Ecological Flows and Their Potential Effects in NC

Environmental Review Commission

November 15, 2012

Overview

- What are ecological flows?
- Potential effects on:
  - Existing & Future Water Withdrawals
- Positive Impacts of Ecological Flows
- Water Security in NC

What are Ecological Flows?

- Flow needed to remain in the water body to maintain instream uses.
- Site Specific – habitat type, species of interest, drainage area
- Varies with Time – monthly, seasonal , or yearly variation

Instream Flows Provide for a Diversity of Uses

Water Supply

Thermoelectric Energy

Offstream Uses are Critical for Society

Agriculture

Hydropower diversion

Ecological Flow Regime

- **Retains natural stream flow variability:**
  - **magnitude**
  - **timing**
  - **frequency**
  - **duration**
  - **rate of change**
- **Variability differs depending upon location & type of water body**
  - **This makes statewide determination of ecological flows very challenging.**

Ecological Flows vs. Minimum Flows

- Minimum flows – a minimal threshold to maintain aquatic life for short periods of time
- The lower the minimum flow – the more it is suited only to allow survival for brief periods
- Ecosystems suffer when the minimum flow becomes THE flow for extended periods.

What is NC Doing?

- SL 2010-143 mandated that DENR:
  - Identify the flow necessary to maintain ecological integrity (ecological flow).
  - Create a Science Advisory Board to assist in characterizing and determining ecological flows.
  - Incorporate ecological flows into hydrologic river basin models.
  - Determine if ecological flows will be adversely affected by existing or future water withdrawals.

Ecological Flows Are A Planning Tool

- Not policy
- DWR task is to identify through hydrologic modeling where eco flows could be affected
- Policy will determine response to these effects

Other States' Programs

- Minimum Flow Threshold: 7Q10
  - Alabama / Louisiana / Mississippi
- Minimum Flow Threshold: % of Annual Flow
  - Arkansas / Georgia

- Flow Regime w/ Allowable % Reduction
  - Some Florida Water Management Districts

Ecological Flows in SC

- Component of SC water withdrawal permitting program
- Based on “mean annual daily flow (MADF)”
- SC law establishes “minimum instream flows”
  - Jan–April: Minimum instream flow = 40% of MADF
  - May/June/Dec: Minimum flow = 30% of MADF
  - July-Nov: Minimum instream flow = 20% of MADF

Ecological Flows in VA

- Comprehensive, scientific approach similar to NC
- Exploring relationship between flow metrics and biometrics of fish and benthic species
- 23,000 statistical relationship
- May structure permit conditions to limit impacts to instream uses

Existing Water Withdrawals with the Greatest Potential to be Impacted by the Implementation of Ecological Flow Policy

Categories of Existing Withdrawals

- Utilities
  - Hydropower Generation
  - Thermal Power Generation
- Public Water Supply
- Industry
- Agriculture
- Mining

Assumptions

- Policy will be developed to maintain eco flows to the greatest extent possible.
- Withdrawals associated with projects with an established flow standard will not be affected:
  - FERC Licenses
  - Flow requirements for dams and reservoirs
  - Projects associated with an instream flow study

