

Drought Management Plan

Cities of Concord and Kannapolis

Final - December 2007

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The Draft Drought Management Plan for the Cities of Concord and Kannapolis was submitted to North Carolina Division of Water Resources on July 31, 2007. Revisions have been made based on Division of Water Resources comments and this plan is now being resubmitted.

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Acronyms and Abbreviations

ADD	Average Daily Demand
CA	Critical Areas
cfs	Cubic Feet per Second
Cities	Cities of Concord and Kannapolis
CMU	Charlotte-Mecklenburg Utilities
DENR	North Carolina Department of Environment and Natural Resources
DMAC	North Carolina Drought Management Advisory Council
DMP	Drought Management Plan
DWQ	Division of Water Quality
DWR	North Carolina Division of Water Resources
EMC	Environmental Management Commission
FERC	Federal Energy Regulatory Commission
FY	Fiscal Year
GPCD	Gallons per Capita per Day
HQW	High Quality Water
IBT	Interbasin Transfer
ICI	Industrial, Commercial, Institutional
LIP	Low Inflow Protocols
MDD	Maximum Daily Demand
MGD	Million Gallons per Day
MSL	Mean Sea Level
NGVD	National Geodetic Vertical Datum 1929
NME	Normal Minimum Elevation
PIO	Public Information Officer
SI	Storage Index
Triggers	Drought Condition Indicators
USACE	The U.S. Army Corps of Engineers
USGS	United States Geological Services
WSACC	Water and Sewer Authority of Cabarrus County
WTP	Water Treatment Plant

1.0 Introduction

The Cities of Concord and Kannapolis (Cities) have received an interbasin transfer (IBT) Certificate to meet their projected water supply shortfall during the next 30 years. The North Carolina Environmental Management Commission (EMC) has approved, on a maximum day, 10 million gallons per day (mgd) from the Catawba River Basin to the Rocky River Basin and 10 mgd from the Yadkin River Basin to the Rocky River Basin. As a condition of the IBT Certificate, the Cities are required to produce a Drought Management Plan (DMP) that outlines measures that will be taken to restrict water usage during varying degrees of drought conditions. In this plan it is also required to document the Cities' authority to implement drought mitigating measures within their own jurisdictions as well as any other municipalities that receive water from the interbasin transfers via the Cities' distribution system (CH2M HILL, 2006).

The purpose of this DMP is to meet the condition of the IBT Certificate, but it is also being implemented because the Cities are cognizant of the fact that droughts have a significant impact on their water supply, as evidenced by the extensive drought that lasted from 1999 through the spring of 2003 and the current drought occurring in 2007. The 1999-2003 drought impacted the Cabarrus County communities for a longer period of time than elsewhere because of the small size of their drinking water watersheds. This prompted the communities to adopt stringent water conservation programs including a tiered rate structure that promotes water conservation and discourages irrigation by making high levels of water use more expensive, which each City maintains to this day. The Cities have accepted the responsibility of being good water stewards as part of their business operations.

An update to the 2002 Drought Management Plan (Black & Veatch, 2004) is necessary because of the requirements of the IBT Certificate and recent ordinance and rule changes. Since the Cities are expanding their water supply sources outside of their own jurisdictions, drought considerations within each of the source basins need to be taken into account within the Cities' drought management planning. Two Low Inflow Protocols (LIPs) will provide, in part, the basis for the DMP for the Cities: the LIPs for the Catawba-Wateree and Yadkin-Pee Dee River Hydroelectric Projects. These LIPs were developed as part of the relicensing efforts in each basin, with stakeholders from North Carolina and South Carolina, both private and public, involved throughout the process. The LIPs were developed such that each party with interests in water quantity will share the responsibility to conserve the limited resources; this responsibility now includes Concord and Kannapolis. These LIPs must be included in the DMP as a condition of the IBT certificate.

In addition, the EMC adopted rules related to water use during droughts and water emergencies (15A NCAC 02E Section .0600) that became effective in March 2007 and must be addressed in the DMP. The U.S. Army Corps of Engineers (USACE) identified the following elements as minimum requirements of a drought response plan (Managing Water for Drought, IWR Report 94-NDS-8, September 1994):

- Triggers
- Forecasts

- Monitoring
- Enforcement
- Public affairs strategy
- Management measures
- Coordination mechanism

The LIPs outline the following factors essential for managing water resources during a drought period:

- Drought condition indicators (triggers), e.g., reservoir levels that indicate drought response action levels
- Potable water use priorities, which indicate the responses at each drought trigger level, e.g., limitations on outdoor water use (lawn watering and car washing)
- Low-flow protection, to ascertain that minimum instream flow requirements are being met
- Water storage during a critical drought

In addition to incorporating the trigger points-associated action items of the Catawba and Yadkin Pee-Dee River Basins LIPs and the state rules adopted by the EMC, the Cities also will follow actions triggered by drought designations by the NC Drought Management Advisory Council and/or drought condition indicators in the Rocky River Subbasin, where their reservoirs are located. Because their reservoirs are located in the headwaters of their respective watersheds, they are very sensitive to drought conditions.

Establishing the trigger points and the response actions should incorporate stakeholder input and an assessment of drought impacts (economic, cultural and environment), reflecting all likely uses of the reservoirs including municipal water supply, recreation (fishing, boating), and downstream users.

As briefly outlined above, the Cities updated DMP is a comprehensive document comprised of the following sections:

- Drought Response Plan
- Existing Water Conservation Measures
- Water Supply Assessment

The following in depth sections provide a clear and precise plan of action to be taken by the Cities in time of drought; the DMP defines and describes all water conservation actions in place and currently implemented by the Cities. These plans for implementation also include enforcement policies. In conclusion, the DMP thoroughly details the Cities water supply sources and uses providing an all-inclusive understanding of the Cities water consumption.

2.0 Drought Response Plan

A drought response plan consists of multiple parts. The first essential piece is the definition of the stages of drought, each stage indicating the increasing severity of the drought conditions. Each of the drought stages must be triggered by a water resource indicator related to water supply, which includes but is not limited to the following: instream flows, precipitation, and reservoir levels. These indicators reach threshold values called trigger points, which will initiate different drought stages and subsequently require a water supplier to instate different levels of drought response including water reduction efforts to prolong water supplies during severe water deficit periods thereby avoiding potential water supply catastrophes. Trigger points can occur from each basin as presented by Table 2-1, located on the next few pages.

The following sections outline the drought response plan for the Cities.

2.1 Stages

The proposed Drought Response Plan is broken into five stages (Table 2-2); these stages are modeled after the Catawba-Wateree and Yadkin Pee-Dee LIPs and the WSACC Drought Operational Plan (Black & Veatch, 2004), which is based in the Rocky River Subbasin. The aforementioned LIPs have been established for two of the source basins (Catawba and Yadkin Pee-Dee) used by the Cities for water supply. Therefore, these LIPs will be used as the framework for the Cities' Drought Response Plans. This updated plan for the Cities will meet the requirements for the Drought Response Plan as outlined in the IBT Certificate and the requirement of all public water supplies that receive water from the Catawba and Yadkin Pee-Dee River basins to adhere to the measures outlined in the LIPs. Table 2-2 presents the drought stages of the Cities of Concord and Kannapolis.

TABLE 2-2
Concord and Kannapolis Drought Stages
Concord & Kannapolis Drought Management Plan

Drought Stage	Stage Name
0	Drought Planning
1	Drought Watch
2	Drought Warning
3	Drought Emergency Level I
4	Drought Emergency Level II

INSERT TABLE 2-1
Concord and Kannapolis Drought Management Trigger Points

Insert Table 2-1 (Page 2 of 3)

Insert Table 2-1 (Page 3 of 3)

2.2 Drought Stage Trigger Points

The goal of staged trigger points is to provide the ability for parties that have a vested interest in a water supply watershed to delay the point at which the available water storage is depleted. The staging of these trigger points slows the depletion process, extending the length of time the water supply will last, increasing the probability that precipitation will assist in restoring the water supply to normal ranges. Therefore, a quality understanding of the water supply storage capacity of a watershed is essential for planning the trigger points.

