



# *Sustainable Rivers Program*

## Cape Fear River Initiation into the Sustainable Rivers Program and Launch Meeting 2017

October 2017

Compilation by The Nature Conservancy and the Wilmington District,  
U.S. Army Corps of Engineers

Prepared for U.S. Army Corps of Engineers  
and other cooperating organizations

### Description of SRP Site

The Cape Fear River is a new river in the Sustainable Rivers Program. It encompasses 9,164 square miles making it the largest river basin contained entirely within North Carolina (see map below). The river basin contains over two million people (2010 census), one-fifth of the state's population. The upper basin contains rapidly growing cities such as Greensboro, Durham, Chapel Hill and others which contribute urban runoff into the river (see the figure below of the SWAT model that shows the upper basin contributes 50% of nutrients to drinking water pipes in the lower basin). The mid and lower Cape Fear have extensive confined agricultural feeding operations (CAFOs), also contributing to high levels of nutrients in the river. There are drinking water users throughout the entire basin, including growing cities like Wilmington in the lower basin, who are trying to maximize water resource use.

The US Army Corps of Engineers (Corps) has multiple projects influencing the Cape Fear River basin, including managing B. Everett Jordan Lake (Jordan Lake), operating three lock and dams, and dredging (see map below). Jordan Lake's five project purposes are to provide water supply, flood control, water quality, recreation, and fish and wildlife conservation. Jordan Lake was almost immediately impaired for high levels of nutrients, and the State declared it a nutrient sensitive water body the same year that the reservoir was completed. Jordan Lake supplies drinking water to over 300,000 upper basin users.

The three locks and dams were built between 1915 and 1935 to assist commercial traffic up and down the river. Today, the lock and dams are rarely used for large vessels, but they help protect water intakes for cities such as Wilmington and Fayetteville. The lock and dams also significantly impede diadromous fish from reaching their historic spawning grounds. Over the past two centuries, commercial fish landings are 87% lower than historical estimates.<sup>1</sup> The Corps completed a rock ramp fishway in 2012 on Lock and Dam 1 (i.e. the first barrier) to help passage over the dam. The Corps, through its Section 408 process, is working with partners (including TNC) to assess the potential for modification of the rock ramp passage, as well as to support potential fish passage structures on the other two lock and dams.

In addition to diadromous fish habitat, the Cape Fear River Basin contains many different aquatic ecosystems, lending itself to a diverse species assemblage including 95 species of commercial and recreational fish, 42 rare aquatic species, and streamside habitat having the oldest trees east of the Rocky Mountains (over 2000 years old). Both people and wildlife rely on the Cape Fear, making its water quality and water quantity of the utmost importance.

### Authorities

Following a category 1 hurricane's impacts (heavy precipitation) in central North Carolina and the Cape Fear River basin in 1945, the Corps was directed by Congress to study water resources needs and flooding issues in the Cape Fear River basin. What's now known as the B. Everett Jordan Lake project

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<sup>1</sup> <http://www.habitat.noaa.gov/protection/capefear/pdf/CapeFearActionPlan.pdf>

was approved in 1963 as the New Hope Lake project, with construction beginning in 1967. In 1973 the project was renamed in honor of former Senator B. Everett Jordan. The reservoir impounded in 1981 and reached normal pool level in 1982.

The three Cape Fear River locks and dams projects were part of a 1902 congressional authorization that allowed their construction as improvements to Cape Fear River navigation between Wilmington and Fayetteville.

The Corps is also responsible for maintaining the Wilmington Harbor Federal Navigation project. Dredging ensures safe navigation and continued commerce via the Port of Wilmington. Additionally, the Military Ocean Terminal Sunny Point (MOTSU) relies on the Wilmington Harbor Federal Navigation Project to execute its mission of supporting military operations overseas.

## Partners / Stakeholders

The Cape Fear River is a new entry into the Sustainable Rivers Program. We have taken the last 6 months to introduce the program throughout the basin to the various stakeholders listed below, many of which we expect to be strong partners.

- Entire Basin: Cape Fear River Assembly (<http://cfra-nc.org/>)  
Cape Fear River Watch (<http://www.capefearriverwatch.org/>)  
American Rivers (<https://www.americanrivers.org/>)  
US Geological Service (<https://www.usgs.gov/>)  
NC Department of Environmental Quality (<https://deq.nc.gov/>)  
NC Wildlife Resources Commission (<http://www.ncwildlife.org/>)  
US Fish and Wildlife Service (<https://www.fws.gov/>)  
National Marine Fisheries Service ([www.nmfs.noaa.gov](http://www.nmfs.noaa.gov))
- Upper Basin: Upper Cape Fear Basin Association (<http://www.ptrc.org/index.aspx?page=459>)  
Jordan Lake Partnership (<http://www.jordanlakepartnership.org/>)  
North Carolina Policy Collaboratory (<http://collaboratory.web.unc.edu/>)
- Middle Basin: Middle Cape Fear River Basin Association (<http://ncdenr.s3.amazonaws.com/s3fs-public/Water%20Quality/Coalition%20Program/MCFBA%20Members%207.1.2013.pdf>)
- Lower Basin: Cape Fear River Partnership (<http://www.capefearriverwatch.org/about-us/the-cape-fear-river-partnership>, <http://www.habitat.noaa.gov/protection/capefear/>)  
Lower Cape Fear River Program (<http://uncw.edu/cms/aelab/lcfrp/>)  
Cape Fear River Council of Governments (<http://capefearcog.org/>)  
Bladen County, NC (<http://www.bladenncc.govoffice3.com/>)