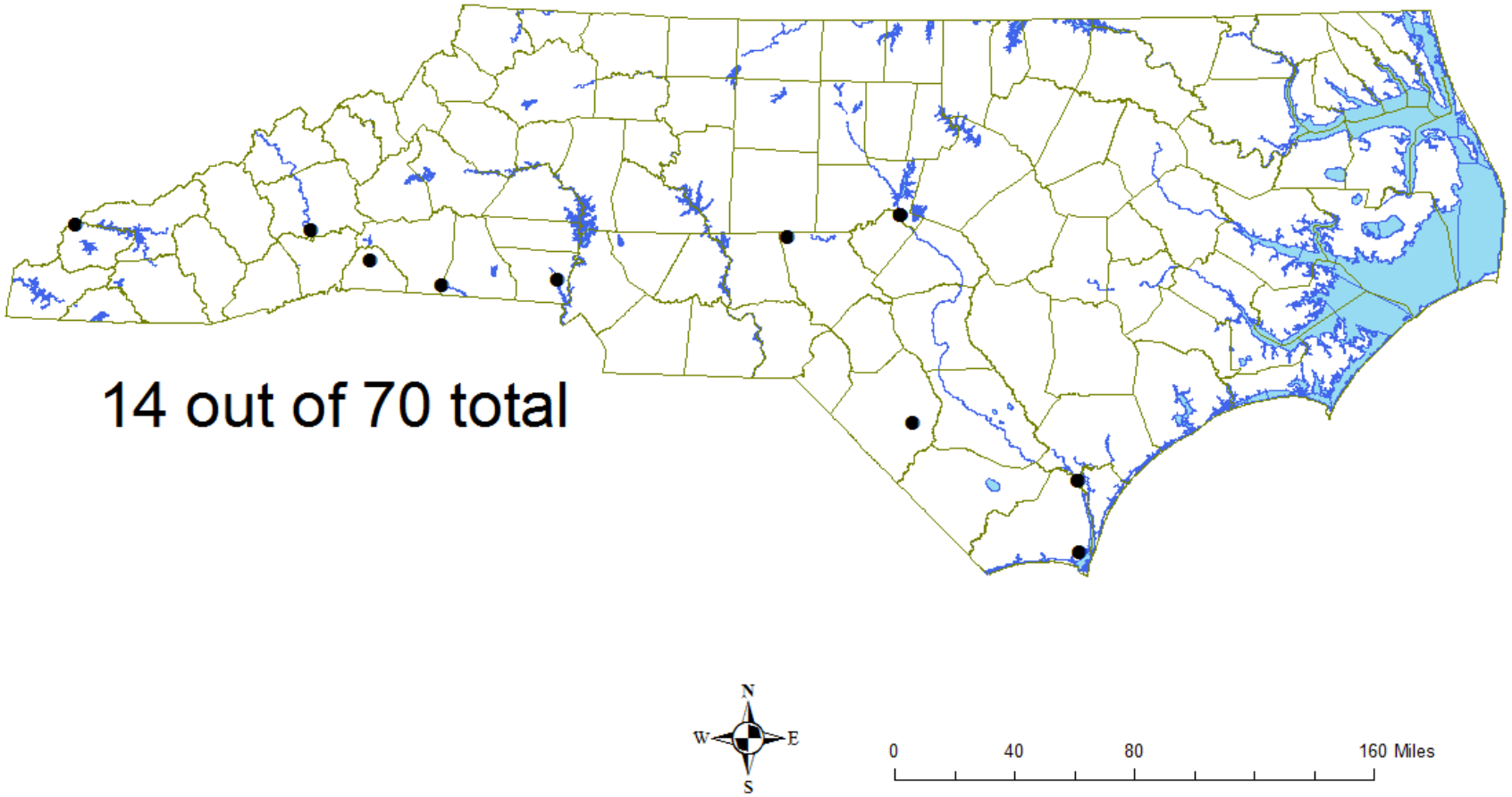
Assumptions

- Withdrawals from isolated, un-connected, ponds and lakes will not be affected.
- Groundwater withdrawals will not be affected.

Assumptions

- Large “run of the river” withdrawals have the potential to be most significantly affected:
  - Dependent upon size and location of withdrawal
- Run of river withdrawals also the most susceptible to drought.

Run-of-River Water Withdrawal Locations Energy



14 out of 70 total

Energy Facility Notes

- 14 facilities are primarily steam generation plants
- Very little consumptive use
- Up to 98.5% of withdrawn water returned to water body

Run-of-River Energy Facilities

owner	name	county
Progress Energy Carolinas, Inc.	Brunswick Steam Electric Plant	Brunswick
Progress Energy Carolinas, Inc.	Asheville Steam Electric Plant	Buncombe
Progress Energy Carolinas, Inc.	Cape Fear Steam Electric Plant	Chatham
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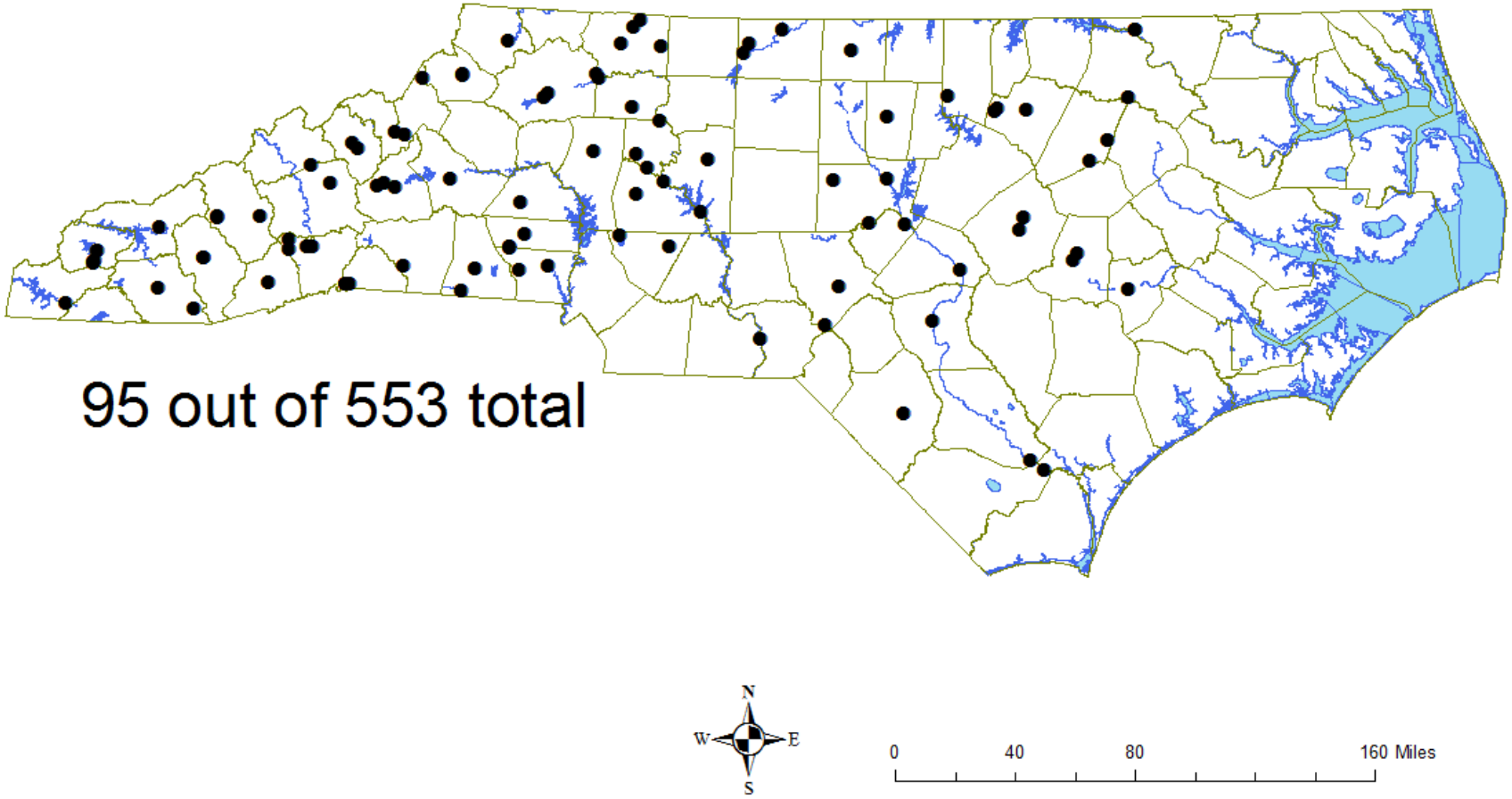
Progress Energy Carolinas, Inc.	Cape Fear Steam Electric Plant	Chatham
Progress Energy Carolinas, Inc.	Sutton Steam Electric Plant	New Hanover
Progress Energy Carolinas, Inc.	Sutton Steam Electric Plant	New Hanover
Progress Energy Carolinas, Inc.	Weatherspoon Stream Electric Power Plant	Robeson
Duke Power a Duke Energy Company	Cliffside Steam Station	Cleveland
Duke Power a Duke Energy Company	Dan River Steam Station	Rockingham
Stowe-Pharr Mills, Inc.	Phar Yarns Hydroelectric Plant	Gaston
Alcoa Power Generating Inc. - Tapoco Div	Cheoah Powerhouse	Graham
Northbrook Carolina Hydro Llc	Turner Shoals Hydroelectric Plant	Polk