The Cities have a complicated network from which they obtain their total water supply. The Cities' water supply is derived from three different basins – the Rocky River Subbasin, the Catawba River Basin, and the Yadkin Pee-Dee River Basin – subjecting them to the IBT Certification process as described earlier. Two hydroelectric projects, one in the Catawba and one in the Yadkin Pee-Dee, have recently completed their relicensing with the FERC; one result of these relicensing efforts was the establishment of new LIPs. The LIPs outline the protocol for each Licensee and all public water supplies that have interest in the water quantity within either basin. Because, the Cities have received an IBT certificate to receive water from both the Catawba River Basin and the Yadkin River Basin, they too are now subject to there LIPs.

The following three sections describe the trigger points outlined in the Final Catawba-Wateree LIP, the Draft Yadkin Pee-Dee LIP, and the WSACC Drought Operation Plan. The entirety of each document can be found in Appendices A and C.

2.2.1 Final Catawba-Wateree Low Inflow Protocol

The Catawba-Wateree LIP provides trigger points and procedures for the Catawba-Wateree Hydroelectric Project, and lists all parties with vested interests in water quantity of the Catawba River Basin. The LIP provides procedures for the Licensee for FERC License No. 2232, as well as all public water supply withdrawal within the Catawba River Basin. The LIP trigger points are designed in accordance with worsening hydrologic conditions within the Catawba River Basin from Lake James to Lake Wateree in South Carolina. The trigger points are a combination of factors that are indicators of the hydrologic condition of the Catawba River Basin. These indicators include (1) the storage index (SI), which is the ratio of the remaining useable storage, difference between the actual reservoir elevation at any given time and the critical reservoir elevation, to the total usable storage, sum of all reservoirs volume of water between the reservoirs critical reservoir elevation and full pond, at any given point in time. (2) The Drought Monitor trigger point is the 3-month numeric average of the published U.S. Drought Monitor for the region. (3) The final indicator used is United States Geologic Survey (USGS) stream gage data to determine the rolling 6-month average for USGS monitored streams as a percentage of the period of record rolling average for the same 6-month period. Table 2-3 presents the trigger points for the Catawba-Wateree LIP drought response.

TABLE 2-3
 Catawba-Wateree LIP Drought Response Trigger Points
Concord & Kannapolis Drought Management Plan

Stage	Storage Index		Drought Monitor (3-month average)		Monitored USGS Stream Flow Gages
0 ^a	90% < SI < 100% TSI		3 m. Ave DM ≥ 0		Ave ≤ 85% LT 6 mo. Ave
1	75% TSI < SI ≤ 90% TSI	and	3 m. Ave DM ≥ 1	or	Ave ≤ 78% LT 6 mo. Ave
2	57% TSI < SI ≤ 75% TSI	and	3 m. Ave DM ≥ 2	or	Ave ≤ 65% LT 6 mo. Ave
3	42% TSI < SI ≤ 57% TSI	and	3 m. Ave DM ≥ 3	or	Ave ≤ 55% LT 6 mo. Ave
4	SI ≤ 42% TSI	and	3 m. Ave DM = 4	or	Ave ≤ 40% LT 6 mo. Ave

^aStage 0 is triggered when any two of the three trigger points are reached.

2.2.2 Draft Yadkin Pee-Dee Low Inflow Protocol

The LIP for the Yadkin-Pee Dee River is based on the water storage of High Rock Reservoir’s normal minimum elevation (NME), which is a monthly value that ranges from 613.9 feet above mean sea level (MSL) (National Geodetic Vertical Datum [NGVD] 1929) in January to 619.9 feet above MSL from April to October. The second two trigger points for the Yadkin-Pee Dee River Basin are the same as in the Catawba-Wateree, except the monitored USGS stream flow gage data are the 3-month rolling average as a percent of the historical average. Table 2-4 presents the trigger points for the Yadkin-Pee Dee LIP drought response.

TABLE 2-4
 Yadkin Pee-Dee LIP Drought Response Trigger Points
Concord & Kannapolis Drought Management Plan

Stage	High Rock Reservoir Elevation		Drought Monitor (3-month average)		Monitored USGS Stream flow Gages
0	< Normal Min. Elevation (NME)	and either	3 m. Ave DM ≥ 0	or	Ave <48 % LT Ave
			OR		
1	<NME minus 0.5 ft		Any		Any
1	<NME minus 1 ft	and	3 m. Ave DM ≥ 1	or	Ave <41 % LT Ave
2	<NME minus 2 ft	and	3 m. Ave DM ≥ 2	or	Ave <35 % LT Ave
3	<NME minus 3 ft	and	3 m. Ave DM ≥ 3	or	Ave <30 % LT Ave
4	<1/2 (NME minus Critical Elevation)	and	3 m. Ave DM ≥ 4	or	Ave <30 % LT Ave

2.2.3 NC Drought Management Advisory Council

Drought level designation by the NC Drought Management Advisory Council is also a trigger mechanism for this DMP and will be followed.

2.2.4 WSACC Drought Operation Plan

Lake Howell represents 74 percent of the total useable storage for Cabarrus County's reservoir system and has been selected as the reservoir that provides the indication of the hydrologic condition of the County's water supply watersheds within the Rocky River subbasin. Five conditions or trigger points, normal and Stages 1 through 4, were identified and are based on the useable volume available in the reservoir and the current reservoir inflow. A full explanation of the WSACC Drought Operation Plan can be found in Section 3.1. Table 2-5 shows the trigger points for the Rocky River Subbasin, and Figures 2-1 and 2-2 show the seasonal drought curves for Lake Howell, which are used to determine the drought stage by month of the year.

TABLE 2-5
WSACC Regional Drought Operation Plan Drought Response Trigger Points
Concord & Kannapolis Drought Management Plan

Stage	Lake Howell Useable Volume		% of Historical Mean Reservoir Inflow (cfs)
<i>Normal</i>	>70%	<i>and</i>	>75%
1	>70%	<i>but</i>	<75%
2	=70%		---
3	40% to 60%		---
4	30% to 50%		---

Note:

cfs = cubic feet per second

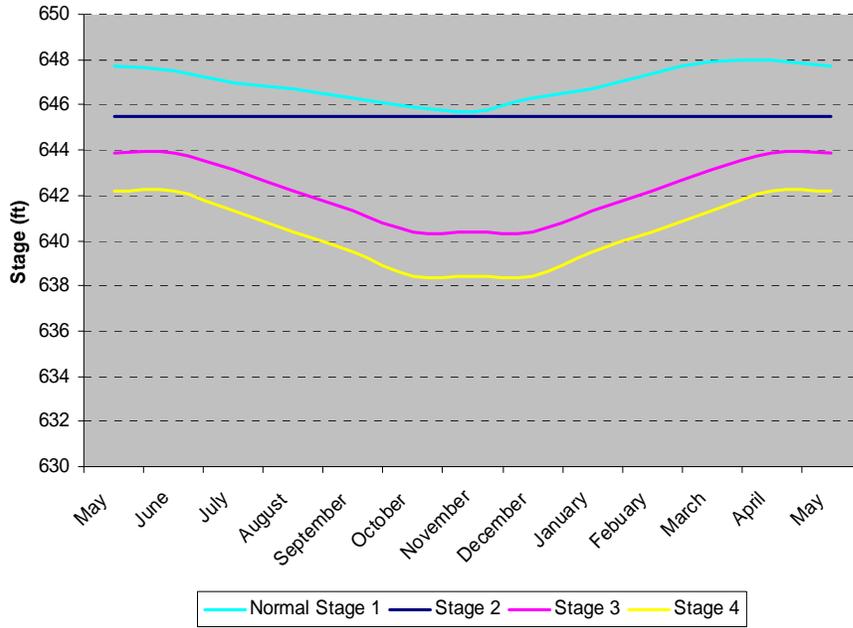
Source: Black and Veatch, 2004.

