



**Lloyd Shoals Relicensing
Study Results Meeting - July 29, 2020
Agenda**

Morning Session (10:00 a.m. – 1:00 p.m.)

- Welcome, Safety, Overview of Meeting Format, Attendee Roll Call
- Project Operations Review
- Water Resources
- Fish and Aquatic Resources
- American Eel Abundance and Upstream Movements (12:00- 12:30)
- Geology and Soils

Lunch Break (1:00 p.m.– 2:00 p.m. - everyone stay online but remain on mute)

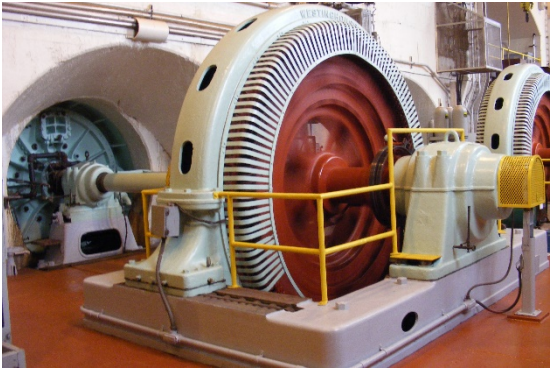
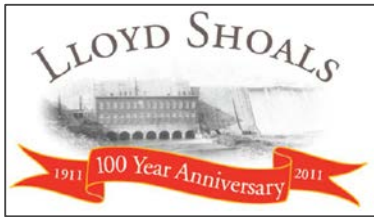
Afternoon Session (2:00 p.m. – 5:00 p.m.)

- Brief Overview, New Phone Attendee Roll Call if needed
- Recreation and Land Use
- Terrestrial, Wetland & Riparian
- Rare, Threatened, & Endangered Species
- Cultural Resources
- Questions and Next Steps



Introduction

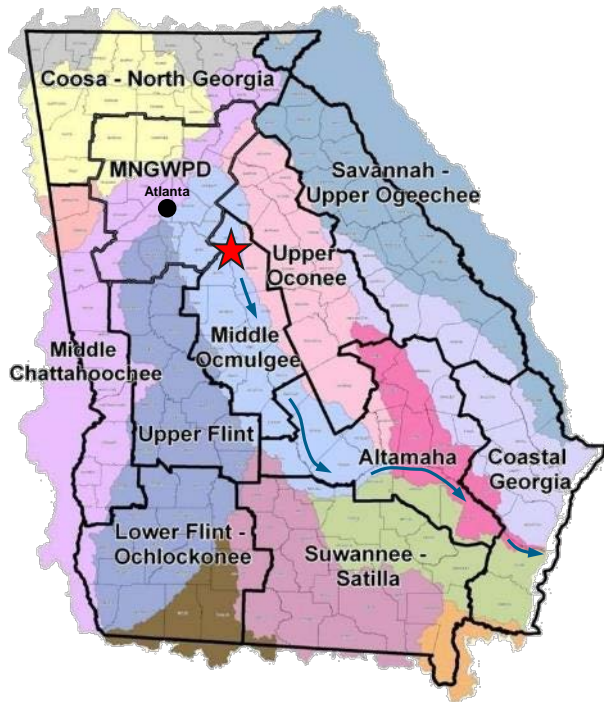
Courtenay O'Mara, P.E.
Southern Company



Project Location (★)