Run-of-River Water Withdrawal Locations
Public Water Supply



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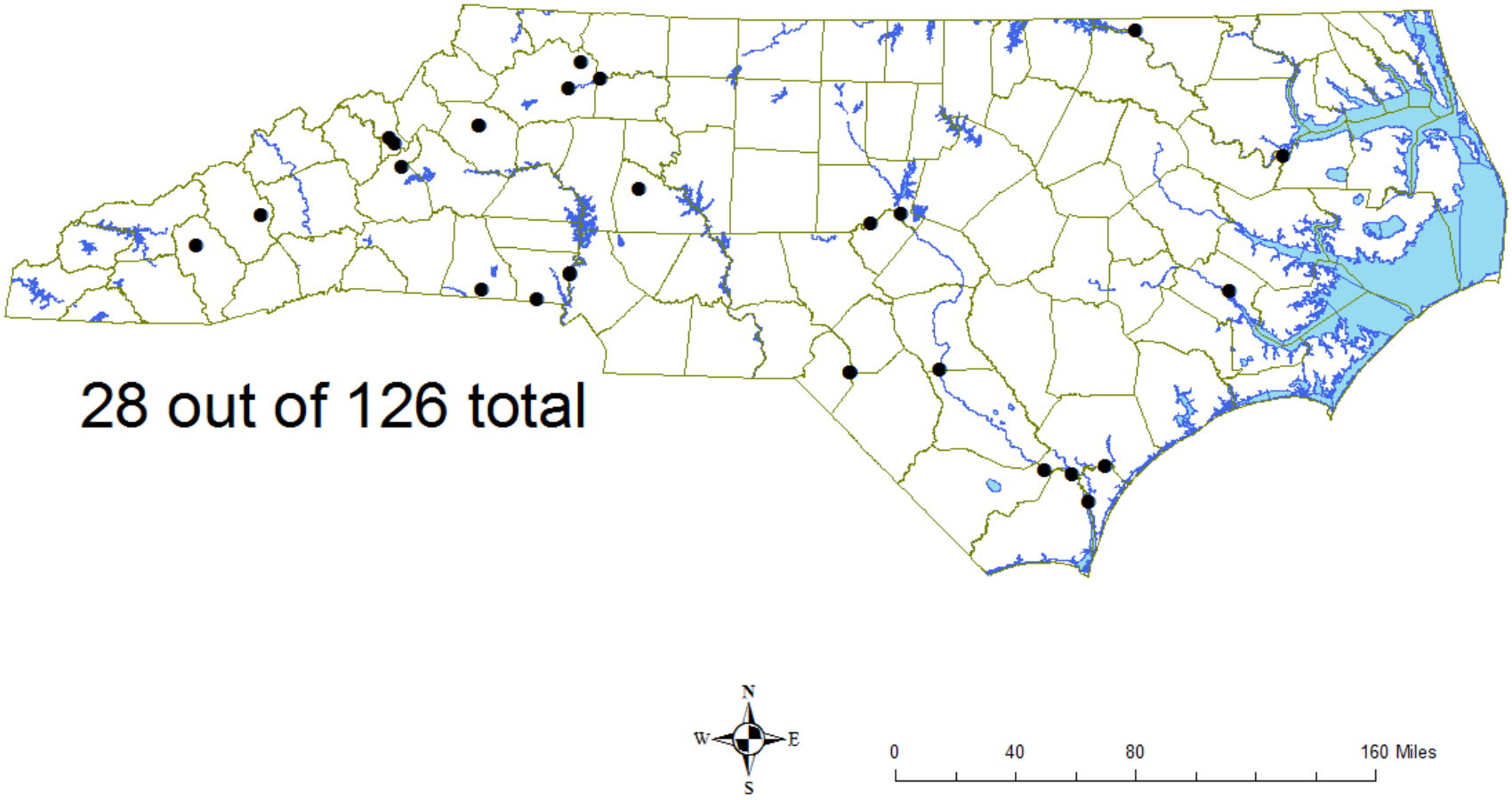
Run-of-River PWS Facilities