## Resources

- a) Key Publications: The Cape Fear River is a recent addition to the SRP and identification of key publications and data is in progress; although multiple partners / stakeholders currently have useful data with immediate SRP applicability.
- b) Key Data Sets: The Cape Fear River is a recent addition to the SRP and identification of key publications and data is in progress; although multiple partners / stakeholders currently have useful data with immediate SRP applicability.
- c) Images / Visual Aids: (see Figures 1-2 and Photos 1-5)



Figure 1. Cape Fear River Basin (image credit TNC)

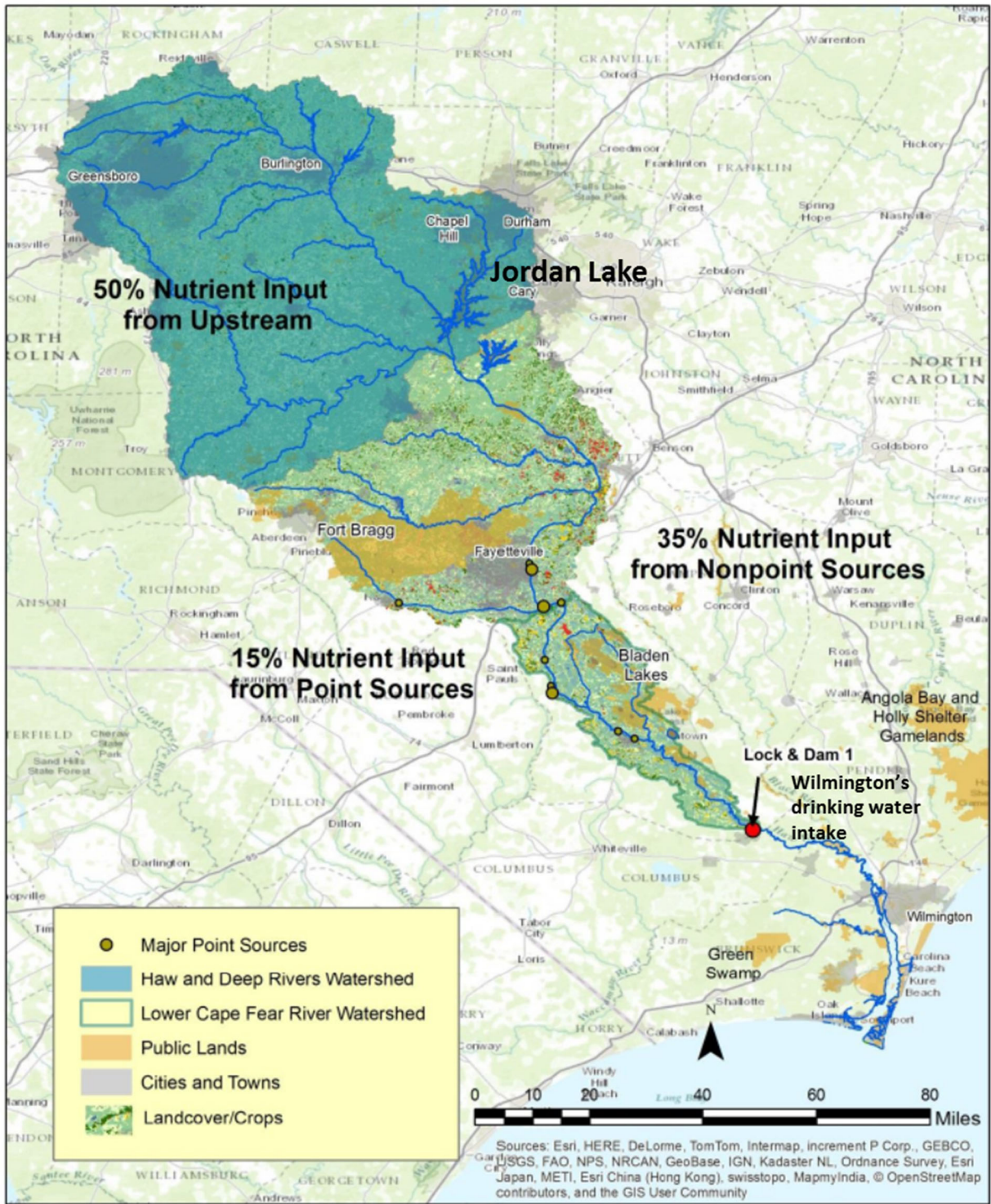


Figure 2. SWAT Model – Cape Fear River Basin, Nutrient Input Sources (image credit TNC)



**Photo 1. B. Everett Jordan Lake, Dam and Tailrace (image credit USACE)**



**Photo 2. Lock and Dam #1, Cape Fear River (image credit USACE)**



**Photo 3. Rock Arch Rapids at Lock and Dam #1 (image credit CFRW)**



**Photo 4. CAFO, Hurricane Matthew Flooding 2016 (image credit CFRW)**





**Photo 5. Algal Bloom in Cape Fear River** (image credit NSF)

## **Web Links**

See hyperlinks associated with 'Partners / Stakeholders'.

## **History**

This is the first year of introducing the Sustainable Rivers Program in the Cape Fear, although both TNC and the Corps have been working in the basin for decades. Over the summer and fall of 2017, TNC and the Corps have presented the SRP concept to basin stakeholder groups, often at their annual meetings (see Partners/Stakeholders section).

The Corps has been working in the basin since 1902 when they were authorized to create the Locks and Dams. Jordan Lake dam added new authority in the basin, and the Corps was authorized to start work in 1963. More recently, the Corps completed a rock ramp fishway in 2012 on Lock and Dam 1 (i.e. the first barrier) to help fish passage over the dam. The Corps is also currently engaging on modifications to Locks and Dams 2 and 3 through the 408 process.