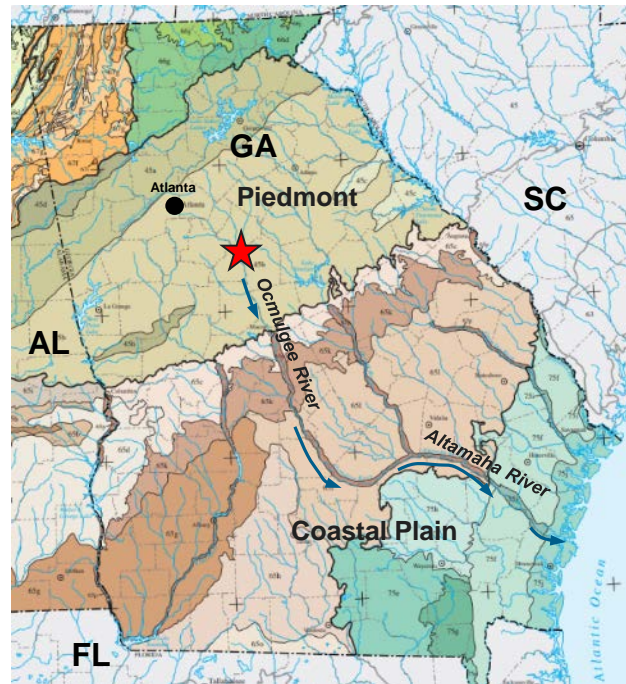


GA Water Planning Regions



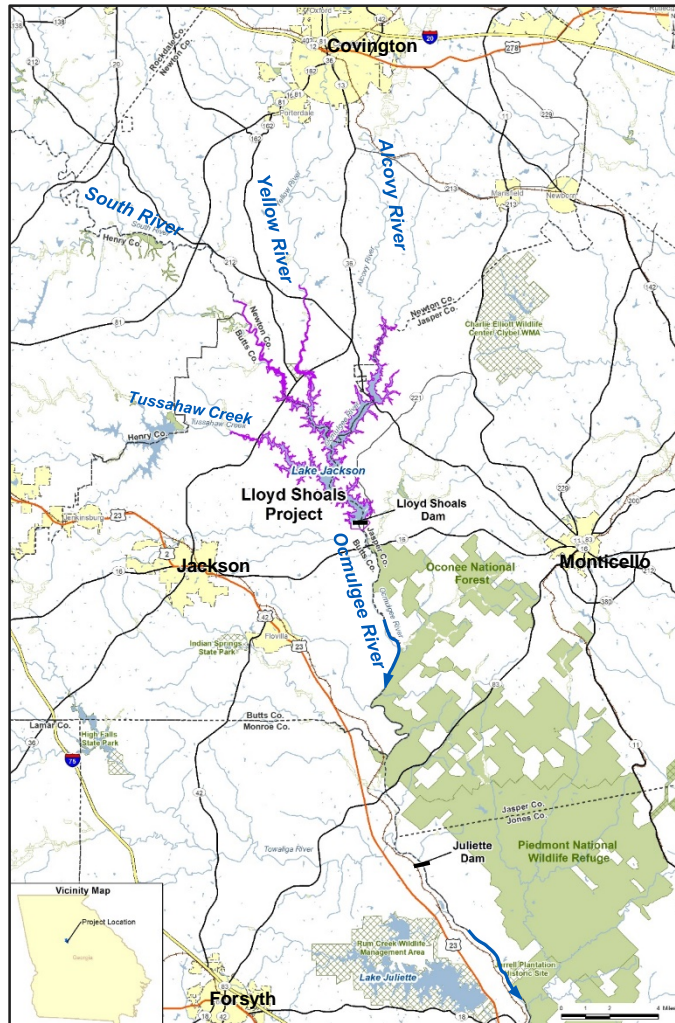
 Ocmulgee River Basin

Physiography



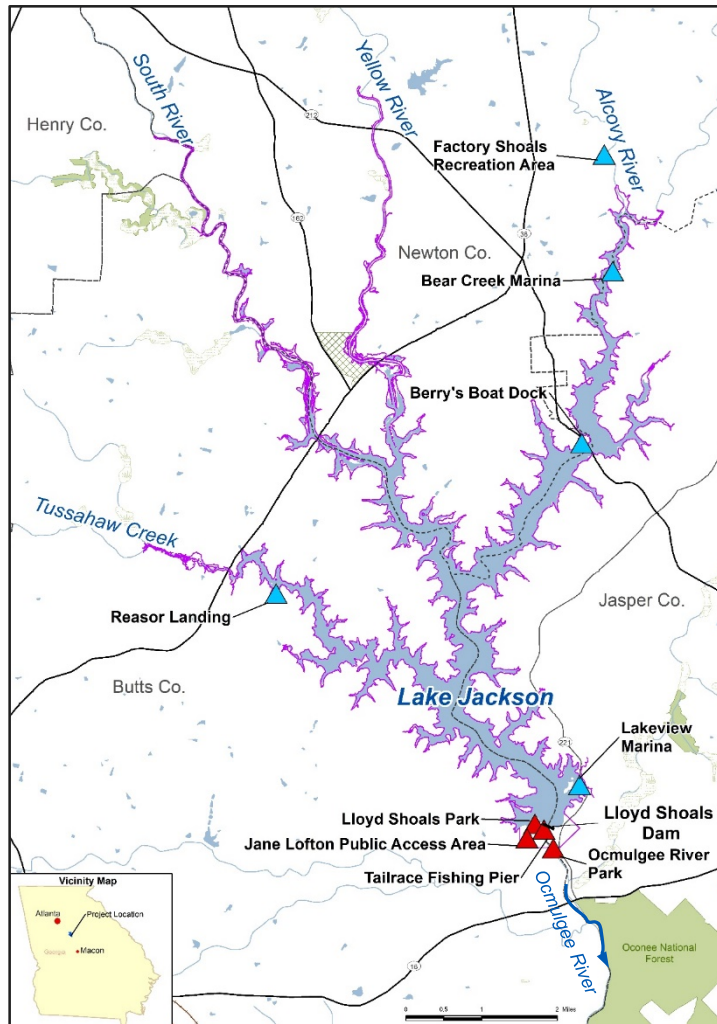
Project Vicinity

□ Project Boundary



Project Boundary

- Project Boundary
- ▲ Georgia Power Project Recreation Facilities
- ▲ Public/Private Recreation Access