SYSTEM NAME	COUNTY	SYSTEM NAME	COUNTY	SYSTEM NAME	COUNTY	SYSTEM NAME	COUNTY
JEFFERSON, TOWN OF	Ashe	LOUISBURG, TOWN OF	Franklin	SMITHFIELD, TOWN OF	Johnston	KANNAPOLIS, CITY OF	Rowan
BEECH MOUNTAIN, TOWN OF	Avery	BESSEMER CITY, TOWN OF	Franklin	PILGRIM`S PRIDE WATER SYSTEM	Lee	SALISBURY-ROWAN	Rowan
SPRUCE PINE, TOWN OF	Avery	CHERRYVILLE, CITY OF	Gaston	SANFORD, CITY OF	Lee	BROAD RIVER WATER AUTHORITY	Rutherford
BRUNSWICK COUNTY WATER SYSTEM	Brunswick	CHERRYVILLE, CITY OF	Gaston	LINCOLNTON, CITY OF	Lincoln	DOBSON, TOWN OF	Surry
ASHEVILLE CITY OF	Buncombe	DALLAS, TOWN OF	Gaston	FRANKLIN, TOWN OF	Macon	ELKIN, TOWN OF	Surry
WEAVERVILLE, TOWN OF	Buncombe	ROBBINSVILLE, TOWN OF	Gaston	HIGHLANDS, TOWN OF	Macon	ELKIN, TOWN OF	Surry
WOODFIN SANITARY WATER AND SEWER	Buncombe	ROBBINSVILLE, TOWN OF	Graham	MARION, CITY OF	McDowell	MOUNT AIRY, CITY OF	Surry
MORGANTON CITY OF	Burke	ROBBINSVILLE, TOWN OF	Graham	MARION, CITY OF	McDowell	MOUNT AIRY, CITY OF	Surry
MOUNT PLEASANT, TOWN OF (WSACC)	Cabarrus	ROBBINSVILLE, TOWN OF	Graham	MARION, CITY OF	McDowell	PILOT MOUNTAIN, TOWN OF	Surry
NEWTON, CITY OF	Catawba	SOUTH GRANVILLE WTR&SEWER AUTHORITY	Graham	SPRUCE PINE, TOWN OF	Mitchell	BRYSON CITY, TOWN OF	Swain
PITTSBORO, TOWN OF	Chatham	ENFIELD WATER SYSTEM	Granville	CARTHAGE, TOWN OF	Moore	BREVARD, CITY OF	Transylvania
SILER CITY, CITY OF	Chatham	ROANOKE RAPIDS SANITARY DIST	Halifax	SOUTHERN PINES, TOWN OF	Moore	APPALACHIAN STATE UNIV WTP	Watauga
MURPHY, TOWN OF	Cherokee	WELDON WATER SYSTEM	Halifax	ROCKY MOUNT, CITY OF	Nash	APPALACHIAN STATE UNIV WTP	Watauga
SHELBY, CITY OF	Cleveland	DUNN, CITY OF	Halifax	HILLSBOROUGH, TOWN OF	Orange	GOLDSBORO, CITY OF	Wayne
SHELBY, CITY OF	Cleveland	CANTON, TOWN OF	Harnett	TRYON, TOWN OF	Polk	GOLDSBORO, CITY OF	Wayne
INTERNATIONAL PAPER COMPANY	Columbus	MAGGIE VALLEY SANITARY DIST	Haywood	TRYON, TOWN OF	Polk	NEUSE REGIONAL WTR & SWR AUTH	Wayne
FAYETTEVILLE PUBLIC WORKS COMM	Cumberland	MAGGIE VALLEY SANITARY DIST	Haywood	TRYON, TOWN OF	Polk	NORTH WILKESBORO, TOWN OF	Wilkes
DENTON, TOWN OF	Davidson	HENDERSONVILLE, CITY OF	Haywood	RICHMOND COUNTY WATER SYSTEM	Richmond	WILKESBORO, TOWN OF	Wilkes
LEXINGTON, TOWN OF	Davidson	HENDERSONVILLE, CITY OF	Henderson	LUMBERTON, CITY OF	Robeson	WILSON, CITY OF	Wilson
DAVIE COUNTY WATER SYSTEM	Davie	HENDERSONVILLE, CITY OF	Henderson	EDEN, TOWN OF	Rockingham	YADKINVILLE, TOWN OF	Yadkin
DAVIE COUNTY WATER SYSTEM	Davie	STATESVILLE, CITY OF	Henderson	MADISON, TOWN OF	Rockingham	BURNSVILLE, TOWN OF	Yancey
MOCKSVILLE, TOWN OF	Davie	TUCKASEIGEE WATER & SEWER AUTH	Iredell	MAYODAN, TOWN OF	Rockingham	BURNSVILLE, TOWN OF	Yancey
FRANKLINTON, TOWN OF	Franklin	WESTERN CAROLINA UNIV WTP	Jackson	KANNAPOLIS, CITY OF	Rowan	YANCEYVILLE, TOWN OF	Yancey
FRANKLINTON, TOWN OF	Franklin	JOHNSTON CO WATER SYSTEM	Johnston				