2.3 Drought Stage Response Plan

A drought stage response plan must provide answers to the following questions:

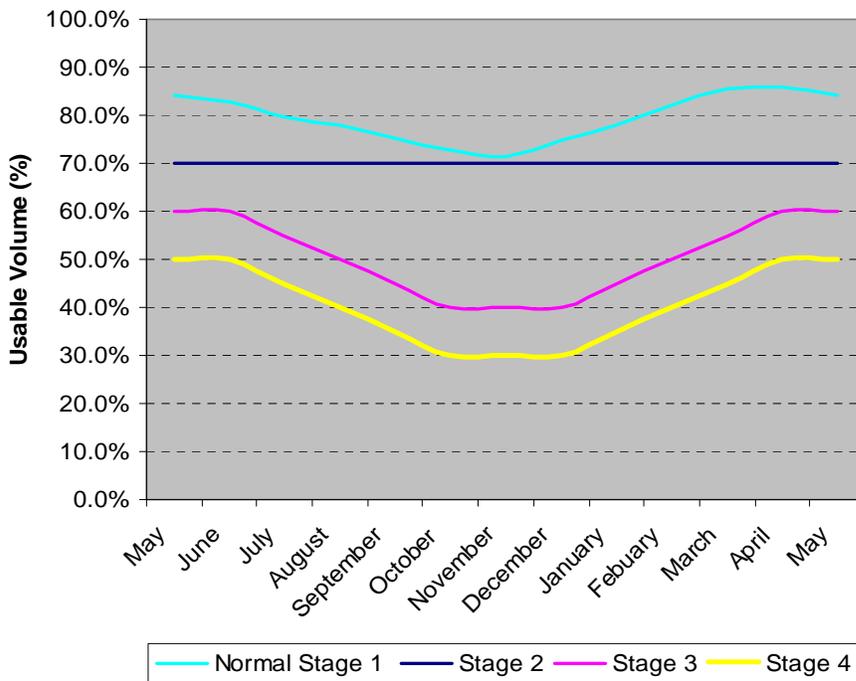
- How will public officials and the general public be informed of the drought conditions and the requirements in place to mitigate the drought effects?
- What are the requirements (voluntary or mandatory) of both residential and commercial water customers, including municipalities, during each drought stage?
- What are the consequences for both residential and commercial water customers if the water reduction requirements are not followed?
- How does a facility, such as a hospital, that has essential water needs that may exceed the required reductions apply for a variance during drought conditions?

The following subsection presents the drought response plan for the Cities.



(Source: Reproduced from Black & Veatch, 2004)

FIGURE 2-1
Lake Howell Seasonal Drought Curve, Stage



(Source: Reproduced from Black & Veatch, 2004)

FIGURE 2-2
Lake Howell Seasonal Drought Curve, Useable Volume

2.3.1 Public Notification

This section outlines the procedure for the Cities for designating the drought stage they are under and the subsequent steps that will be taken to inform the City Managers (of both Concord and Kannapolis), who will each then initiate the distribution of information to the public. A sequenced outline of the drought response actions is as follows:

Step 1: The Water Resources Director for Concord and the Water and Sewer Utilities Director for Kannapolis, who will monitor all of the drought trigger points outlined in the previous section, will notify the Public Utilities Director (or designee) of the drought stage based on conditions and their relation to the drought trigger points.

Step 2: The Public Utilities Director (or designee) will notify the City Manager, who will then determine the necessity of the implementation of water usage restrictions as appropriate.

Step 3: Once the water usage restrictions are implemented, the following notifications will be made:

- a. The City Manager (or designee) of each City will notify their respective Mayor, City Council, all neighboring municipalities that receive water from the Concord or Kannapolis water systems, and the City governmental departments.
- b. The Public Information Officer (PIO) will contact the media. The media, including television and radio news programs, will inform the public. The phone number of each municipality's Public Utility department will be broadcast to provide additional information, if needed.
- c. In order to inform the public of the water restriction in the instance of long-term drought conditions or rapidly escalating drought conditions, the PIO will provide the primary information on water restrictions. Additional information, including penalties for not following the restrictions, will be distributed via the following avenues:
 - City websites
 - Customer billing statements
 - Flyers, which will be distributed to the public by field employees and either posted on customers' doors or provided directly to customers needing additional information.
- d. Utilities Customer Service will contact Finance Customer Service and the Water Distribution System Operator, and an e-mail will be distributed to all City employees (for all municipalities) so that they can provide accurate information to the public.
- e. Finance Customer Service will phone all major water customers and inform them of the implemented water restrictions.

Step 4: The Public Utilities Department will begin repairing water leaks on a higher-priority basis.

Step 5: Staff will regularly evaluate the ability of the system to meet the demand and make changes accordingly, especially if the drought stage is escalated, and a repeat of the above sequence will be conducted for every change in drought stage. All measures remain in effect until declared otherwise by the City Managers.

2.3.2 Drought Mitigation Measures

The Drought Mitigation measures were developed to match the five drought stages as follows:

- Drought Planning
- Drought Watch
- Drought Warning
- Drought Emergency Level 1
- Drought Emergency Level 2

Each of these stages will be triggered by the trigger points outlined in the Catawba-Wateree LIP, Yadkin Pee-Dee LIP, or the WSACC Drought Operation Plan (Table 2-1). In an effort to protect valuable water resources in all three of these basins from which the Cities obtain their water supply and regardless of the impacted river basin, the Cities will implement their drought response plan based on the first trigger point that indicates drought conditions.

2.3.2.1 Drought Planning Stage

City personnel will start planning measures to prepare for drought. Elements of the drought planning stage are as follows:

- Notify all water customers of current drought conditions.
- Prepare public outreach and communication campaign if the drought stages are escalated above the planning stage.
- Monitor water supply daily (to be continued until conditions return to normal).
- Notify City Managers of the potential for upgrading to drought watch stage.
- Participate in the Catawba-Wateree or Yadkin Pee-Dee (or both) Drought Management Advisory Group meetings, if drought conditions were triggered in these respective basins.

Action items which are always in place, not just during the planning stage, include:

- Require the use of rain sensors on irrigation systems that use public water.
- Require that Non-residential customers must have a separate meter for irrigation water.
- Enforce the assessment of penalties and retain the ability to restrict or terminate the water service associated with violations

2.3.2.2 Drought Watch Stage

The response to the watch stage will include the request to limit water use to an amount necessary for health, safety, and economic necessity. Water users should use water wisely and prevent its waste and unreasonable use. The following actions are outlined in the Cities' Water Emergency Ordinances and are described as a Level I water emergency. These actions model

the restrictions recommended, for users with Public Water Supply interests, within the LIPs for the Catawba and Yadkin Pee-Dee River Basins:

The following voluntary water conservation practices shall be encouraged for the public water system served by the Cities:

- Limit watering of lawns, ornamental plants, and gardens to that necessary for plant survival only, watering only between the hours of 8PM and 8AM on only two days per week designated by the City Manager.
- Defer planting of new ornamental plants and seeding of lawns until the water emergency situation no longer exists.
- Household water should be reused to the greatest possible extent for watering.
- Use of water for washdown of outside areas such as driveways or parking lots should be curtailed.
- Eliminate the habit of leaving faucets running while shaving, brushing teeth, or washing dishes.
- The use of washing machines and dishwashers should be limited if possible and these units should be operated with full loads.
- Curtail the washing of cars or other vehicles to only two designated days each week. Hoses should not be left running while washing vehicles
- The use of flow restrictions and other water saving devices is encouraged.
- Utilize showers should for bathing only and limit the duration of the shower.
- Filling of pools shall be deferred or limited to hours between 9:00 p.m. and 6:00 a.m.