Project Facilities and Recreation Access

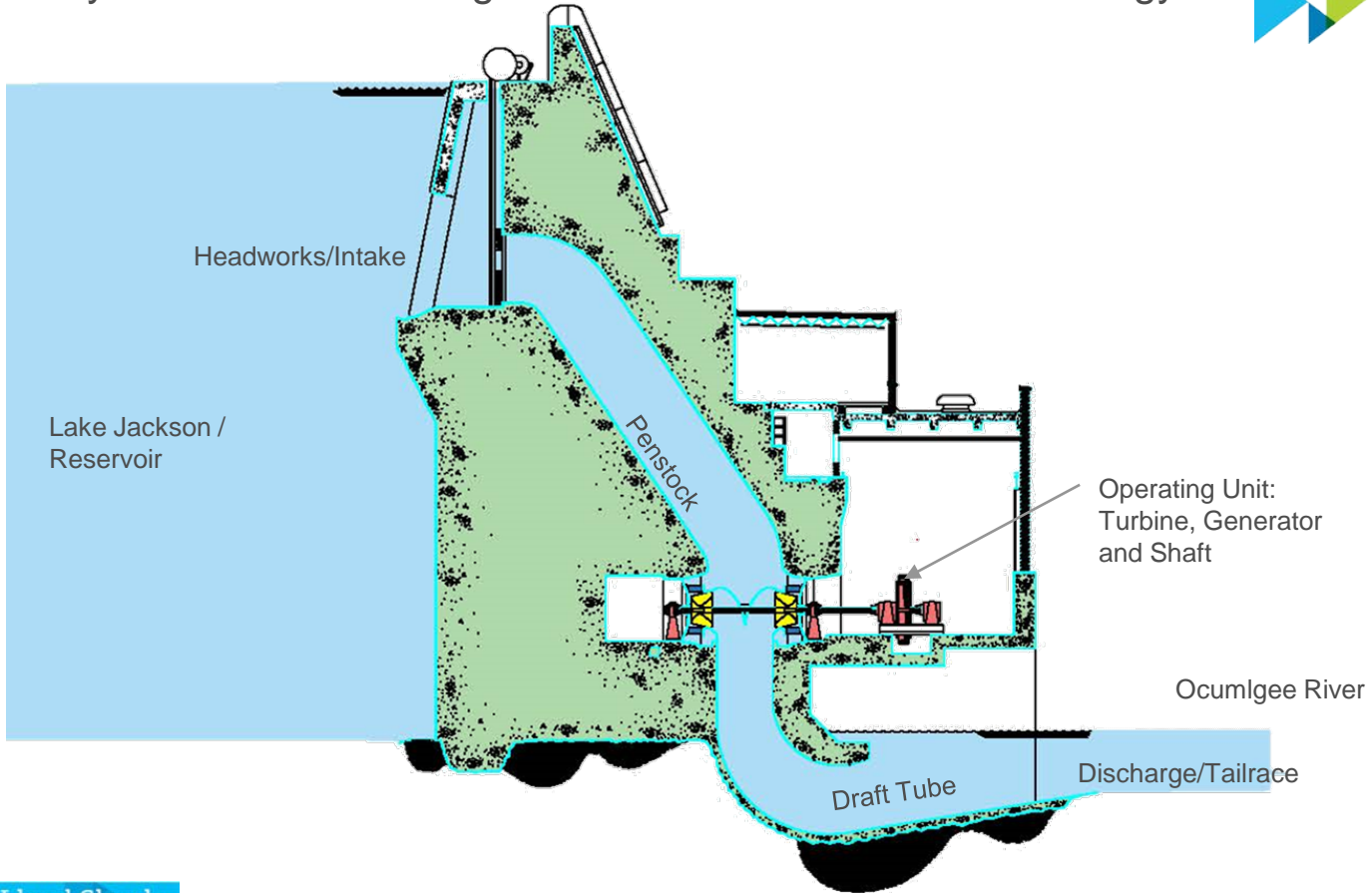




Project Operations

Melissa Crabbe, P.E.
Southern Company

Lloyd Shoals Generating Unit Cross-section and Terminology



Lloyd Shoals Project (FERC No. 2336)



Generating Capacity	18 MW
Number of units:	6 (horizontal, Francis-type)
Max. hydraulic capacity:	620 cfs/unit or 3,720 cfs total plant capacity
Full reservoir storage:	107,000 acre-feet
Normal operating range:	527 to 530 feet
Average annual inflow:	1,732 cfs
Operation mode:	Modified run-of-river
Minimum flow:	400 cfs or inflow, whichever is less
Spillway Capacity:	16,770 cfs



Lloyd Shoals Project Works Flow Release Sequence



Reservoir Storage and Effect on Operations

Small Reservoirs – Run-of-River Operation



- No storage
- Run-of-River
Inflow = outflow all the time
- Example: old mill sites where steady power was more important than peaking power
- Project purpose: steady power or no power



Reservoir Storage and Effect on Operations

Medium Reservoirs – Modified Run-of-River Operation



- Some storage
- Water is stored for hours or days
- Inflow \neq outflow hourly
- Water is released for the week
Inflow = outflow on a weekly basis
- Example:
Lake Jackson (useable storage = 74,750 acre-feet)
- Project purpose: power generation