Run-of-River Water Withdrawal Locations
Industrial



28 out of 126 total

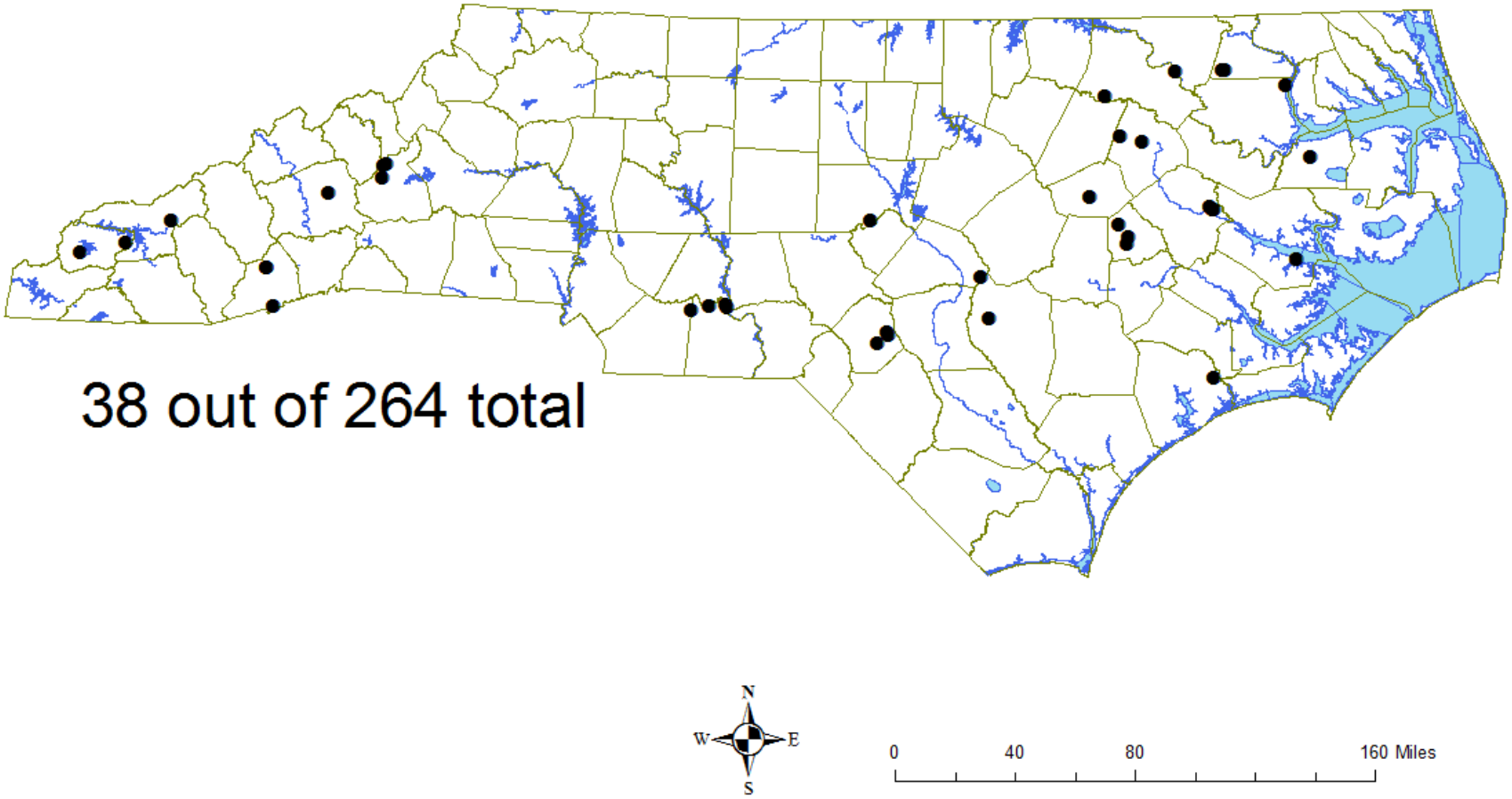
Notes on Industrial Facilities

- Most industries purchase water from community water systems.

Run-of-River Industrial Facilities

owner	name	county
Louisiana Pacific Corporation	Louisiana Pacific Corporation	Wilkes
American & Efird, Inc.	Plant 15	Gaston
Kapstone Kraft Paper Corp.	Roanoke Rapids Mill	Halifax
Coats American	Sevier Finishing Plant	McDowell
Dupont	Dupont Company - Fayetteville	Bladen
International Paper	Riegelwood Mill	Columbus
International Paper	The Feldspar Corporation	Mitchell
International Paper	K-T Feldspar	Mitchell
Westpoint Stevens	West Point Home Filter/Waste Treatment	Scotland
Westpoint Stevens	West Point Home Filter/Waste Treatment	Scotland
Westpoint Stevens	West Point Home Filter/Waste Treatment	Scotland
Elementis Chromium L.P.	Elementis Chromium Castle Hayne Plant	New Hanover
Pilgrim's Pride Water System	Gold Kist	Lee
Blue Ridge Paper Products, Inc.	Canton Mill	Haywood
Clariant Corporation	Mt. Holly Plant	Mecklenburg
CNA Holdings, Inc.	CNA Holdings, Inc.-TICONA	Cleveland
Performance Fibers Inc.	Performance Fibers - Salisbury Facility	Rowan
Uniboard USA LLC	Moncure Division	Chatham
Dak Monomers, LLC	DAK Americas - Cape Fear Site	Brunswick
Jackson Paper Manufacturing Company	Jackson Paper Manufacturing Company	Jackson
True Textiles, Inc.	True Elkin, Inc.	Surry
True Textiles, Inc.	True Elkin, Inc.	Surry
Valley Proteins, Inc.	Carolina By- Products, Gastonia Division	Gaston
NPS Corporation	Blue Ridge Tissue Corporation	Caldwell
NPS Corporation	Blue Ridge Tissue Corporation	Caldwell
Gavilon Fertilizer	Gavilon Fertilizer - Wilmington	New Hanover
Weyerhaeuser	Weyerhaeuser Co.	Washington
Domtar Paper Company LLC	Weyerhaeuser Co.	Washington

Run-of-River Water Withdrawal Locations
Agriculture



38 out of 264 total

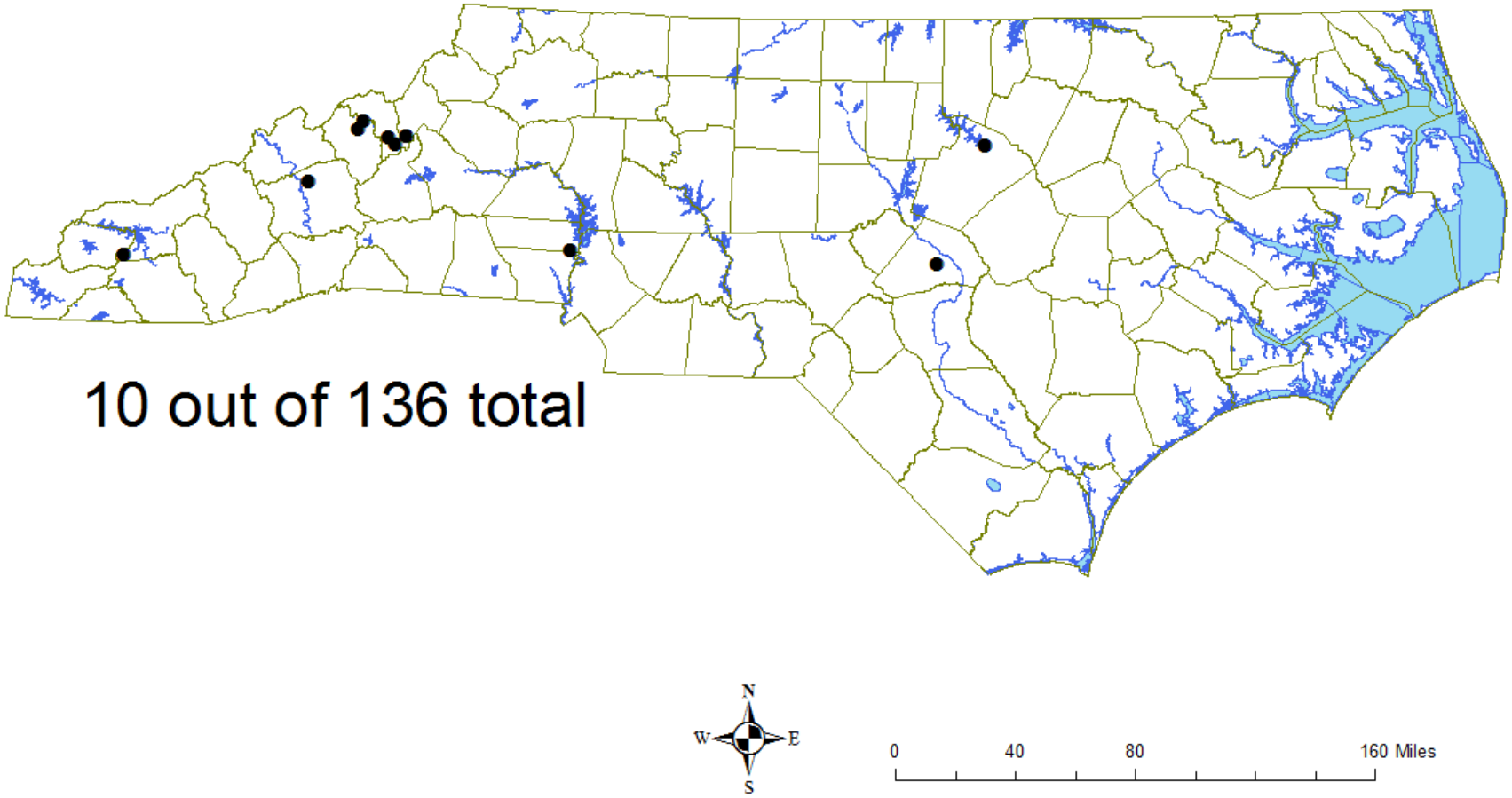
Agriculture Facilities based on Ag Survey