TNC has worked in the Cape Fear River basin since 1977 when it first received 13,850 acres of the Green Swamp. TNC also started to acquire land along the Black River, a tributary to the Cape Fear, protecting 2,835 acres along the Black River to date. TNC joined the Cape Fear River Partnership in 2011, which increased the chapter's work to include fish passage and water quality work. Through this partnership, TNC helped fund a study of migratory fish in the Cape Fear River in 2012 that supported efforts as the Corps created fish passage on Lock and Dam 1. TNC also funded the SWAT nutrient model (shown

above) to analyze the incoming nutrients in the Cape Fear River at the point of Wilmington's drinking supply intake. TNC currently participates in other stakeholder basin groups such as the Jordan Lake Partnership.

## **Status**

This is the first year of introducing the Sustainable Rivers Program in the Cape Fear. Over the summer and fall of 2017, TNC and the Corps have introduced the SRP to basin partnerships. This Friday, at Jordan Lake, the Corps and TNC will host an in-person technical stakeholder meeting to determine the studies and modeling efforts that would be additive to other groups' work in the basin. There are needs to study environmental flows, releases from of Jordan Lake, and the interaction of water quantity with water quality that affect both people and aquatic species. We plan to identify the most pressing needs and initiate the science and modeling that will guide future management options.

## **Successes**

Partner groups, like the Cape Fear River Partnership and the Jordan Lake Partnership, have been excited for TNC and the Corps to present the Sustainable Rivers Program at their stakeholder meetings. Through these presentations, we have reached practitioners, academics, local politicians, utilities, federal and state government.

## **Challenges**

There are needs to study environmental flows, releases out of Jordan Lake, and the interaction of water quantity with water quality that affect both people and aquatic species. At times, stakeholder needs in the basin appear in conflict, for instance when diadromous fish are blocked by a dam that creates a drinking water supply pool. Yet, with increasing algal blooms and other issues, there is a lot of potential to make positive change in the basin. To date, many stakeholders focus on only one section of the basin. TNC and the Corps can benefit the Cape Fear by adding a holistic perspective that is basin-wide.

## **Direction**

TNC and the Corps are hosted a technical stakeholder meeting in October 2017 to identify the most pressing modeling and scientific studies that will advance our understanding of basin-wide issues. Meeting agenda, attendees list, introductory presentation, and notes included in Appendix A.

## Appendix A – Technical Stakeholder Meeting Summary

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### Technical Stakeholder Meeting, October 2017

Meeting agenda, attendees list, introductory presentation, and notes follow:

#### Agenda:

#### Cape Fear Sustainable Rivers Program

#### Launch Meeting

Oct 17, 2017

<u>Time</u>	<u>Activity</u>
9:00-10:00	Tour Jordan Lake dam
10:00-11:00	Welcome and group intros (20 min), overview of the SRP process (15), intro to the Savannah River Process (10), and Des Moines River example of a new SRP site (15)
11:00-11:15	Corps and TNC's suite of tools, overview of CFR basin and stakeholder groups in basin
	Specific presentations on efforts in the basin
11:15-11:30	DEQ nutrients in Jordan Lake
11:30-11:45	DEQ modeling - middle and lower basin/ River Basin planning
11:45-12:00	UNC-W algal studies in lower basin (12:00-1:00 Lunch)
12:00-1:00	Lunch
1:00-1:15	DEQ flows
1:15-1:30	USGS flow work
1:30-1:45	NOAA- Endangered Species
1:45-2:00	WRC - Anadromous Fish
2:00-2:15	Break
2:15-3:15	Group Brainstorming of Corps/TNC studies for the basin

**Attendees (Table 1; Photo 6):**

**Table 1. Meeting attendees and associated organizations**

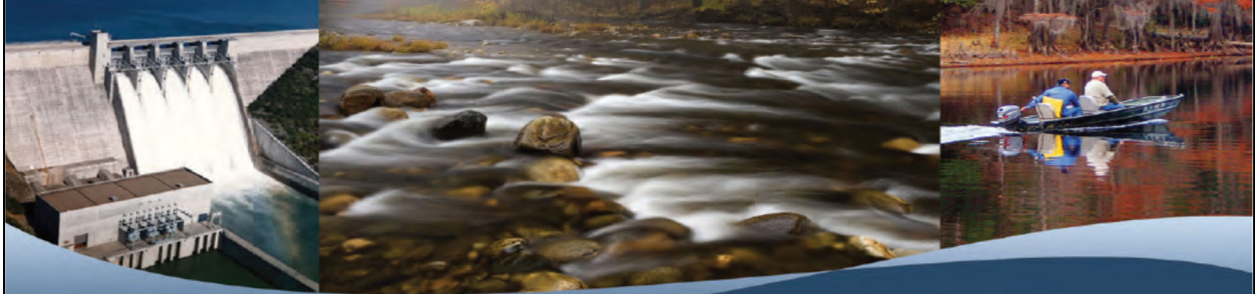
<b>Name</b>	<b>Organization</b>
Peter Raabe	American Rivers
Mindy Simmons	Corps
Ashley Hatchell	Corps
John Hickey	Corps
Justin Bashaw	Corps
Tony Young (or representative)	Corps
Jenny Owens	Corps
Hugh Howe	Corps
Mick Noland or Chad Ham	Fayetteville PUC
Rich Gannon	NC DEQ
Patrick Beggs	NC DEQ
Fred Tarver	NC DEQ
Nora Deamer	NC DEQ
Jeremy McCargo	NC WRC
Fritz Rhode	NOAA
Jen Schmitz	TJCOG/ Jordan Lake Partnership
Gretchen Benjamin	TNC
Julie DeMeester	TNC
Chuck Peoples	TNC
Dave DeGeus	TNC
Mike Mallin	UNC-W
Sara Ward	USFWS
Chad Wagner	USGS



**Photo 6. Meeting attendees (image credit USACE)**

**Introductory Presentation:**

# The Sustainable Rivers Program



**A Joint Program with the US Army Corps of Engineers and The Nature Conservancy**

*Benefiting rivers, communities and the nation.*

## History of the Sustainable Rivers Program

1998- 2002: TNC approached the Corps to modify flows on the Green River, KY. Together, they determined they could modify flows to enhance fish spawning, maintain flood control, and increase the recreation season

A 2002 MOU with TNC and the Corps launched the nationwide Sustainable Rivers Program!