Large Reservoirs – Storage Operation



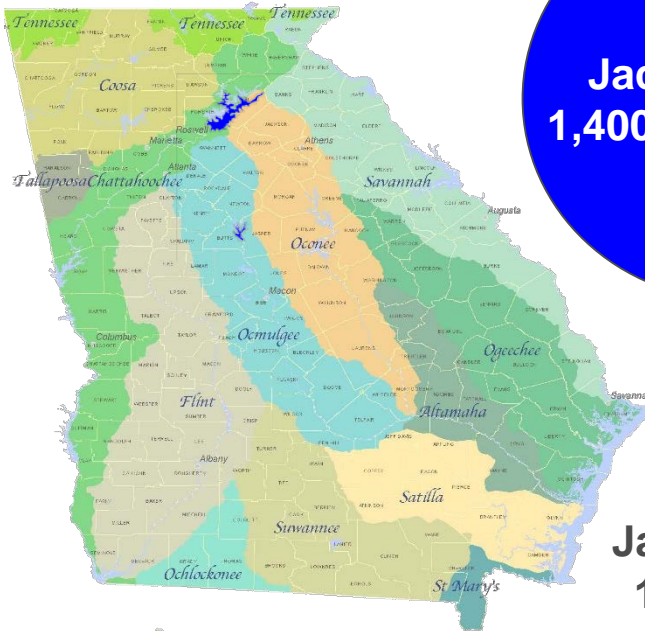
- Significant storage
- Water is stored for months or years
Inflow \neq outflow
- Capture flows during high flow periods for use in low flow periods



<https://media.defense.gov/2017/Nov/29/2001849723/-1/-1/0/171129-A-CE999-006.JPG>

- Example:
Lake Lanier (Useable Storage = 1,087,600 acre-feet)
- Project purposes: power generation, flood control, navigation, and recreation