- Data based upon most recent Agriculture Survey
- 1,308 unique operations withdrawing > 10,000 gpd
- 504 withdraw ground water
- 537 withdraw water from lakes and ponds
- 267 withdraw water from rivers & streams
  - 88 are flow through
- 179 operations out of 1,308 remaining
  - These have the greatest potential to be affected.

Notes on Agriculture

- Often relatively small withdrawals
- Withdrawals are often seasonal, not year-round
- Aquaculture operations are often “pass through”
  - Returns withdrawn water to water body
- Withdrawals are often in rural locations
- Withdrawals most needed during periods of below normal precipitation

Run-of-River Water Withdrawal Locations
Mining



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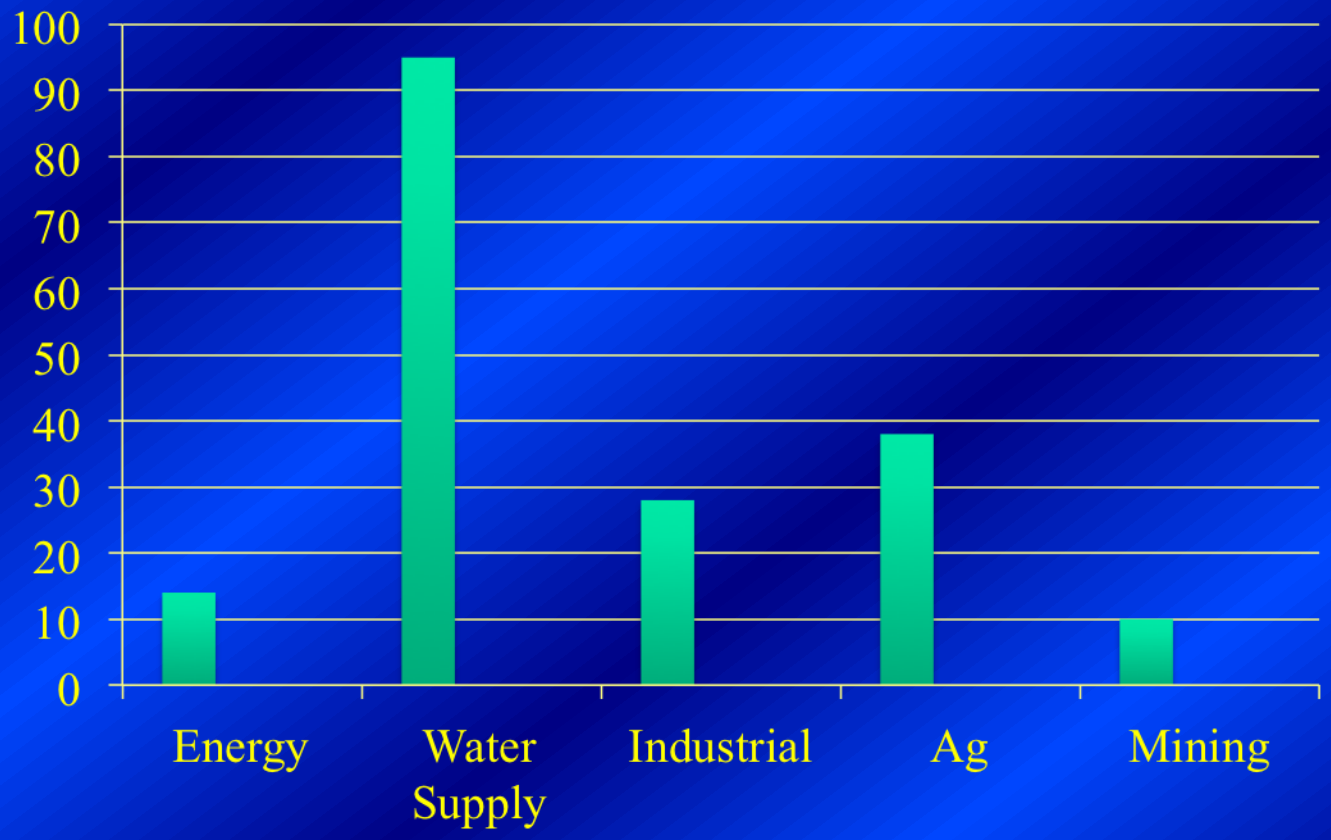
Notes on Mining

- Many mining operations eventually return withdrawn water to the water body.