2.3.2.3 Drought Warning Stage

The following mandatory water use restrictions shall be taken in response to the elevation to the Drought Warning stage. This stage corresponds with a Level II emergency in the Cities' Water Emergency ordinances:

- All voluntary practices listed in the Drought Watch stage shall become mandatory.
- Watering and irrigation of lawn, ornamental plants, and gardens and shall occur only between 8:00 PM and 8:00 AM on the two days each week designated by the City Manager. The use of hand-held watering containers is permitted on any day without restrictions. Businesses whose stock in trade is live plants, including nurseries and retail garden centers are exempt from this provision.
- Planting of new ornamental plants or seeding of lawns shall be deferred until the water emergency no longer exists.
- The use of water for wash down of public buildings, sidewalks and street washing activities should be limited except as required for safety and/or regulatory compliance. Residential washing of cars and other vehicles is prohibited. Commercial washing facilities, including

those providing handheld washing nozzles may continue normal operation. However, the facility owner/operator shall ensure that water is not wasted.

- Commercial, industrial, and construction operations shall eliminate all possible waste of water.
- Newly constructed or drained pools shall be filled by permit only. Fill permits shall be issued by the Backflow Administrator and issuance of the permits may be curtailed depending on the severity of the situation.

2.3.2.4 Drought Emergency Level I Stage

The following mandatory water use restrictions shall be taken in response to the elevation to the Drought Emergency Level I stage, which corresponds with a Level III emergency in the Cities' Water Emergency ordinances:

- Prohibit recreational use of potable water including filling of pools.
- Watering and irrigation of lawn, ornamental plants, and gardens shall occur only between 8:00 PM and 8:00 AM on the one day each week designated by the City Manager. Businesses whose stock in trade is live plants, including nurseries and retail garden centers are exempt from this provision.
- Hydrant flushing and testing programs are prohibited, except to maintain public health, water quality or other special circumstance.

2.3.2.5 Drought Emergency Level II Stage

The following mandatory water use restrictions shall be observed in response to the elevation to the Drought Emergency Level II stage. This stage corresponds with a Level IV emergency in the Cities' Water Emergency ordinances:

- All use of water for purposes other than maintenance of public safety is prohibited.
- Residential water use shall not exceed 300 gallons per day at each metered location.
- In situations for which the City system is not functional, National Guard and emergency service vehicles shall be used to distribute water for household use at prearranged locations within the affected area. Usage by individuals shall be limited to those amounts necessary to sustain life through drinking, food preparation, and personal hygiene.
- Compliance plans for industries during Level IV remain the same as for Level III or as directed by the state public health officials. Such plans shall be submitted to the City's Water Resources Department within 90 calendar days from the adoption of this section. Plans shall be updated at least every 5 years.
- Non-residential water customers and construction activities using 5,000 or more gallons water per day are required to reduce daily water usage through whatever means is available to the target percentages listed above. The Director of Public Works or her or his designee shall determine compliance with the daily usage reduction targets. Variances to this restriction may be granted to designated public health facilities including, but not limited to, hospitals and nursing homes.

2.3.3 Non-Compliance with Mandatory Drought Stage Water Restrictions

2.3.3.1 Customers

The following is a list of action that will be taken by the Cities upon customers who do not adhere to the water restrictions outlined above and in their individual Water Emergency ordinances. The enforcement of the water restrictions does not only apply to individual customers, but also to municipalities that receive water from the Cities' distribution system.

(1) *Penalties.* Any person violating the mandatory provisions of the water restrictions shall be issued a citation and a penalty of \$100.00 for residential customers or the amount established in the individual City Code of Ordinances for non-residential or commercial or industrial users.

(2) *Discontinuance of Service.* Water service may be temporarily discontinued for willful disregard of water restrictions. All applicable penalty fees may be applied in the event of service suspensions. In the event of continued gross noncompliance with the water restrictions, the meter will be removed and the service will be discontinued. Connection fees and deposits will be forfeited.

(3) *Adoption and Enforcement of Drought Mitigative Measures.* Municipal customers, water corporations or company compliance municipalities as well as water corporations or companies purchasing water from the Cities shall adopt and enforce this entire section as a condition of continuing existing water sales agreements. Upon declaration of a water emergency, such municipalities and companies shall enforce the appropriate water use restrictions for the level of drought stage. Water service to such municipalities and companies shall be terminated for not enforcing the provisions of this section.

2.3.3.2 Water Sales

The Cities have agreements in place that include enforcement policies with other systems that purchase water from them. Table 2-6 includes a list of these systems and their respective agreement dates so that the same enforcement actions listed above apply to these customers as well.

TABLE 2-6
Concord and Kannapolis Water Sales
Concord & Kannapolis Drought Management Plan

Provider	Municipality	Date of Agreement
	Mount Pleasant	Not Currently Selling *
Concord	Midland	Primary Water Provider
&	Cabarrus County	--
Kannapolis	Harrisburg	Agreement in Place
	Landis	Working Through Final Adoption of Agreement

*Mount Pleasant connection is currently for emergency only. If this were to change to a more regular purchase, then an agreement would be reached.

2.3.4 Measure Variances

The Cities understand that water restrictions can cause economic hardships on certain portions of their water customers; additionally, the restriction could be infeasible for others. Variances from the water restrictions have been allowed for public health facilities in each of the Cities' Water Emergency ordinances, with the point of contact to apply for a variance going to the respective director in charge of water resources for each City.

3.0 Existing Water Conservation Measures

The Cities have been cited by State officials as having one of the most aggressive water conservation programs and water rate structures in the State, which together have reduced irrigation and other consumptive water uses, which, since the drought of 1999 through 2003, typically represent 50 to 75 percent of the peak day demand.

Typically for a water system, irrigation and other consumptive uses such as cooling waters can represent 50 to 70 percent of the peak day demand and 20 to 25 percent of average annual consumptive water use. Since conservation measures and the new rate structure were implemented by the Cities, metered irrigation use is only a small percentage of the average water use in fiscal year (FY) 2004 and 2005. Since the drought ended, peak water demands have not returned to previous levels because the rate structure discourages irrigation use. The aggressive mandatory conservation program includes a level that completely bans irrigation. Mandatory water use restrictions were in place for nearly 3 years during the drought, from February 2, 2001, through November 14, 2003. Irrigation was not allowed for more than 2 years, from February 2, 2001, through June 4, 2003. After that period, irrigation was limited from 6:00 p.m. to 6:00 a.m. When Governor Easley called for a 20 percent reduction in water use during the summer of 2002, Concord and Kannapolis had already achieved a reduction in water use of nearly 30 percent, even though this resulted in substantial losses in water and wastewater revenue.

The Cities have kept in place their water conservation measures and tiered water structure rates since the end of the drought. Additionally, these conservation measures apply to all service areas of the Cities.

3.1 Drought Operations Plan (2002)

As a follow-up to the completion of the WSACC Master Plan in 2002, a regional DMP was prepared. This report reevaluated the safe yield of existing water sources available to Cabarrus County, and established a drought operations plan for the county (Black & Veatch, 2004).

This plan is based on the implementation of drought operating curves for Lake Howell that indicate drought severity. Lake Howell was selected as the drought indicator reservoir for the County because it represents 74 percent of the total useable storage of the County reservoir system and therefore can be considered to represent the condition of the total system (Black & Veatch, 2004). Five conditions, normal and Stages 1 through 4, were identified and are based on the useable volume available in the reservoir and the current reservoir inflow. The current reservoir inflow is compared to the historical mean monthly inflow for the current month and a historical percentage is identified. The ultimate goal of the five conditions is to preserve usable volume in the reservoir and increase restrictions on the withdrawals as a drought increases in severity from "normal" conditions up to Stage 4. Table 3-1 displays the drought stages, the trigger points for each stage, and the operational changes required at each stage. Additionally, seasonal drought operating curves were developed as part of the WSACC Safe Yield Update and Regional Drought Operations Plan (Black & Veatch, 2004); this report

can be found in Appendix A. Additionally, Table 3-2 presents the drought stages as defined and classified by the North Carolina Drought Management Advisory Council, WSACC, and the Cities. The measures that would be taken to actually meet the percent reduction at each drought stage are outlined in each City’s Water Emergency Ordinance (Appendix B) and are applied to all service areas.