Hydroelectric Project Purpose Comparison

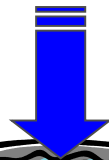


Jackson Basin
1,400 square miles

Lanier Basin
1,040 square miles



Jackson Storage
107,000 acre-ft



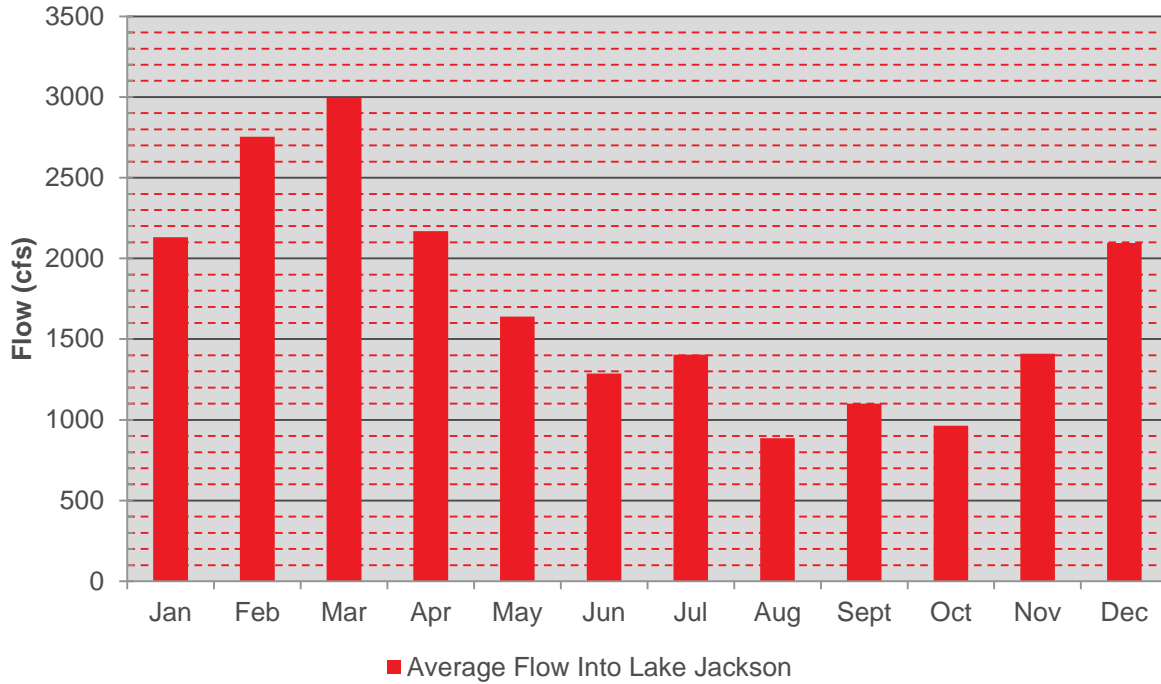
Lanier Storage
2,554,000 acre-ft



Large Drainage Basin – Small Amount of Storage



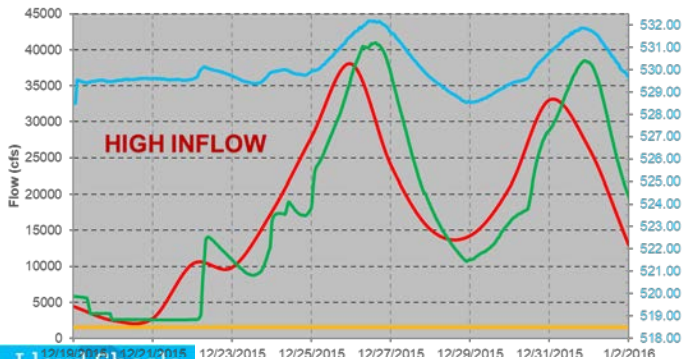
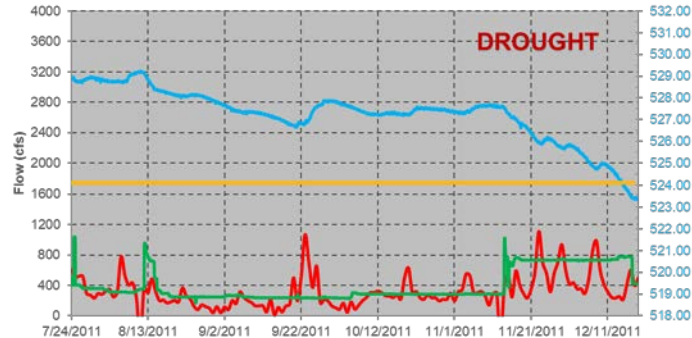
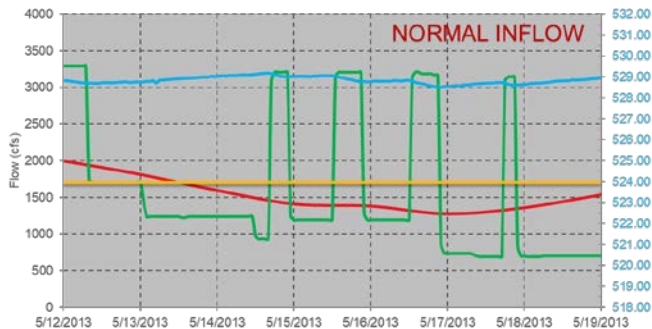
20-Year Average Monthly Calculated Inflow January 1997 through December 2016



Lloyd Shoals Operations Examples

NORMAL, DROUGHT AND HIGH INFLOW OPERATIONS

Average Annual Inflow = 1,732 cfs



— Daily Average Inflow (cfs)

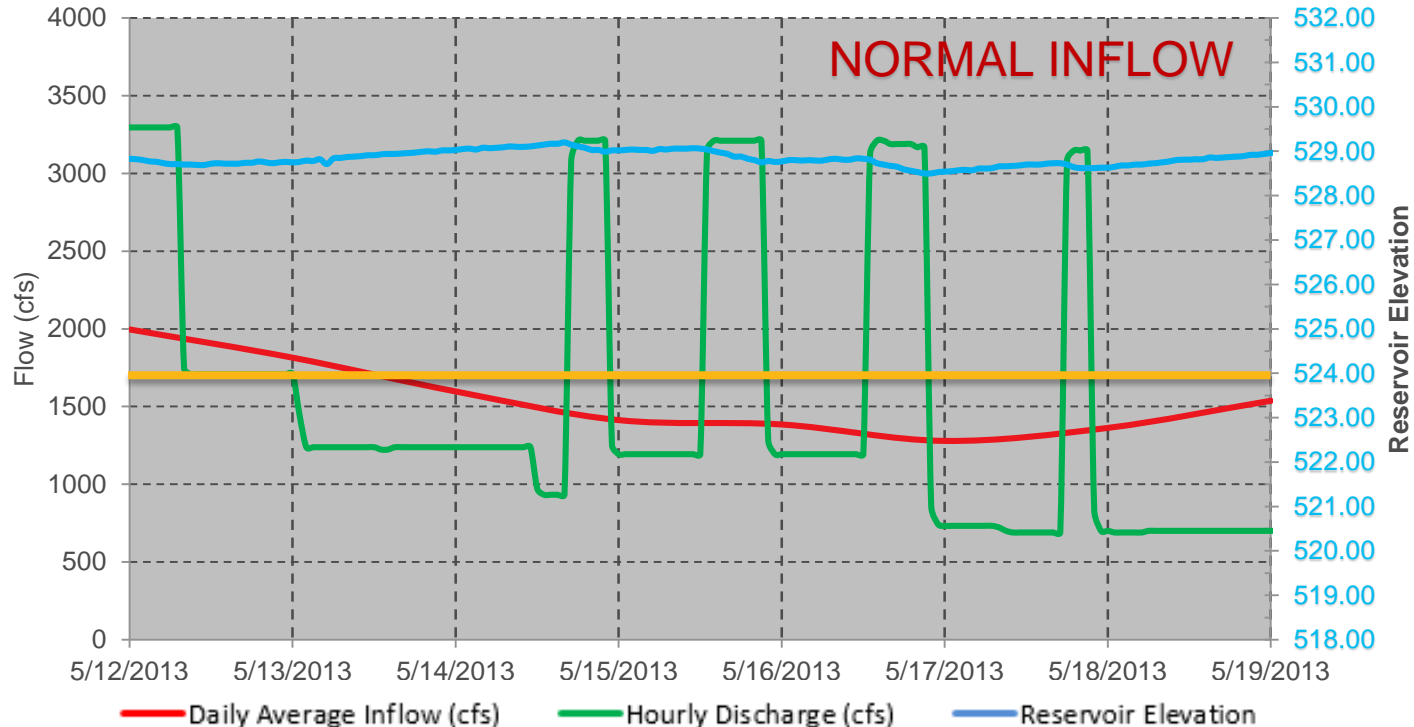
— Hourly Discharge (cfs)

— Reservoir Elevation

— Average Annual Inflow (cfs)