Run of River Systems



Potential Effects on Future Water Withdrawals

- Difficult to predict
- Dependent upon location and size of withdrawal
  - Possible minimal effects in less populated river basins
- Planning tool for small/medium withdrawals
  - SEPA/NEPA analysis
- Major withdrawals may still use site-specific analysis

Positive Effects from the Maintenance of Ecological Flows

Positive Impacts of Eco Flows

- The maintenance of ecological flows will have significant positive impacts on:
  - The protection of NC's natural heritage
  - Aquatic ecology
  - Recreational uses of NC's water bodies
  - Recreational fishing
  - Tourism
  - Threatened and endangered aquatic species
  - Wastewater assimilation

Positive Impacts of Eco Flows

- The maintenance of ecological flows will have significant positive impacts on:
  - Aquaculture
  - Diadromous fish species
  - Fish hatcheries and breeding areas
  - Commercial fishing
  - Wetlands
  - Water Quality

Water Security

Robust, resilient water supplies adequate to support future population and economic growth

+

Instream flows capable of supporting NC's diverse natural heritage

Building Resilient Water Supplies

- Maximize use of existing water supplies
- Identify vulnerable water systems
- Reduce system vulnerability

Building Resilient Water Supplies

- Maximize existing water sources
  - Statewide water efficiency policy (SL 2011-374)
    - Water Efficiency BMP Manual
  - Water audits for underperforming systems
  - Use of reclaimed water
  - Interconnections
    - Over 300 interconnections in NC

Systems w/ History of > 30% Unaccounted Water

Alamance	Connestee Falls*	LaGrange	Roseboro
Asheville	Conway	Lake Santeetlah	Roxboro
Bakersville	Dan River Water*	Lewiston-Wood.	Smithfield
Bayleaf Master*	Edenton	Lumberton	South Mills*
Banner Elk	Fairfield Sapp.*	Marion	Sugar Mountain*
Beech Mountain	Fairmont	Marshall	Warsaw
Carolina Beach	Highlands	Murphy	Waynesville
Caswell Beach	Holden Beach	Old Fort	Whiteville
Chimney Rock	Johnston County	Rich Square	

* Denotes private water system

Identification of Vulnerable Systems

- Systems revealed by hydrologic modeling to have inadequate future water supplies
- Systems in need of IBT to meet future water needs
- Run of the river (ROR) water systems
  - ROR systems w/ no storage
  - ROR systems w/ no interconnections
  - ROR systems w/ limited access to water

Vulnerable Water Systems

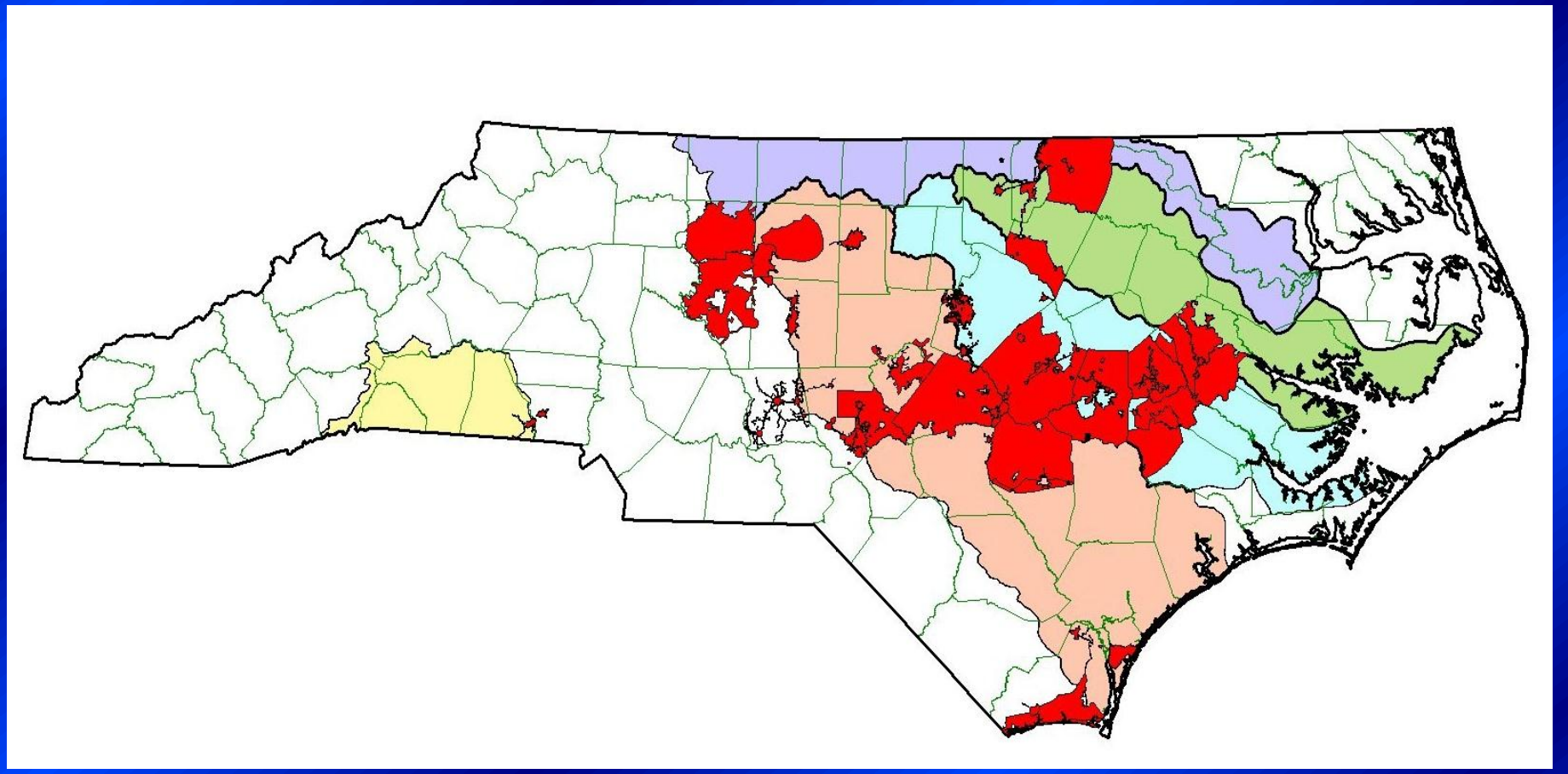
- Systems denoted by existing hydrologic modeling to have inadequate future water supplies to date:
  - Raleigh
  - South Granville Water & Sewer Authority

Systems in Cape Fear, Neuse, Tar-Pam, Roanoke, and Broad River Basins that need IBTs to meet Projected 2060 Water Demands*

System	IBT Need	System	IBT Need
Cary**	8.34 mgd	Kerr Lake RWS**	15.18 mgd
Greensboro	4.07 mgd	Davidson	1.24 mgd
High Point	3.85 mgd	Asheboro	9.24 mgd
Brunswick Co**	4.65 mgd	Greenville Utilities	13.85 mgd
Wilmington	1.08 mgd	Montgomery Co	?
Raleigh (Zebulon)	3.44 mgd	Sanford	?
Neuse Regional	8.71 mgd	Johnston Co	?