TABLE 3-1
 WSACC Operational Drought Stages (all related to Lake Howell)
Concord & Kannapolis Drought Management Plan

Drought Stage	Drought Stage Trigger Point			Operational Changes	
	Reservoir Storage ^a		Reservoir Inflows ^b	Minimum Reservoir Release	Water withdrawal reduction
Normal	>70% of useable volume	and	>75% of historical mean	6 cfs	0 %
Stage 1	>70% of useable volume	and	<75% of historical mean	3 cfs	10%
Stage 2	70% of useable volume		NA	2 cfs	10%
Stage 3	60% of useable volume		NA	2 cfs	20%
Stage 4	50% of useable volume		NA	2 cfs	25%

^aRemaining volume on a seasonal basis

^bHistorical Monthly Mean Flow

TABLE 3-2
 Drought Stages as Classified by North Carolina Drought Management Advisory Council, WSACC, Concord, and Kannapolis
Concord & Kannapolis Drought Management Plan

Drought Stages		
NCDMAC	WSACC	Concord/Kannapolis
Abnormally Dry	Normal	Drought Planning
Moderate Drought	Stage 1	Drought Watch
Severe Drought	Stage 2	Drought Warning
Extreme Drought	Stage 3	Drought Emergency Level I
Exceptional Drought	Stage 4	Drought Emergency Level II

Note:

DMAC = North Carolina Drought Management Advisory Council

3.2 Water Emergency Ordinances

The Cities have in place Water Emergency Management Ordinances. Concord's ordinance was updated in March 2003 to address future connection and extension of its water systems, and Kannapolis's ordinance has been in place since March 2001. The Cities' ordinances are very similar in structure and content, outlining the type of restrictions under each drought stage and the enforcement measures. Each ordinance has four levels of drought stages; the following are brief descriptions of each stage for the Cities:

- *Level I:* This level focuses on voluntary water conservation practices for the public water systems supplied by the Cities. Residential customers are the focus of this level with recommendations made on how to reduce indoor water demand and encourage timing restrictions for watering the lawn and ornamental plants (9:00 p.m. to 7:00 a.m.).
- *Level II:* Mandatory restrictions begin with this level. Those voluntary restrictions used in Level I become mandatory restrictions at this level. Outdoor watering is restricted to being done by hand, washdowns are prohibited, restaurants will serve water only to patrons that ask for it, restrictions on car washing are detailed, and any new or drained pools shall be filled only after receiving a fill permit from the Water and Sewer Utilities Director. At Level II, commercial, industrial, and construction operations are required to eliminate any waste of water, and those customers that utilize in excess of 150,000 gallons per month are required to submit a water reduction compliance plan to achieve 25, 50, and 75 percent water reduction in 14 days from the effective date of the Level II Water Emergency declaration.
- *Level III:* All outdoor watering of lawns, gardens, and other plants is prohibited along with washing cars and recreational uses. Restaurants shall utilize single serving utensils and plates, and serve water only at patron request. Large scale commercial and industrial water customers, including construction operations, utilizing 5,000 gallons per day or more shall undergo mandatory reduction in daily water usage of 25, 50, or 75 percent, with the target reduction based on the severity of the water emergency.
- *Level IV :* All water use for purposes other than maintenance of public safety is prohibited. Residential usage shall not exceed 300 gallons per day at each metered location. Should the Cities' system fail to provide water to all areas, then the National Guard and Emergency Service vehicles shall be used to distribute water for household use. Compliance plans for industries will remain the same or as directed by the State of North Carolina Public Health Officials.
- *Non-Compliance of Water Emergency Ordinance:* Any residential customer violating mandatory provisions within the Cities or service areas will be issued a citation and a penalty of \$100.00 per infraction. For commercial customers, the penalties are \$500.00 per infraction in accordance with the Cities Code of Ordinances Section 1-6 and 62-8, which additionally outlines the penalties for non-residential customers. In the case of gross non-compliance with the Water Emergency Ordinance, the Cities reserve the right to discontinue service to a customer.

The Cities aggressively enforced the ordinances' water use restrictions during the drought (1999 through 2003). Concord issued fines totaling \$72,600 during the drought, which made the

headlines of *USA Today* and was described by State officials as the most significant water use enforcement effort in North Carolina's history.

The last condition of the ordinance for both Cities states that all municipal customers, water corporations, or companies purchasing water from the City shall adopt and enforce the entire Water Emergency Management Ordinance. If an entity that is provided water service by the Cities does not comply with the adoption and enforcement of the ordinance, their water service will be terminated. Copies of the Cities' full ordinances can be found in Appendix B.

3.3 Irrigation Ordinance

The City of Concord has adopted an ordinance that outlines the requirements on water customers that make use of an in-ground irrigation system within their municipal boundary; a copy of the ordinance can be found in Appendix B. The purpose of the ordinance is to regulate the use of water for irrigation and to prevent the waste of water. Under this ordinance, required equipment and maintenance for every system includes the following:

- A rain sensor, adjusted to shut off after ¼ inch of rain
- A double check valve
- Irrigation heads adjusted such that they do not water impervious surfaces to the point when run-off is generated
- A properly functioning backflow prevention assembly
- A separate irrigation meter from their domestic service meter for all non-residential customers with in-ground irrigation systems

The ordinance states that irrigation systems will operate only on scheduled days and times set forth by City of Concord Utilities, will not be operated during periods of rain, and shall comply with the Water Emergency Management Ordinance. Penalties for violations of this ordinance cost residential customers \$100.00 for a first offense; additional offenses may result in a penalty of \$300.00 in accordance with the Code of Ordinance Section 1-6 and 62-8. Non-residential users cited with violations will be automatically subject to the penalty of \$500.00 for a first offense and a violation cost of \$1,500.00 for each additional offense. Lastly, Concord may restrict or terminate service if deemed appropriate for multiple violations.

The City of Kannapolis is currently in the process of updating their City Code to include similar guidance for separate irrigation meters. Administrative orders modifying the Water Emergency Management Ordinance have been used in the past, on the basis of need resulting from lack of rainfall and low lake levels. For example, administrative order dated June 4, 2003, stated, "The use of automated irrigation or household sprinklers is permitted during the hours of 6 p.m. to 6 a.m. any day of the week. Rain sensors are suggested for use with all automated systems." This was a modification issued while under a Level II Mandatory Restriction, due to months of increased rainfall that resulted in the Kannapolis Lake level at and above full. Penalties for violations of water use orders in Kannapolis may result in a fine of \$100 for each of the first three offenses. After these penalties, Kannapolis may

3.4 Rate Structure

The City of Concord has adopted a rate structure designed to discourage or at least reduce the amount of irrigation by residential customers. Table 3-3 outlines the rates for water customers inside and outside the City limits. The volume charge threshold is 7,500 gallons and the charge per 1,000 gallons used increases by more than two dollars. Concord first adopted this approach to rates during the drought from 1998 through 2003 and has kept it to this date.

TABLE 3-3
City of Concord Residential Water Rate Structure
Concord & Kannapolis Drought Management Plan

Inside City Limits Residential		
Base Charge	\$3.51	
Volume Charge	0-6,000 gallon per month	\$4.72/1,000 gallons
Volume Charge	> 6,000 gallons per month	\$6.84/1,000 gallons
Irrigation (Separate Meter)	All volumes	\$6.84/1,000 gallons
Outside City Limits Residential		
Base Charge	\$3.94	
Volume Charge	0-6,000 gallon per month	\$5.66/1,000 gallons
Volume Charge	> 6,000 gallons per month	\$8.21/1,000 gallons
Irrigation (Separate Meter)	All Volumes	\$8.21/1,000 gallons

Note:

Rates effective July 1, 2007

The City of Kannapolis adopted the following rate structure, as outlined in Table 3-4, including rates for water customers both inside and outside the City limits (as does the City of Concord).