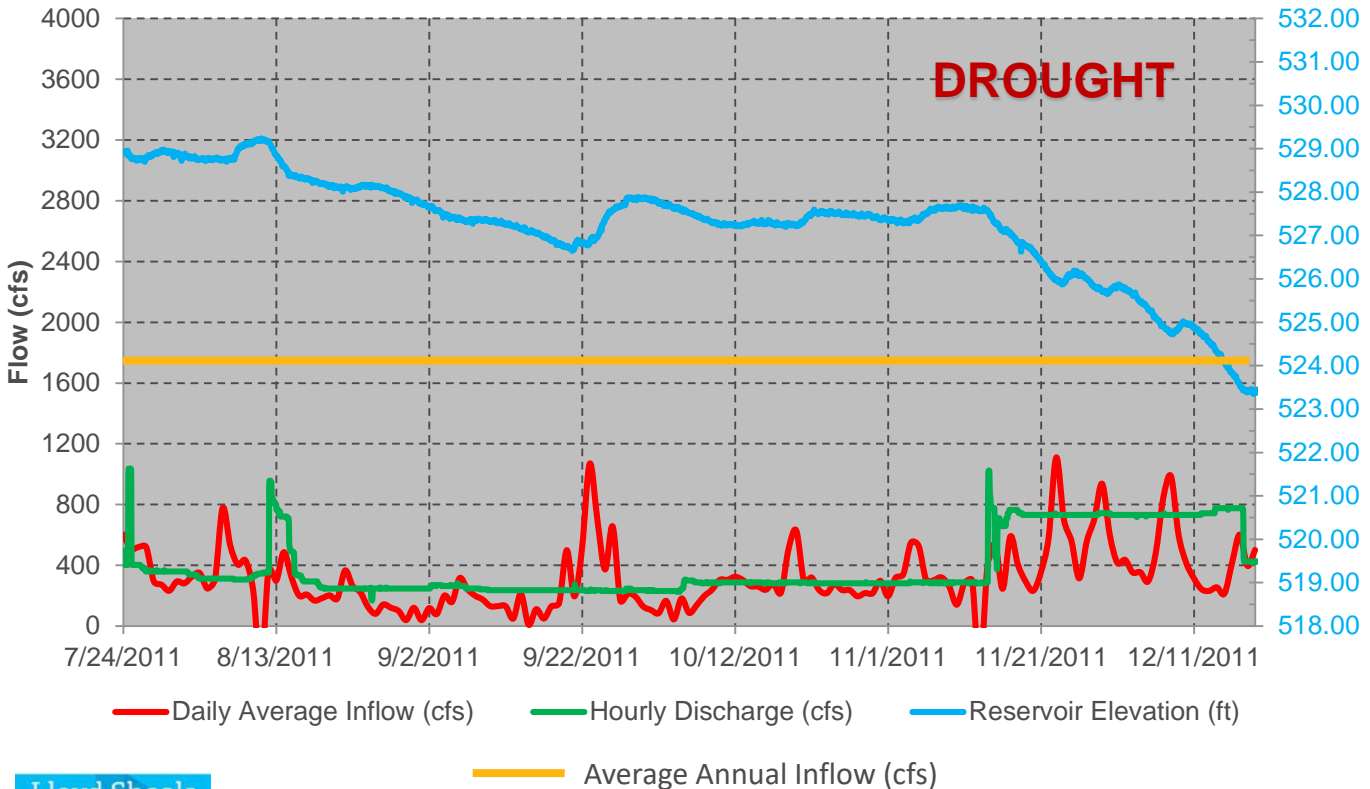
Lloyd Shoals Operations Example

NORMAL Inflow Week of 1,547 cfs, Average Annual Inflow = 1,732 cfs



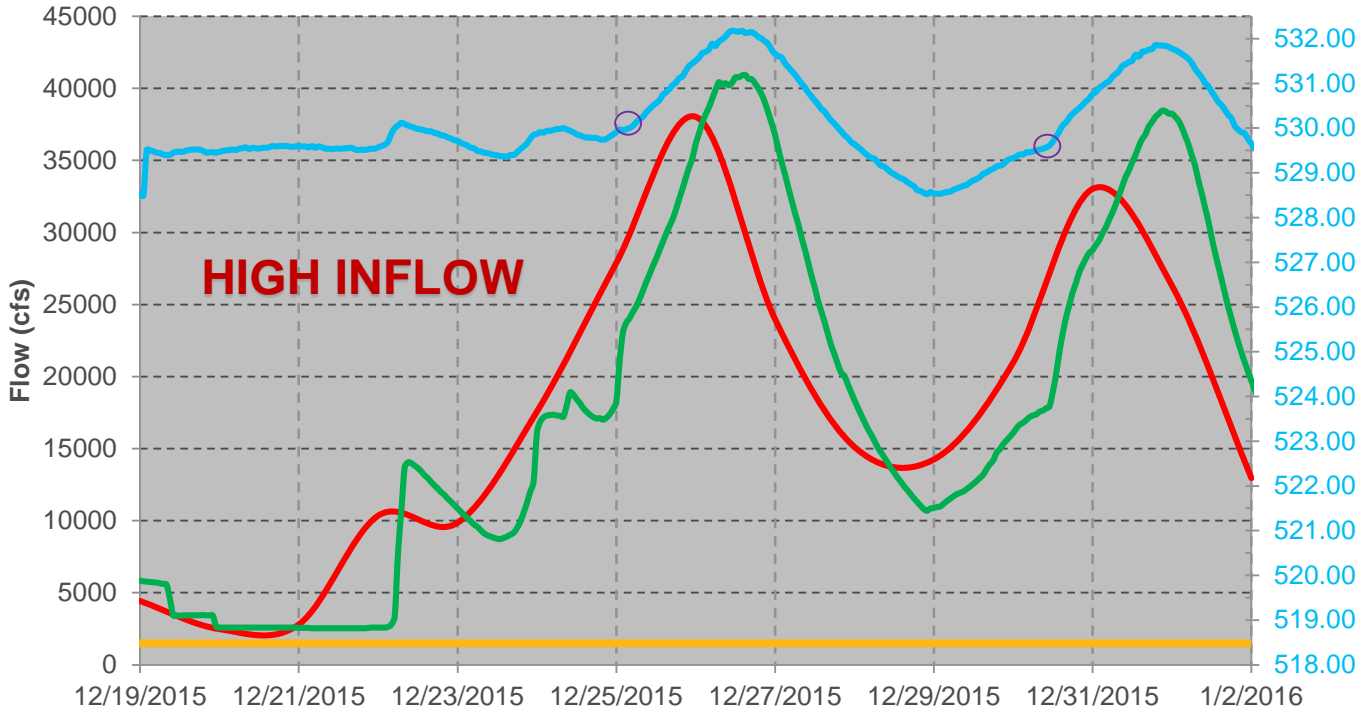
Lloyd Shoals Operations Example

DROUGHT Period of 313 cfs, Average Annual Inflow = 1,732 cfs



