - Other system specific considerations.

   c. Provide a status update to the CW-DMAG on actual water withdrawal trends. Discuss plans for moving to mandatory restrictions, if required.

4. Owners of Large Water Intakes, other than those referenced in item 3 above, will complete the following activities within 14 days after the Stage 1 LIC declaration:

   a. Notify their customers of the Low Inflow Condition through public outreach and communication efforts.

   b. Request that their customers conserve water through reduction of water use, electric power consumption, and other means.

   c. Provide a status update to the CW-DMAG on actual water withdrawal trends.

Stage 2 Actions:

1. The Licensee will declare a Stage 2 Low Inflow Condition (LIC) and notify the CW-DMAG if:

    a. On the first day of the month, Storage Index is at or below 75% of the Target Storage Index, but greater than 57% of the Target Storage Index, while providing the Stage 1 Minimum Project Flows during the previous month.

    and either of the following conditions exists:

    b. The U.S. Drought Monitor Three-Month Numeric Average has a value greater than or equal to 2.

    c. The sum of the actual rolling six-month average streamflows at the Monitored USGS Streamflow Gages is equal to or less than 65% of the sum of the period of record rolling average streamflows for the same six-month period.

2. The Licensee will complete the following activities within 5 days after the Stage 2 LIC declaration:

    a. Eliminate prescribed recreation flow releases at this stage and all subsequent stages. Reduce the remaining Project Flow Requirements by 95% of the difference between the Project Flow Requirements and Critical Flows. These reduced flows are referred to as Stage 2 Minimum Project Flows.

    b. Reduce the Stage 1 Minimum Elevations by one additional foot (two feet total below Normal Minimum Elevation) at each reservoir, except by one additional foot at Lake James (three feet total below Normal Minimum Elevation) and two additional feet at Lake Norman (four feet total below Normal Minimum Elevation), but not to levels at any reservoir below the Critical Reservoir Elevations. These elevations are referred to as the Stage 2 Minimum Elevations.

    c. Update its website and IVR messages to account for the impacts of the LIP on reservoir levels, usability of the Licensee's public access areas, and recreation flow schedules.

    d. Provide bi-weekly information updates to owners of Large Water Intakes about reservoir levels, meteorological forecasts, and inflow of water into the system.

3. Owners of Public Water Supply intakes and other intakes with a capacity greater than 100,000 gallons per day used for irrigation will complete the following activities within 14 days after the Stage 2 LIC declaration:

    a. Notify their water customers of the continued Low Inflow Condition and movement to mandatory water use restrictions through public outreach and communication efforts.

    b. Require that their water customers implement <u>mandatory</u> water use restrictions, in accordance with their drought response plans, which may include:

        - Limiting lawn and landscape irrigation to no more than <u>two days</u> per week (i.e. residential, multi-family, parks, streetscapes, schools, etc).
        - Eliminating residential vehicle washing.

- Limiting public building, sidewalk, and street washing activities except as required for safety and/or to maintain regulatory compliance.

At this level, the goal is to reduce water usage by approximately 5-10% from the amount that would otherwise be expected (as discussed in Stage 1 above).

c. Enforce mandatory water use restrictions through the assessment of penalties.

d. Provide a status update to the CW-DMAG on actual water withdrawal trends.

4. Owners of Large Water Intakes, other than those referenced in item 3 above, will complete the following activities within 14 days after the Stage 2 LIC declaration:

   a. Continue informing their customers of the Low Inflow Condition through public outreach and communication efforts.

   b. Request that their customers conserve water through reduction of water use, electric power consumption, and other means.

   c. Provide a status update to the CW-DMAG on actual water withdrawal trends.

<u>Stage 3 Actions:</u>

1. The Licensee will declare a Stage 3 Low Inflow Condition (LIC) and notify the CW-DMAG if:

   a. On the first day of the month, Storage Index is at or below 57% of the Target Storage Index, but greater than 42% of the Target Storage Index, while providing the Stage 2 Minimum Project Flows during the previous month.

   and either of the following conditions exists:

   b. The U.S. Drought Monitor Three-Month Numeric Average has a value greater than or equal to 3.

   c. The sum of the actual rolling six-month average streamflows at the Monitored USGS Streamflow Gages is equal to or less than 55% of the sum of the period of record rolling average streamflows for the same six-month period.