TABLE 3-4
City of Kannapolis Residential Water Rate Structure
Concord & Kannapolis Drought Management Plan

Inside City Limits Residential		
Base Charge	\$3.30	
Volume Charge	All Volumes	\$5.40/1,000 gallons
Outside City Limits Residential		
Base Charge	\$3.96	
Volume Charge	All Volumes	\$6.48/1,000 gallons

3.5 Public Education

The public education component of the water conservation measures used by the Cities is focused primarily around times of water shortage. Each City does maintain a water resources website that tracks the current water supply conditions for the County, provides information on conservation tips for indoor and outdoor usage, and provides information on ordinances that affect water usage especially during droughts. In addition, the City of Kannapolis has a timeline of the 1998 through 2003 drought water restrictions.

Both Cities had a heavy advertising campaign during the drought from 1998 through 2003. Mailers and newspaper advertisements outlined the conditions of the drought and the measures to be followed by households, voluntarily or mandatorily, depending on the drought stage.

The Cities also offer household water conservation kits for \$7.00; they include leak detection supplies, a flow rate bag for the toilets, a drip gauge, toilet tank displacement bag, a pressure enhanced showerhead, a kitchen faucet aerator, two bathroom faucet aerators, Teflon tape, and a toilet fill cycle diverter. A customer can obtain one of these conservation kits by calling the Water and Sewer Administration for the City of Kannapolis or Alfred M. Brown Operations Center for the City of Concord. The City of Concord also offers rain barrels at cost to its customers.

3.6 Reclaimed Water

A reclaimed water system is a beneficial program that manages potable demand by replacing some of the outdoor potable water demand with reclaimed water. Neither of the Cities have a reclaimed water system at this time. However, WSACC began a conceptual investigation of developing a startup reclaimed water system as part of the Master Plan (Black & Veatch, 2002) and then completed a more detailed reclaimed water system master plan (CDM, 2007). The Cities will continue to investigate the feasibility of the implementation of a reclaimed water system within their service areas.

4.0 Water Supply Assessment

This section provides an overview of the potable water distribution systems and service areas, along with elements of the water supply for both the Cities' water systems. This section also describes the interconnectedness of the two systems. Figures 4-1 and 4-2 show service areas and IBT connections associated with the Cities. Additionally Figure 4-3 is a flow diagram illustrating the transfer of water between the Cities.

4.1 Overview of Concord-Kannapolis Water Systems and Service Areas

4.1.1 City of Concord

The City of Concord is located in Cabarrus County, which is adjacent to Mecklenburg County where the City of Charlotte is located. The City of Concord's water service area contains an estimated population of 84,500, encompasses approximately three-quarters of the County (278 square miles), and serves approximately 31,061 residential and 2,529 commercial and industrial accounts. The City currently provides water to the Towns of Harrisburg, Midland, and Mount Pleasant.

The City of Concord operates a water distribution system that includes two water treatment plants (WTPs) with high service pump stations, five booster stations, five elevated and one ground storage tanks, and approximately 631 miles of pipes. In 1948, the Hillgrove WTP was commissioned and the City of Concord began producing its own potable water. The Hillgrove WTP has a permitted capacity of 12 mgd and receives surface water for treatment from Lake Concord, Lake Fisher, and Lake Howell. The water from the Hillgrove WTP predominantly serves downtown Concord and additionally serves the Towns of Midland and Mount Pleasant. The Coddle Creek WTP has a permitted capacity of 12 mgd and receives surface water for treatment from the Lake Howell Reservoir. The water from the Coddle Creek WTP directly serves the eastern portion of the City of Concord.

The City of Concord is connected to Charlotte-Mecklenburg Utilities' (CMU) water distribution system in three locations, which are used for water purchases only. A single connection with Mount Pleasant is the point from which the City of Concord sells water. Three existing connections with the City of Harrisburg are the locations from which the City of Concord sells water. Plans are proceeding to establish a connection with Stanly County (with water provided by the City of Albemarle) that will provide additional service to the Midland area.

4.1.2 City of Kannapolis

The City of Kannapolis is located in northern Cabarrus County and southern Rowan County. The Kannapolis water system supplies areas within the Kannapolis city limits in both Cabarrus and Rowan Counties, and adjacent areas including the Town of Landis and portions of Cabarrus County. The City of Kannapolis operates a water system that serves an estimated population of 40,000. The service area distribution system consists of 225 miles of pipes and serves approximately 16,373 water customers.

The City of Kannapolis' water distribution system includes one WTP with high service pump station, one booster station, and five water storage facilities. The WTP was formerly owned and operated by Pillowtex, the largest industrial water user in the City; however, the manufacturing facility closed in 2003. The City of Kannapolis WTP has a permitted capacity of 14 mgd and receives surface waters from Lake Howell, Kannapolis Lake, and Second Creek via water pumped to Kannapolis Lake.

4.1.3 Interconnections

Combined, the Cities' water systems supply a majority of the public water supply in Cabarrus County. Other sources include groundwater wells in Mount Pleasant and Harrisburg. The Cities own, operate, and maintain individual water distribution systems, including water treatment facilities. However, interconnections between the two systems provide the ability to purchase or sell water between the two systems. The interconnections between the Cities are described below:

- Davidson Highway: existing 24-inch Concord water main connected to 8-inch Kannapolis water main, which provides water to a housing development and a few businesses.
- Trinity Church Road: existing 12-inch Concord water main connected to 12-inch Kannapolis water main. The 12-inch Kannapolis line is in need of replacement; therefore, this connection has been out of service for approximately 2 years.
- Kannapolis Parkway: existing 24-inch Concord water main connected to 24-inch Kannapolis water main, which is used for purchasing water from Kannapolis.

4.1.4 Existing Water Supplies

To meet the demand in the service areas described above, the Cities treat raw water from their reservoirs and have purchased limited amounts of finished water from neighbors. The primary water sources are the existing reservoirs within the Rocky River Subbasin, where the Cities are located. This raw water is supplemented with water from Second Creek in the South Yadkin Basin, which has a grandfathered IBT amount of 6 mgd. To supplement these sources, finished water has been purchased from neighbors in the Catawba and Yadkin Pee-Dee River Basins.

Raw water sources, finished water transfers via connections and safe yields are specifically discussed in the following sections:

4.1.5 Rocky River Subbasin

4.1.5.1 Raw Water

The City of Concord's current raw water supplies lie within the Rocky River Subbasin and include withdrawals from:

- Lake Howell (Coddle Creek Reservoir) operated by the Water and Sewer Authority of Cabarrus County (WSACC)
- Lake Concord
- Lake Fisher

One of the City of Kannapolis's raw water sources, Kannapolis Lake, is located in the Rocky River Subbasin.

4.1.5.2 Safe Yield

The combined 50-year safe yield of the local government's raw water supply is approximately 31 mgd. Additionally, the combined 100-year safe yield indicates that the available supply can decrease to 16.5 mgd during severe droughts such as the one experienced in 1999 through 2003. Further detail regarding safe yield amounts is included in Appendix A and in the WSACC Safe Yield Update and Drought Operations Plan (Black & Veatch, 2004).

Table 4-1 presents the 50- and 100-year safe yield amounts available from current water supply sources in the Rocky River Subbasin.