Lloyd Shoals Operations Example

HIGH Inflow Period of 17,544 cfs, Average Annual Inflow = 1,732 cfs

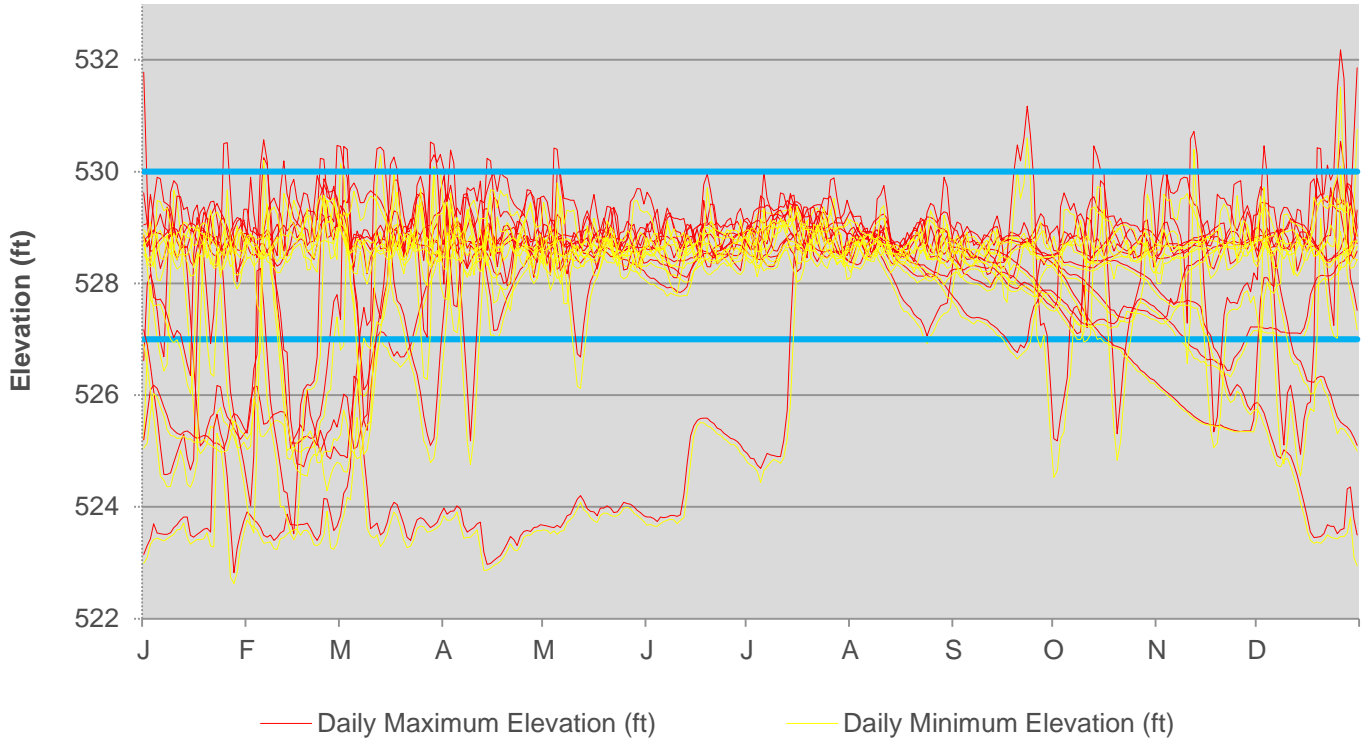


— Daily Average Inflow (cfs) — Hourly Discharge (cfs) — Reservoir Elevation

— Average Annual Inflow (cfs)