2. The Licensee will complete the following activities within 5 days after the Stage 3 LIC declaration:

   a. Reduce the Stage 2 Minimum Project Flows to Critical Flows. These reduced flows are referred to as Stage 3 Minimum Project Flows.

   c. Reduce the Stage 2 Minimum Elevations by one additional foot (three feet total below Normal Minimum Elevation) at each reservoir, except by seven additional feet at Lake James (ten feet total below Normal Minimum Elevation) and one additional foot at Lake Norman (five feet total below Normal Minimum Elevation), but not to levels at any reservoir below the Critical Reservoir Elevations. These elevations are referred to as the Stage 3 Minimum Elevations.

   d. Update its website and IVR messages to account for the impacts of the LIP on reservoir levels, usability of the Licensee's public access areas, and recreation flow schedules.

e. Provide bi-weekly information updates to owners of Large Water Intakes about reservoir levels, meteorological forecasts, and inflow of water into the system.

3. Owners of Public Water Supply intakes and other intakes with a capacity greater than 100,000 gallons per day used for irrigation will complete the following activities within 14 days after the Stage 3 LIC declaration:

   a. Notify their water customers of the continued Low Inflow Condition and movement to more stringent mandatory water use restrictions through public outreach and communication efforts.

   b. Require that their water customers implement increased mandatory water use restrictions, in accordance with their drought response plans, which may include:

      - Limiting lawn and landscape irrigation to no more than one day per week (i.e. residential, multi-family, parks, streetscapes, schools, etc).
      - Eliminating residential vehicle washing.
      - Limiting public building, sidewalk, and street washing activities except as required for safety and/or to maintain regulatory compliance.
      - Limiting construction uses of water such as dust control.
      - Limiting flushing and hydrant testing programs, except to maintain water quality or other special circumstances.
      - Eliminating the filling of new swimming pools.

      At this level, the goal is to reduce water usage by approximately 10-20% from the amount that would otherwise be expected (as discussed in Stage 1 above).

   c. Enforce mandatory water use restrictions through the assessment of penalties.

   d. Encourage industrial/manufacturing process changes that reduce water consumption.

   e. Provide a status update to the CW-DMAG on actual water withdrawal trends.

4. Owners of Large Water Intakes, other than those referenced in item 3 above, will complete the following activities within 14 days after the Stage 3 LIC declaration:

   a. Continue informing their customers of the Low Inflow Condition through public outreach and communication efforts.

   b. Request that their customers conserve water through reduction of water use, electric power consumption, and other means.

   c. Provide a status update to the CW-DMAG on actual water withdrawal trends.

Stage 4 Actions:

1. The Licensee will declare a Stage 4 Low Inflow Condition (LIC) and notify the CW-DMAG if:

a. On the first day of the month, Storage Index is at or below 42% of the Target Storage Index, while providing the Stage 3 Minimum Project Flows during the previous month.

and either of the following conditions exists:

b. The U.S. Drought Monitor Three-Month Numeric Average has a value of 4.

c. The sum of the actual rolling six-month average streamflows at the Monitored USGS Streamflow Gages is equal to or less than 40% of the sum of the period of record rolling six-month average streamflows for the same six-month period.

2. The Licensee will:

a. Continue to provide Critical Flows as long as possible.

b. Reduce the Stage 3 Minimum Elevations to the Critical Reservoir Elevations.

c. Establish a meeting date and notify the CW-DMAG within 1 day following the Stage 4 LIC declaration.

d. Continue to update its website and IVR messages to account for the impacts of the LIP on reservoir levels, usability of the Licensee's public access areas, and recreation flow schedules.

e. Provide bi-weekly information updates to owners of Large Water Intakes about reservoir levels, meteorological forecasts, and inflow of water into the system.

Note: Once a Stage 4 LIC is declared, the Remaining Usable Storage in the reservoir system is small and can be fully depleted in a matter of weeks or months. Groundwater recharge may also contribute to declining reservoir levels. For these reasons in the Stage 4 LIC, the Licensee may not be able to ensure that releases from its hydro developments will meet or exceed Critical Flows or that reservoir elevations will be greater than or equal to the Critical Reservoir Elevations.