“The goal of the SRP program is to improve the health and life of rivers by modifying reservoir operations to achieve ecologically sustainable flows while maintaining or enhancing other project benefits.”

2006: For the first time in history, the operating procedures at the Green River Dam were officially changed solely for ecological benefits



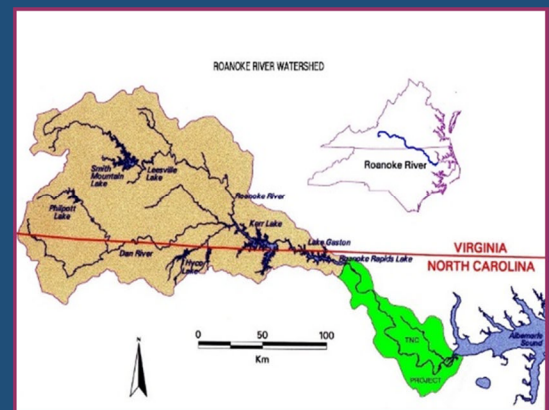
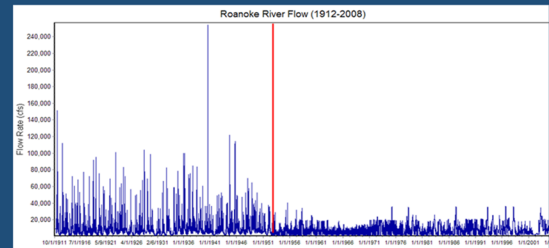
Photo by Mark Godfrey/ TNC

# Eight Initial Focal Rivers



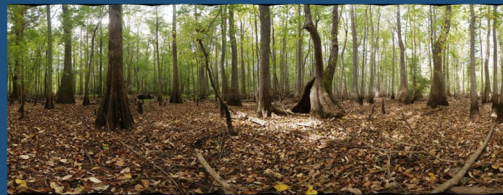
## The Roanoke River in NC

- 1990s: conservation groups recognized that prolonged flooding from 3 dams was hurting the downstream 75,000 acres of high quality floodplains
- 1994: TNC and partners initiate development of a **flow model** and studies of hydrology, geomorphology and vegetation
- 1996: the USACE Wilmington completed an Appraisal Report that indicated a Section 216 Study was needed
  - A 216 study is used to “review the operation of projects.... with recommendations on the advisability of modifying the structures or their operation, and for improving the quality of the environment in the overall public interest.”
- 2000: USACE launched 216 Study – TNC official stakeholder in the process



## The Roanoke Success

- 2010: USACE begins development of Alternatives Formulation Briefing Document. TNC and Resource agencies petition for inclusion of “Run of River Proposal”
- July 2015: 216 Study concludes, USACE Summary Report recommends environmental flow alternative as basis for Kerr Reservoir Water Control Plan revision
- November 2015: Kerr Revised Water Control Plan & Environmental Assessment released
- June 2016: Record of Decision approving Revised Water Control Plan issued from USACE South Atlantic Division



## Expanding the Sustainable Rivers Program

- 2014: The Corps’ Environmental Advisory Board suggested that the number of rivers in the program increase from 8 rivers to 20 rivers by the year 2020.
- 2016: TNC introduced the concept of including the Cape Fear River in SRP
- The concept has been well-received at the Corps to initiate the Cape Fear River into the SRP



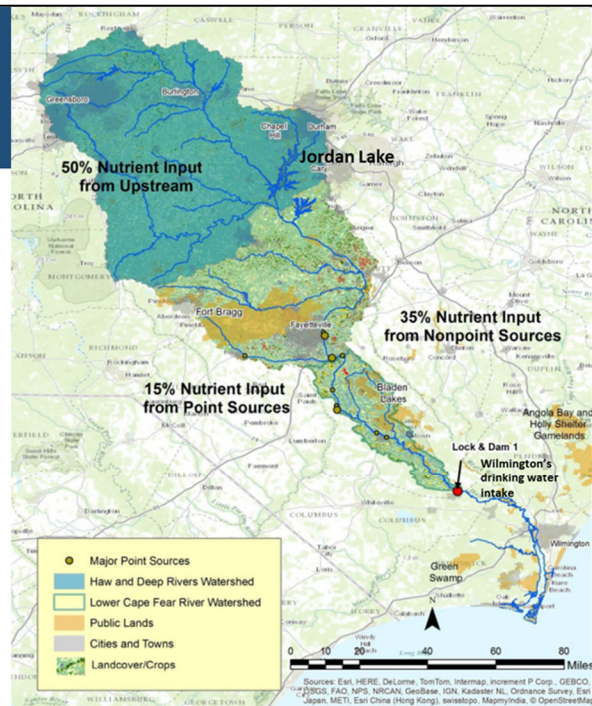
## The Corps Jurisdiction in the Cape Fear

- Reservoir management of Jordan Lake
  - Provides drinking water to >300,000 people
  - Significant nutrient issues
  - Many drinking water users below Jordan Lake
- Operation of 3 Lock and Dams
  - Rarely used for navigation
  - A significant barrier to diadromous fish
- Dredging



## Ongoing Issues in the Basin

- Growing drinking water and resource needs
- Nutrients and water quality
- Increased susceptibility to storms
- Diadromous fish need to reach their spawning habitat
- 2 million users in the basin and that number is growing