TABLE 4-1
Safe Yield Analysis for Existing Water Supply Reservoirs in the Rocky River Subbasin
Concord & Kannapolis Drought Management Plan

Water Source	Drainage Area (mi ²)	Reservoir Size (acres)	50-Year Safe Yield (mgd)	100-Year Safe Yield (mgd)
Rocky River Subbasin				
Lake Howell	47.0	1,285.6	16.20	7.05
Lake Fisher	18.7	230.5	5.15	3.00
Lake Concord	4.7	83.7	1.20	0.70
Kannapolis Lake ^a	10.6	269.8	8.50	5.70
Total Combined Safe Yield			31.05	16.45

^a Withdrawals from Second Creek are transferred to Kannapolis Lake for storage and included in Kannapolis Lake safe yield analysis.

Source: Black & Veatch, 2004.

4.1.6 Catawba River Basin

On January 10, 2007, the North Carolina EMC granted an IBT Certificate to the Cities in the amount of 10 mgd on a maximum day basis from the Catawba River Basin. The Catawba-Wateree River system includes a series of 11 reservoirs that are managed under a Duke Energy Federal Energy Regulatory Commission (FERC) license set to expire in 2008. Relicensing efforts are currently under way.

4.1.6.1 Raw Water

No raw water is drawn from the Catawba River Basin by the Cities of Concord and Kannapolis at this time.

4.1.6.2 Finished Water

Finished water is transferred via interconnections with CMU at three locations. CMU has existing water supply intakes on Lake Norman and Mountain Island Lake permitted by FERC with capacities of 108 and 330 mgd, respectively (Table 4-2). Currently, 5 mgd per day can be transferred according to the contract. This current contract amount was temporary and was

authorized through use of CMU's IBT certificate. The term of this contract is for a period of 5 years, and such terms shall renew automatically unless other actions are needed.

TABLE 4-2
CMU Water Supply Reservoirs in the Catawba River Basin
Concord & Kannapolis Drought Management Plan

Water Source	Drainage Area (mi ²) ^a	Reservoir Size (acres)
Lake Norman	1,790	32,510
Mountain Island Lake	1,860	3,281

^a Drainage area includes upstream reservoirs

Source: Black & Veatch, 2004.

4.1.6.3 Safe Yield

Because the basin is managed as a whole under the FERC license, safe yield calculations cannot be completed for an individual reservoir. As part of the FERC relicensing, Duke Energy developed a Water Supply Study and CHEOPS™ model of the Project for use in long-term analysis of the effects of operational and physical changes made to the hydroelectric system. Updated water withdrawals and return flows through 2058 were developed for all users, including those in the basin and any projected interbasin transfers (HDR, 2006). This information was then used in the model to develop a system management plan suitable to meet the needs of water users and other stakeholders involved in this process. Modeling inputs for projected water demands were conservative, including a larger amount of IBT on behalf of the Cities than was awarded by the EMC. Reservoir minimum operating levels were determined to ensure protection of water intakes during drought conditions. The LIP was developed as part of this process.

4.1.7 Yadkin River Basin

Additionally, on January 10, 2007, the EMC granted an IBT Certificate to the Cities, which included 10 mgd on a maximum day basis from the Yadkin River Basin.

4.1.7.1 Raw Water

The City of Kannapolis's raw water supply, Kannapolis Lake, has a limited watershed of approximately 10 square miles. For this reason, Kannapolis Lake is supplemented with raw water transfers from Lake Howell and Second Creek. Lake Howell is located in the same river subbasin (Rocky River Subbasin); however Second Creek is located in the South Yadkin River Subbasin (Yadkin Pee-Dee River Basin). The transfer from Second Creek is a grandfathered IBT of 6 mgd but only increases the 50-year safe yield of Kannapolis Lake by approximately 2.5 mgd.

4.1.7.2 Finished Water

The City of Concord began the process for establishing a connection with Stanly County's water system for service to the Midland Area. Stanly County purchases finished water from the City of Albemarle. The City of Albemarle's raw water supplies, Tuckertown Reservoir and Badin Lake, are located in the Yadkin River Basin (Table 4-3).

Additionally, the City of Kannapolis purchases finished water from the City of Salisbury, which withdraws raw water from the Yadkin River immediately upstream of the confluence with the South Yadkin River. Currently, this water is used primarily to supply the Town of Landis, which is located in the South Yadkin River Basin.

TABLE 4-3
Water Supply Reservoirs in Yadkin River Basin
Concord & Kannapolis Drought Management Plan

Water Source	Drainage Area (mi ²) ^b	Reservoir Size (acres)
High Rock Lake	3,973	15,180
Tucker Town Reservoir	4,080	2,560
Badin Lake	4,180	5,355
Second Creek ^a	55.6	-

^a Withdrawals from Second Creek are transferred to Kannapolis Lake for storage and included in Kannapolis Lake safe yield analysis.

^b Drainage area includes upstream reservoirs

Source: Black & Veatch, 2004.

4.1.7.3 Safe Yield

The Yadkin Hydroelectric Project, which is comprised of four reservoirs, is operated by APGI, and the Yadkin-Pee Dee Hydroelectric Project, with two reservoirs, is operated by Progress Energy. The FERC license associated with these Projects will also expire in 2008 and relicensing is under way. The OASIS™ model was used to address associated water supply issues. Similar to the Catawba-Wateree Project, a LIP was developed for these Projects. The LIP is based on the same assumption as that used for the Catawba River: all parties with interests in the water storage aspects of the Project will share responsibility to conserve the limited supply.

4.2 Water Supply Classification

Water supply reservoirs are classified by the Division of Environmental Health, Public Water Supply Section. All waters in the State have a beneficial use classification from the EMC and are administered by the Division of Water Quality (DWQ), with several special designations for water supply watersheds. The DWQ identifies the extent of protected and critical areas (CAs) and stream classifications for areas around water supplies in which development directly affects a water supply intake. These classifications are as follows:

- Class WS-I: Waters protected as water supplies that are in natural and uninhabited drainage basins, and by definition also classified as High Quality Water (HQW)
- Class WS-II: Waters protected as water supplies that are generally in predominantly undeveloped drainage basins, and by definition also classified as HQW
- Class WS-III: Waters protected as water supplies that are generally in sparsely to moderately developed drainage basins

- Class WS-IV: Waters protected as water supplies that are generally in moderately to highly developed drainage basins
- Class WS-V: Waters protected as water supplies that are generally upstream of and draining to Class WS-IV waters

Water supply classifications for water sources used by the Cities are presented in Table 4-4.

TABLE 4-4
Water Supply Classifications
Concord & Kannapolis Drought Management Plan

Water Supply	Division of Water Quality ^a	Division of Environmental Health Public Water Supply Section ^b
Rocky River Subbasin		
Kannapolis Lake	WS-III	Class I ^c
Lake Fisher	WS-IV	Class I
Lake Concord	WS-IV	Class I
Lake Howell (Coddle Creek Reservoir)	WS-II; HQW; CA	Class I
Catawba River Basin		
Lake Norman	WS-IV WS-IV, B ^b	-
Mountain Island Lake	WS-IV; CA WS-IV; B CA	-
Yadkin Pee-Dee River Basin		
High Rock Lake	WS-V WS-IV, B WS-IV, B, CA	-
Tucker Town Reservoir	WS-IV, B, CA	-
Badin Lake	WS-IV, B, CA	-
Second Creek	WS-IV	-

^a See Section 2.3 for definitions of Water Supply classes.

^b Waters classified as B waters are protected for recreation on an organized basis.

^c Class I reservoir is defined as one from which water flows by gravity or is pumped directly to treatment plant or to a small intervening storage basin and thence to a treatment plant.

Class II reservoir means a reservoir from which the water flows by gravity or is pumped to a Class I reservoir prior to final entrance to a water treatment plant.

Class III reservoir is an impoundment used for electric power generation, flood control, and similar purposes, and which also serves as a source of raw water for a community water system.

Sources: DWQ, 2003; DWQ, 2004

4.3 Demand

Concord, Kannapolis, Harrisburg, Mount Pleasant, and Cabarrus County all participated in an extensive water and wastewater master planning process conducted between 2000 and 2002, which includes analysis of supply needs. Commonly, future supply needs are predicted by performing water demand calculations that are based on projected populations and current water usage by type of use, such as residential, commercial, and industrial. Other factors include recent development trends, planned transportation improvements, and changes to the non-residential demands.