3. Owners of Public Water Supply intakes and other intakes with a capacity greater than 100,000 gallons per day used for irrigation will complete the following activities within 14 days after the Stage 4 LIC declaration:

a. Notify their water customers of the continued Low Inflow Condition and movement to **emergency** water use restrictions through public outreach and communication efforts.

b. Restrict all outdoor water use.

c. Implement emergency water use restrictions in accordance with their drought response plans, including enforcement of these restrictions and assessment of penalties.

d. Prioritize and meet with their commercial and industrial large water customers to discuss strategies for water reduction measures including development of an activity schedule and contingency plans.

e. Prepare to implement emergency plans to respond to water outages.

At this level, the goal is to reduce water usage by approximately 20-30% from the amount that would otherwise be expected (as discussed in Stage 1 above).

4. Owners of Large Water Intakes on the CW-DMAG, other than those referenced in item 3 above, will complete the following activities within 14 days after the Stage 4 LIC declaration:
    a. Continue informing their customers of the Low Inflow Condition through public outreach and communication efforts.
    b. Request that their customers conserve water through reduction of water use, electric power consumption, and other means.
5. The CW-DMAG will:
    a. Meet within 5 days after the declaration of the Stage 4 LIC and determine if there are any additional measures that can be implemented to:
        (1) reduce water withdrawals;
        (2) reduce water releases from the Project; or
        (3) utilize additional reservoir storage without creating more severe regional problems.
    b. Work together to develop plans and implement any additional measures identified above.

Recovery from the Low Inflow Protocol

1. Recovery from the LIP will simply reverse the same staged approach as noted above, except that:
    a. All three of the trigger points identified above for declaring the lower numbered stage must be met or exceeded before returning reservoir levels and flows to that LIC stage, Low Inflow Watch, or Normal Conditions.
    b. The following groundwater level trigger points must also be attained before returning reservoir levels and flows to that LIC stage, Low Inflow Watch, or Normal Conditions:

    USGS has reviewed available well records and has determined that there are existing wells with an adequate period that can be used for this process and has also determined that additional wells are needed in order to include groundwater data as part of the recovery.

Groundwater Trigger Points (depth below land surface (feet)) for Returning to:					
Groundwater Monitor [Reg.=regolith; BR=bedrock]	**Stage 3 (a)**	**Stage 2 (b)**	**Stage 1 (c)**	**LIW (d)**	**Normal (d)**
#1 Future Well Placeholder					
#2 Future Well Placeholder					
#3 Future Well Placeholder					
#4 Future Well Placeholder					
#5 Future Well Placeholder					

Groundwater Trigger Points (depth below land surface (feet)) for Returning to:					
Groundwater Monitor [Reg.=regolith; BR=bedrock]	**Stage 3 (a)**	**Stage 2 (b)**	**Stage 1 (c)**	**LIW (d)**	**Normal (d)**
#6 USGS Langtree Peninsula RS Reg. well MW-2 & BR well MW-2D	24.91	23.61	22.21	18.21	18.21
#7 USGS Linville RS NC-220 BR well	2.74	2.19	2.11	2.04	2.04
#8 NC DWR Glen Alpine BR well L 76G2	10.01	9.03	8.32	7.69	7.69
#9 Future Well Placeholder					
#10 Future Well Placeholder					

Note: USGS groundwater levels calculated from daily mean data. NCDWR water levels calculated from hourly data. All trigger levels calculated from water levels collected through the 2005 water year. Trigger groundwater levels may be updated on a yearly or water-year basis.

Footnotes:

(a) Stage 3: Period of record low water level
(b) Stage 2: 10th percentile
(c) Stage 1: 25th percentile
(d) LIW and Normal: 50th percentile

2. The NCDENR, SCDNR, SCDHEC, USGS and the Licensee will determine when attainment of the groundwater trigger points for recovery is reached.
3. The Licensee will directly notify the CW-DMAG members within 5 days following attainment of all the trigger points necessary to recover to a lower stage of the LIC, Low Inflow Watch, or Normal Conditions.
4. The Licensee will update its website and IVR messages to account for the impacts of the LIP on reservoir levels, usability of the Licensee's public access areas, and recreation flow schedules.

APPENDIX M

GIS DATABASE

(electronic copy provided on enclosed CD)