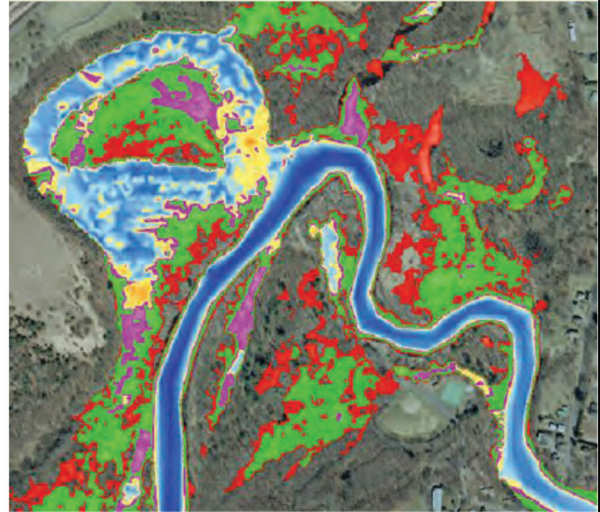


## TNC and the Corps' Suite of Tools

Computer programs to help scientists, engineers and stakeholders evaluate potential water management scenarios:

- IHA: Indicators of Hydrologic Alteration
- HEC-EFM: Ecosystem Functions Model
- HEC-RAS: River Analysis System
- HEC-RPT: Regime Prescription Tool (developed jointly by Corps and TNC)
- HEC-ResSim and Riverware: Reservoir Simulation Models
- MDSWMS: Multidimensional Surface Water Modeling System

*Simulated forest and plant communities.*



## Steps for the Next Year

- Introduce the Sustainable Rivers Program to groups throughout the basin
- Gather interested stakeholders
- Draft 1-3 years of project ideas and submit the first idea for Corps funding

Photo by Skip Pudney



## **Thank you!**

To participate, contact:

Julie DeMeester at TNC

Ashley Hatchell at the US Army Corps

## Notes for each of the four breakout groups tasked with specific questions about the Cape Fear River

### SRP Cape Fear: Group 1 Brainstorming Notes (Photos 7-9)

Group 1 came up with many ideas for future TNC/Corps work. Here are the main thoughts:

- The group wanted the Corps and others to think about the water supply issue for the entire basin. As of now, Jordan has allocations of water supply, but this does not necessarily factor in downstream users (even if their pipes are far outside of the lake). Group wanted broader thinking on this issue.
- The group wanted an assessment on whether the Jordan pools could be reallocated. Specifically, people thought the flood control pool was rarely used and could benefit one of the other pools.
- It was recognized that we have certain aquatic species data around flows- such as the flow speed needed to keep eggs buoyant- but that we are missing key pieces of information about aquatic species flow needs. This was particularly noted for striped bass.
- The group discussed that there is a disposition study for the lock and dams (1,2 and 3) and that further understanding of flows might be important next steps for the locks.
- Seems many people are studying water quality and others study water quantity. Group wanted more overlap of these two topics in the basin. For instance, we know the majority of algal blooms happen at flows less than 2000cfs. Would be good to combine other sorts of knowledge along those lines.
- One national SRP member asked if alluvial groundwater could be used for drinking water sources in the basin. This led the group to ask broad questions about studying groundwater options for drinking water supply. There is a chance that the Cape Fear falls within a broad region that is already allocated for groundwater.
- If users in the basin want to move towards taking out the locks and dams, there was a discussion that a mitigation banker might take on the project and get credits for water management. There was also discussion that we need the right owner for dams if they remain in place (and not with the Corps).
- A nice discussion happened around the obstructions on the Deep River and in other places in the reservoir. There has been little research into things like how Randleman Dam has impacted the basin e-flows, and this would impact significant downstream users.
- All of the group members wanted more information about Jordan Lake sedimentation in the reservoir. If sedimentation was happening more or less quickly than speculated, there are opportunities for management either way. For instance, if sedimentation is happening slower, that might allow reallocation of this pool. Also, it was noted that it is important to understand how legacy sediments are affecting the lake.
- The group wanted more information about how the releases from Jordan could be better optimized for downstream water quality.
- The group also wanted more information to see if the releases from Jordan could help restore downstream floodplain wetlands.
- Currently, the guide curve for Jordan is a flat line. The group was interested if there could be a change to the guide curve to pulse flows (without impacting water supply).
- As noted in some earlier presentations, the presence of mudflats and littoral zones in the lake helped other sites improve nitrogen cycling and water quality. The group wanted more information whether there was a better way to improve littoral zones in Jordan Lake.

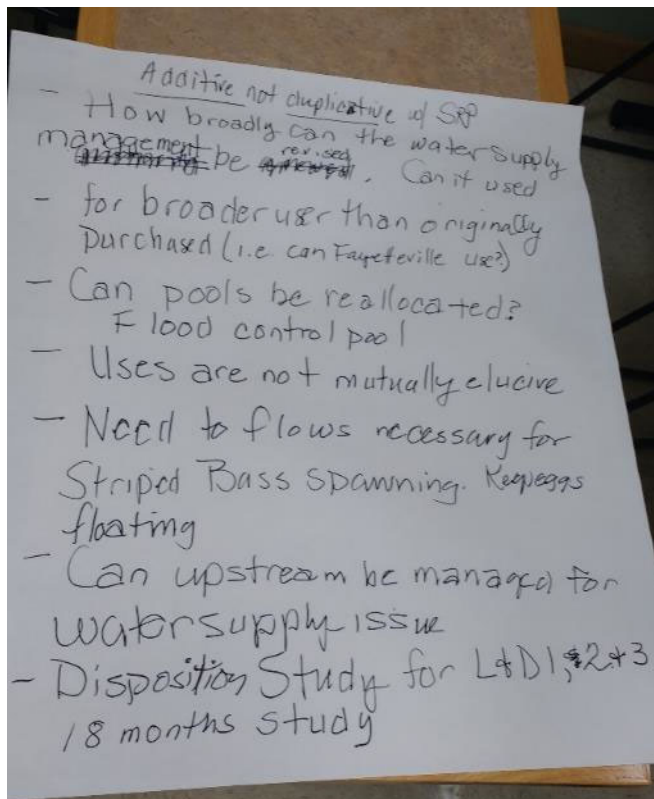


Photo 7. Meeting notes, group 1 (image credit TNC)