These demand projections were reviewed by the North Carolina Division of Water Resources (DWR). Recent per capita water usage in the service areas has decreased as a result of actions taken during the drought of 1999 to 2003 to promote water conservation. The Cities have observed that water use did not return to pre-drought levels when drought-related water restrictions were lifted after the 1999 to 2003 drought. Water conservation measures are further described in Section 3.0.

The City of Kannapolis's largest industrial water user, Pillowtex, closed its facility in 2003. Pillowtex's average daily water demand was approximately 5 mgd. Although this facility is no longer in operation, the property is currently being redeveloped as a biomedical research facility. Preliminary water demands for this area are of the same magnitude as those for Pillowtex. The facility itself is expected to have a water demand of approximately 3 mgd, and spin-off development surrounding the facility will add additional water demand. Water demand for redevelopment of the Pillowtex facility and surrounding area was assumed to return to 5 mgd as development occurs and not to increase beyond that during the 30-year projection period.

For industrial water use, the assumption in the Master Plan was that the major industrial demand would remain constant through 2050 and that the remaining Industrial, Commercial, Institutional (ICI) demand would increase in direct proportion to the population increase. Water data not accounted for were difficult to quantify in the WSACC system; therefore, an industry average of 10 percent of production was used for the purposes of water demand projections.

Projections are for a 30-year planning period through the year 2035 based on discussions with DWR and previous IBT actions by the EMC. According to current water demand projections (Table 4-5), the combined demand will be about 42.5 mgd average daily demand (ADD) by 2035 and 52 mgd ADD in the year 2050. Using the peaking factor from the 2002 Master Plan, this corresponds to a maximum daily demand (MDD) of 67 mgd in 2035 and 83 mgd in 2050.

TABLE 4-5
Current and Projected Water System Demands for the Water Service Areas
Concord & Kannapolis Drought Management Plan

Service Area	2000		2010		2020		2035		2050	
	ADD	MDD								
Concord/Harrisburg /Midland	10.7	17.1	14.8	24.9	19.8	33.0	25.6	42.3	32.3	53.3
Mt. Pleasant	0.3	0.45	0.4	0.7	0.6	0.9	0.8	1.3	1.0	1.7
Kannapolis	8.6	11.8	7.6	11.2	12.0	17.8	16.0	22.9	18.7	27.6
Combined Total	19.6	29.3	22.8	36.9	32.3	51.7	42.5	66.5	52.0	82.6

Note: This table reflects a gradual replacement of Pillowtex flows with flows from the biomedical research facility over the 30-year projection period.

Sources: Cabarrus County Water and Wastewater System Master Plan (Black & Veatch, December 2002); Cities of Concord and Kannapolis.

Insert Figure 4-1

Insert Figure 4-2

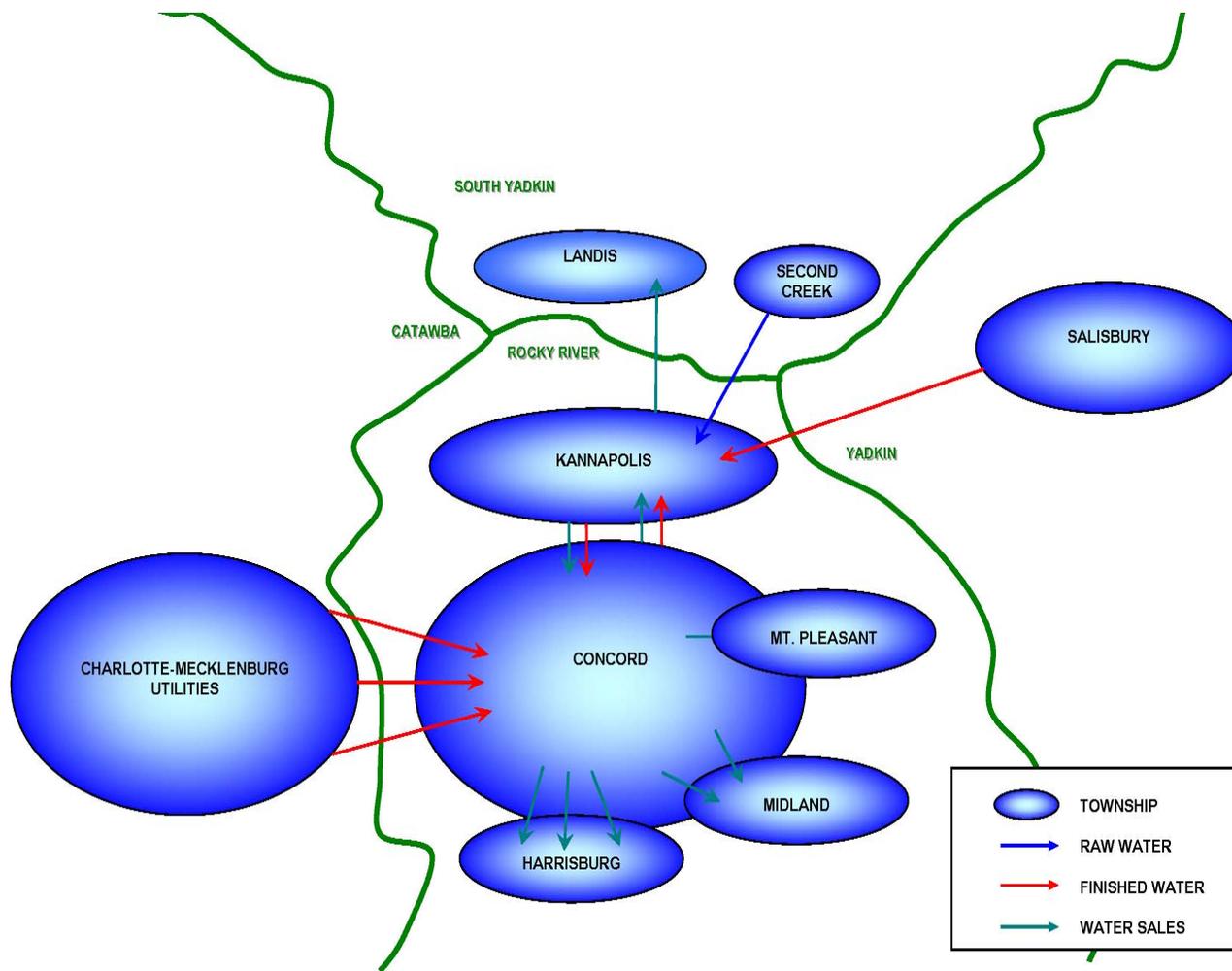


FIGURE 4-3
Flow Diagram of Water Transfers

5.0 Summary

This Drought Management Plan provides an update to the existing drought operations plan currently used by the Cities. This Plan also suffices as the requirement of the Cities' IBT certificates and is aligned with the LIP for both the Catawba and Yadkin Pee-Dee River Basins.

In summary, the any drought activities triggering any of the following cause action under this updated DMP:

- WSACC Drought Operations Plan
- Catawba River Basin LIP
- Yadkin-Pee Dee River Basin LIP
- NC Drought Management Advisory Council.

6.0 References

- Black & Veatch. 2002. *Water and Wastewater System Master Plan*. Prepared for WSACC.
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- North Carolina DWQ. 2004. *Catawba River Basinwide Water Quality Plan*. Raleigh, North Carolina.
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- North Carolina DWR. 2007. *Water Shortage Response Plan (WSRP) Guidelines*. Raleigh, North Carolina.

APPENDIX A

WSACC Safe Yield Update & Drought Operation Plan

APPENDIX B

City of Concord & Kannapolis Ordinances

APPENDIX C

Low Inflow Protocols

APPENDIX D

North Carolina Administrative Code – Water Use During Droughts and Water Supply Emergencies