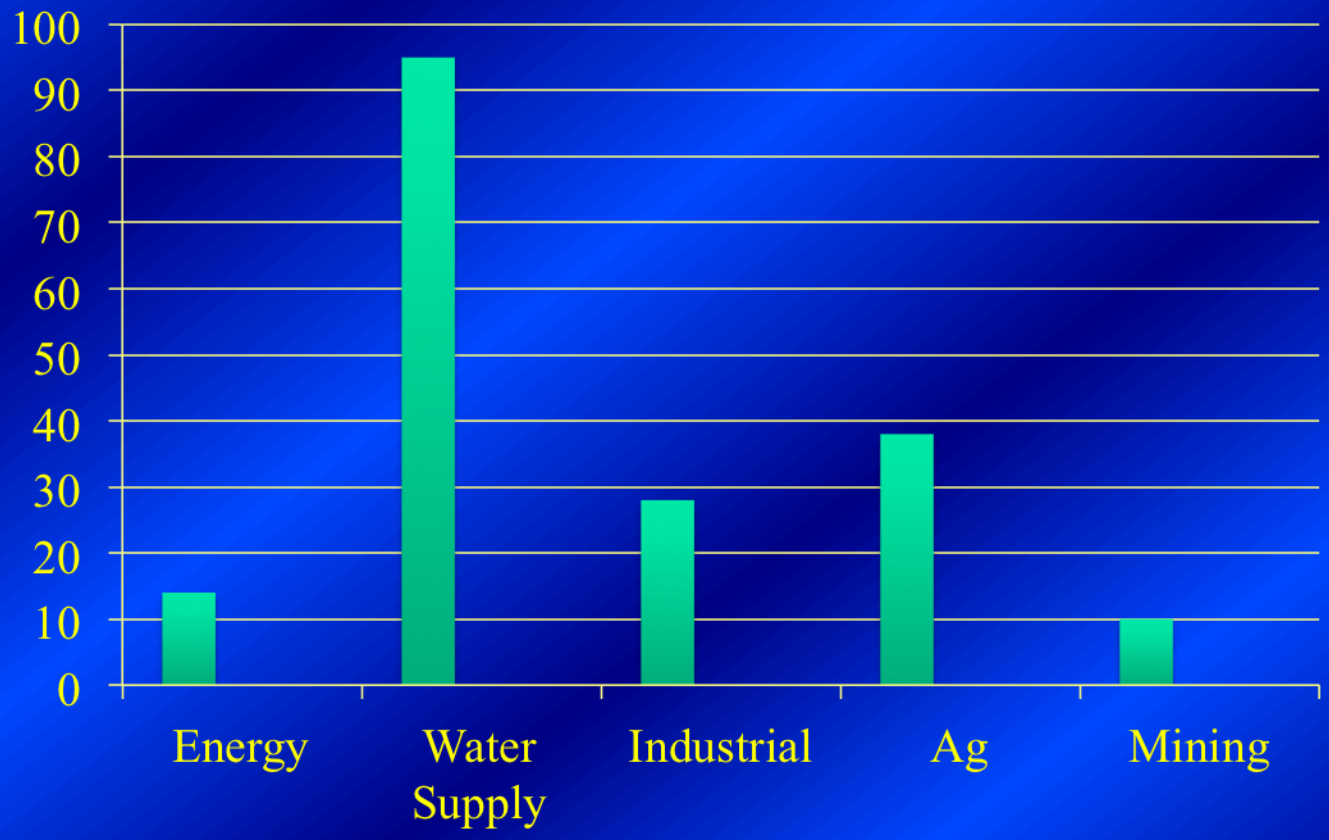
* Projected need greater than 1 million gallon per day (mgd)
** Systems already working on IBT Certificate

Service Areas* in Cape Fear, Neuse, Tar-Pam, Roanoke, and Broad River Basins that need IBTs to meet Projected 2060 Water Demands



* Areas denoted in red are those service areas in need of an IBT

Run of River Systems



Options for Vulnerable Systems

- Aquifer Storage and Recovery (ASR)*
- Desalinization*
- Quarries with high flow skimming*
- Reallocation of existing reservoir storage*
- Use of abandoned reservoirs*
- New surface water intake
- Non-mainstem (offline) reservoir*
- Mainstem reservoir

* Limited impacts on ecological flows

Options for Vulnerable Systems

- Ag Water Resources Assistance Program (Ag WRAP)
- Use of abandoned reservoir
  - Moore County
- Quarries with high flow skimming
  - Durham / Johnston County
- Aquifer storage and recovery
  - Greenville / Cape Fear Public Utilities
- Non-mainstem (offline) reservoir
  - Southern Pines
- Reallocation of existing reservoir storage
  - Kerr Lake / Raleigh – Falls Lake / Jordan Lake

Reallocation Process for Corps Reservoirs

- Corps leadership has adopted streamlined study process
- "3 + 3 + 3" process
  - Completed in less than 3 years
  - For less than $3,000,000
- Expedite reallocation in Corps reservoirs for water supply
  - Falls Lake
  - Kerr Lake
  - Kerr Scott Reservoir
- Utilization of DWR hydrologic modeling results & data

Maintenance of Instream Flows

- Development of Ecological Flow Methodology
  - Science Advisory Board
- Incorporation of Ecological Flows in Models
- Development of Ecological Flow Policy

Contact Information

Tom Reeder
Director, NC Division of Water Resources
919-707-9027
tom.reeder@ncdenr.gov