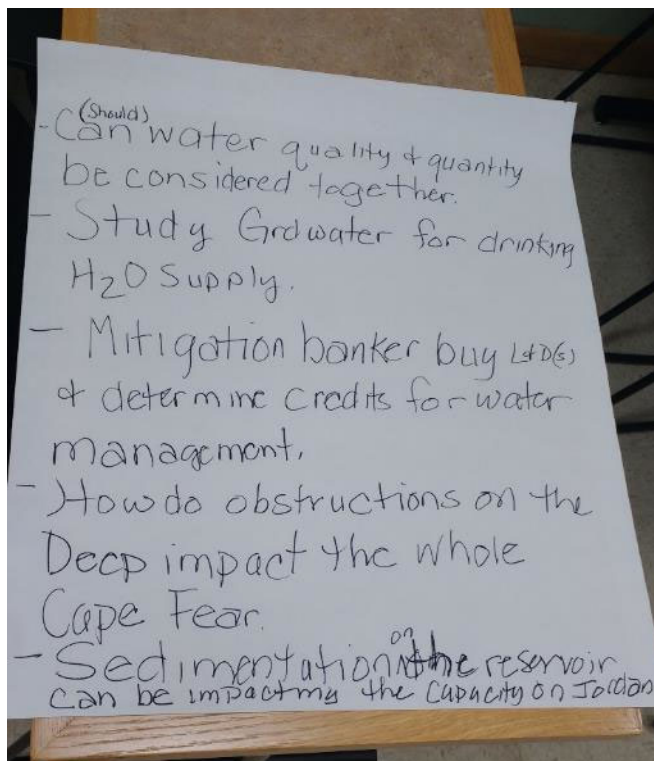


Photo 8. Meeting notes, group 1 (image credit TNC)

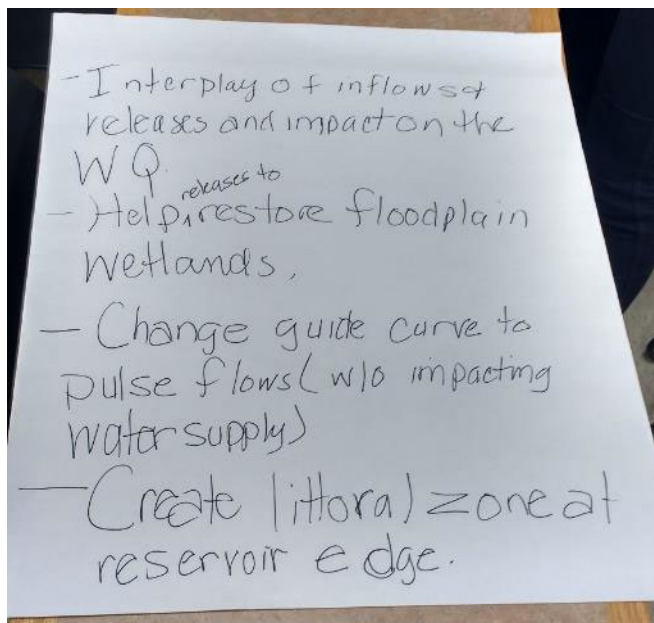


Photo 9. Meeting notes, group 1 (image credit TNC)

## SRP Cape Fear: Group 2 Brainstorming Notes (Photo 10)

Group Members: Justin Bashaw, Mick Noland, Patrick Beggs, Chuck Peoples, Mike Mallin, Hugh Howe

Current holes and data gaps:

- Understanding of Jordan Lake / Cape Fear River economics
  - What does Jordan Lake deliver in terms of economic gain?
  - Which municipalities are primarily responsible for nutrient issues in Jordan Lake / Cape Fear River (E.g. City of Greensboro)?
  - Which municipalities are primarily 'takers' from Jordan Lake / Cape Fear River (E.g. Town of Cary)?
  - What's the value of recreational fishing in the Cape Fear River?
    - How would this value change with improved fish passage?
  - Water treatment (drinking water) is costly, and there's great value in public water supply.
    - Algae / Nutrient removal is difficult and costly.
    - Costs of sediment removal?
- Agricultural engagement
  - Having agricultural industry representatives involved would be beneficial (nutrient input issues)
  - Need to account for *actual* confined agricultural feeding operation (CAFO) inputs to Cape Fear River
    - Does USGS have data to help quantify this?
- Stakeholder relationship expansion
  - Need to be engaging with soon-to-be effected entities including
    - Developers
    - Agri-Business / Farmers
    - Local governments
    - County extension agents
- Properly accounting for impacts to fishes, other aquatic organisms, and plants
  - How do flows affect seed transport?
  - How do flows affect riparian zones?
  - Account for the life histories of fishes and aquatic invertebrates in e-flow decisions.

New ideas and additional data needs:

- Understanding the Corps' sphere of influence
  - The Corps controls more than *just* Jordan Lake above the dam or the three locks and dams on the Cape Fear River (E.g. mitigation projects).
- Modeling

- There seem to be data and models addressing quantitative flows, but what are the qualitative effects (water quality)?
  - SWAT models may partly address this concern
- Interactions of multiple projects
  - How to take into account the multiple Section 408 projects at the three Cape Fear River locks and dams?
  - How to take into account the Corps' Section 216 disposition study of the Cape Fear River locks and dams?

How new ideas fit into the Sustainable Rivers Program framework:

- Data precedence
  - How is it determined whose data are the best data, and which data will ultimately influence policy?
  - Whose data can *actually* affect policy/permitting?

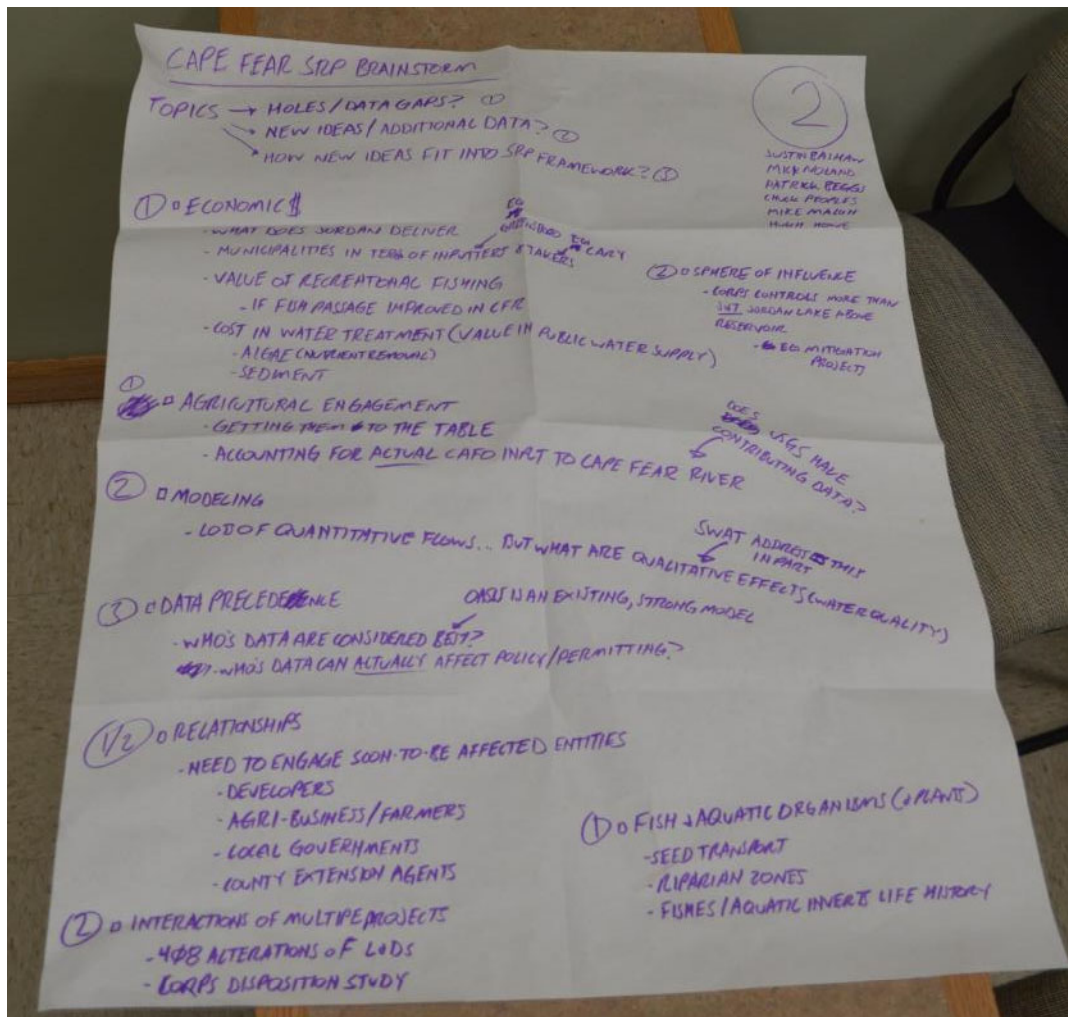


Photo 10. Meeting notes, group 2 (image credit TNC)

### SRP Cape Fear: Group 3 Brainstorming Notes (Photo 11)

Holes that the Sustainable Rivers Program can fill:

- What would be the effects of flow changes on downstream habitat / ecosystem / etc.?
- How would macro-invertebrates be affected by flow changes?
- What are the flow requirements of species inhabiting the Cape Fear River?
- What would be the effects of flow changes on water quality (harmful algal blooms, etc.)?
- What would the preferred e-flow change look like (pulses, etc.)?
- Need to understand existing / future fish habitat needs
  - In Jordan Lake
  - Downstream spawning habitat
- What would be the effects on Jordan Lake / upstream of Jordan Lake if releases from Jordan Dam were changed?
- What are the implications of removal of Buckhorn Dam?
  - Water supply
  - Power generation
- How to quantify the economic benefit of reducing harmful algal blooms
  - Reduced water treatment costs?
- How do ongoing Corps-influenced efforts affect the Cape Fear River Sustainable Rivers Program?
  - Disposition study of the three locks and dams
  - Section 408 efforts at the three locks and dams



① HOLES THAT SRP CAN FILL?

- effect of flow changes on habitat/ecosystem/etc
- macro-invertebrates
- species flow requirements
- priority of species
- effect of flows on WQ (HAB, etc)
- preferred flows (pulses, etc)
- fish habitat/structure
  - in lake
  - downstream spawning habitat

② - effects on reservoir/upstream resulting from any changed releases

- = implications of removal of Buckhorn
  - water supply, power plant
- economic benefits of reducing HABs
  - treatment costs...
- = disposition study of L+Ds
  - removal/modification

Photo 11. Meeting notes, group 3 (image credit TNC)

## SRP Cape Fear: Group 4 Brainstorming Notes (Photo 12)

Group Members: Nora Deamer, Chad Wagner, John Hickey, Jenny Owens

Questions Addressed: What are current data gaps for the Cape Fear River?  
How might the Cape Fear River and Sustainable Rivers Program fit together?  
What are actionable next steps for the Cape Fear River?

- E-flow information lacking for management of Cape Fear River
  - Species flow requirements?
  - Connections between flows and water quality?
  - The State (NCDWR?) is on hold, pending additional information that would help justify proceeding
    - May be helpful to revisit background information / data regarding eco-resources
    - Knowing species flow requirements may be useful to the State
- Current Corps flow targets at Jordan Lake / Dam
  - How are these currently / intended to influence water quality standards?
  - What are the origins of current flow targets at Jordan?
    - Does the 'Water Control Manual' offer answers?
- Biological response to flow changes
  - Opportunity to experiment: water quality vs flow rate vs timing
  - Current fish passage work at the three Cape Fear River locks and dams (Section 408)
    - Flow testing over differing fish passage structures (modeling?)
    - Monitoring strategy to identify successes and opportunities for improvement
- Technology / Modeling
  - Several fundamental models have been developed by a number of agencies with interest in improved management of the Cape Fear River basin
  - Current challenge / task is to transition to scenario testing using models
    - Exercise existing models and linkages among models
    - Explore how model outputs are used
    - Engage stakeholders to ensure best available data and models are known and can be used in e-flow development
- Current and emerging issues
  - Nutrient inputs (upstream and downstream of Jordan Dam)
  - Ecological / water supply implications of changes to flow management
  - Water quality concerns at water supply intakes
- Connections to other efforts in the Cape Fear River
  - The Corps' Section 2016 disposition study for all three locks and dams
  - Section 408 studies aimed at fish passage improvements at all three locks and dams

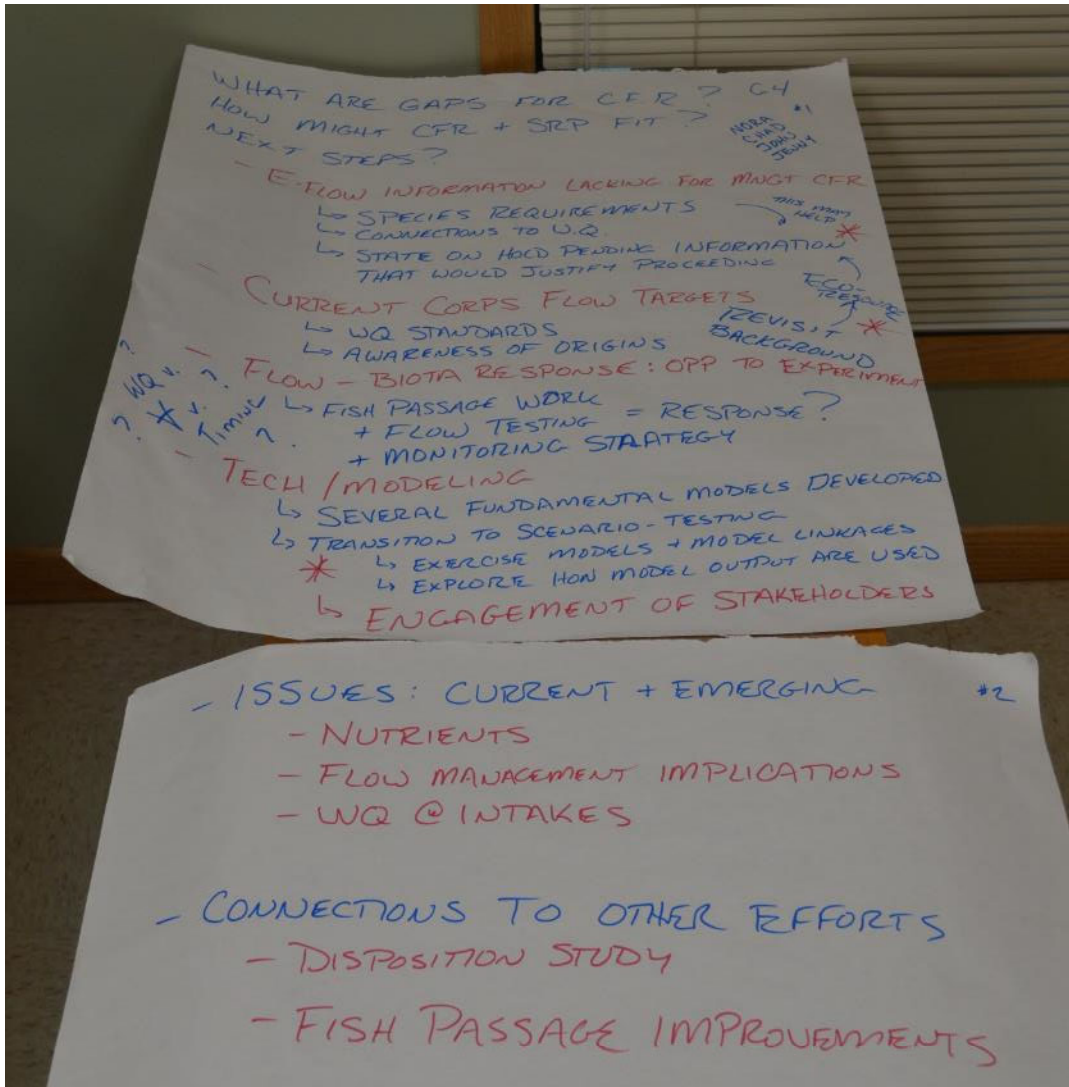


Photo 12. Meeting notes, group 4 (image credit TNC)