Lake Jackson Elevation 2007-2016

Typical Range Between 527 to 530 Feet



— Daily Maximum Elevation (ft)

— Daily Minimum Elevation (ft)

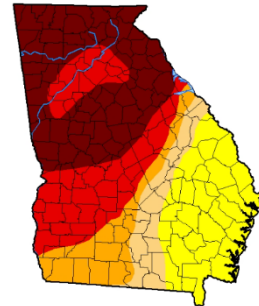
— Typical Operating Range

Operations Outside of Normal Pool Elevation Range



- Weather related events
 - High inflows
 - Drought
- Task/goal oriented
 - Emergency
 - Homeowner or dam maintenance

U.S. Drought Monitor
Georgia



November 22, 2016
(Released Wednesday, Nov. 23, 2016)
Valid 7 a.m. EST

	Drought Conditions (Percent Area)					
	None	D0/D1	D2/D3	D4	D5	D6
Current	93.0	103.00	76.64	67.76	56.65	33.78
Last Week in 2016	15.69	84.37	88.18	88.03	82.38	22.25
5 Months Ago in 2016	26.02	73.98	48.87	28.88	5.92	0.00
Start of Calendar Year in 2016	87.38	12.64	0.00	0.00	0.00	0.00
Start of Water Year in 2016	25.37	66.63	45.94	24.55	14.67	1.00
One Year Ago in 2015	90.41	11.59	0.00	0.00	0.00	0.00

Intensity:
■ D0 Abnormally Dry ■ D3 Extreme Drought
■ D1 Moderate Drought ■ D4 Exceptional Drought
■ D2 Severe Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for local statements.

USDA
Partners in
RISER/ARMA



<http://droughtmonitor.unl.edu/>

Next Homeowner Drawdown
Scheduled for Fall 2021



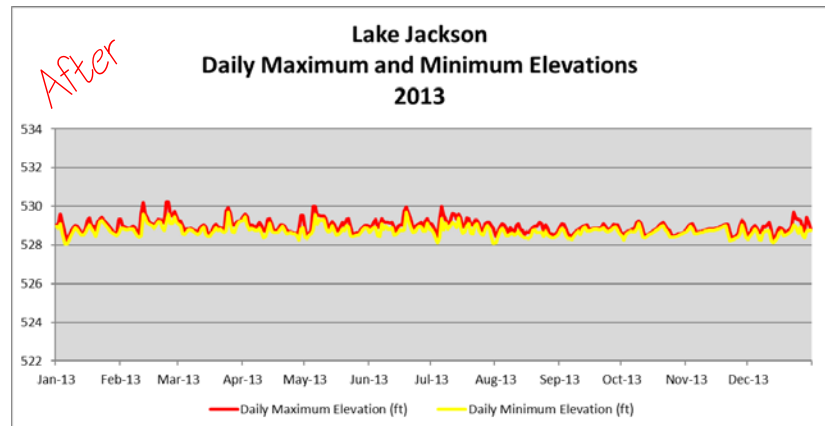
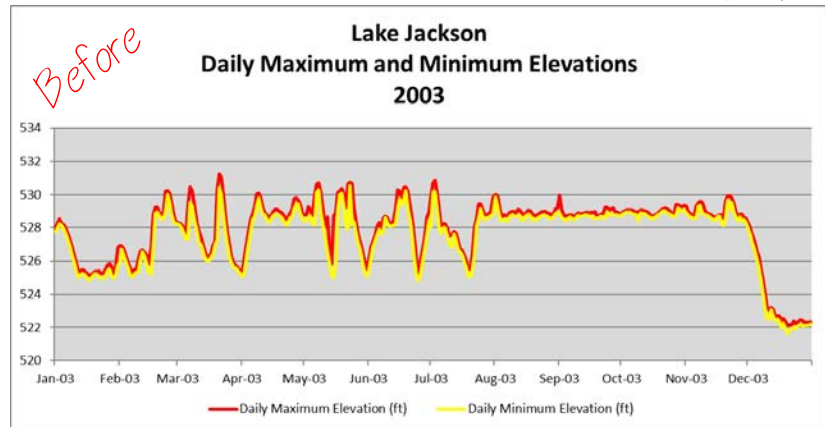
Spillway Gate Enhancement / Operational Improvements



Obermeyer Gates Significantly Reduce Frequency of Reservoir Fluctuations



- Installed in 2011/2012 to replace spillway flashboards
- Decrease frequency of Lake Jackson fluctuations outside of normal pool elevation range caused by high flow events
- Eliminate safety hazards for plant personnel
- Water saved provides more water for reliable, clean, and renewable generation



Total Generation 2012 – 2016



Year	Annual Generation (MWh)	Average Inflow (cfs)	Flow Category
2012	27,175	723	Low
2013	84,296	2,001	High
2014	65,245	1,484	Average
2015	79,413	2,425	High
2016	51,404	1,554	Average



Water Resources

Presented by: Tony Dodd

Study Results Meeting
Lloyd Shoals Project
July 29, 2020

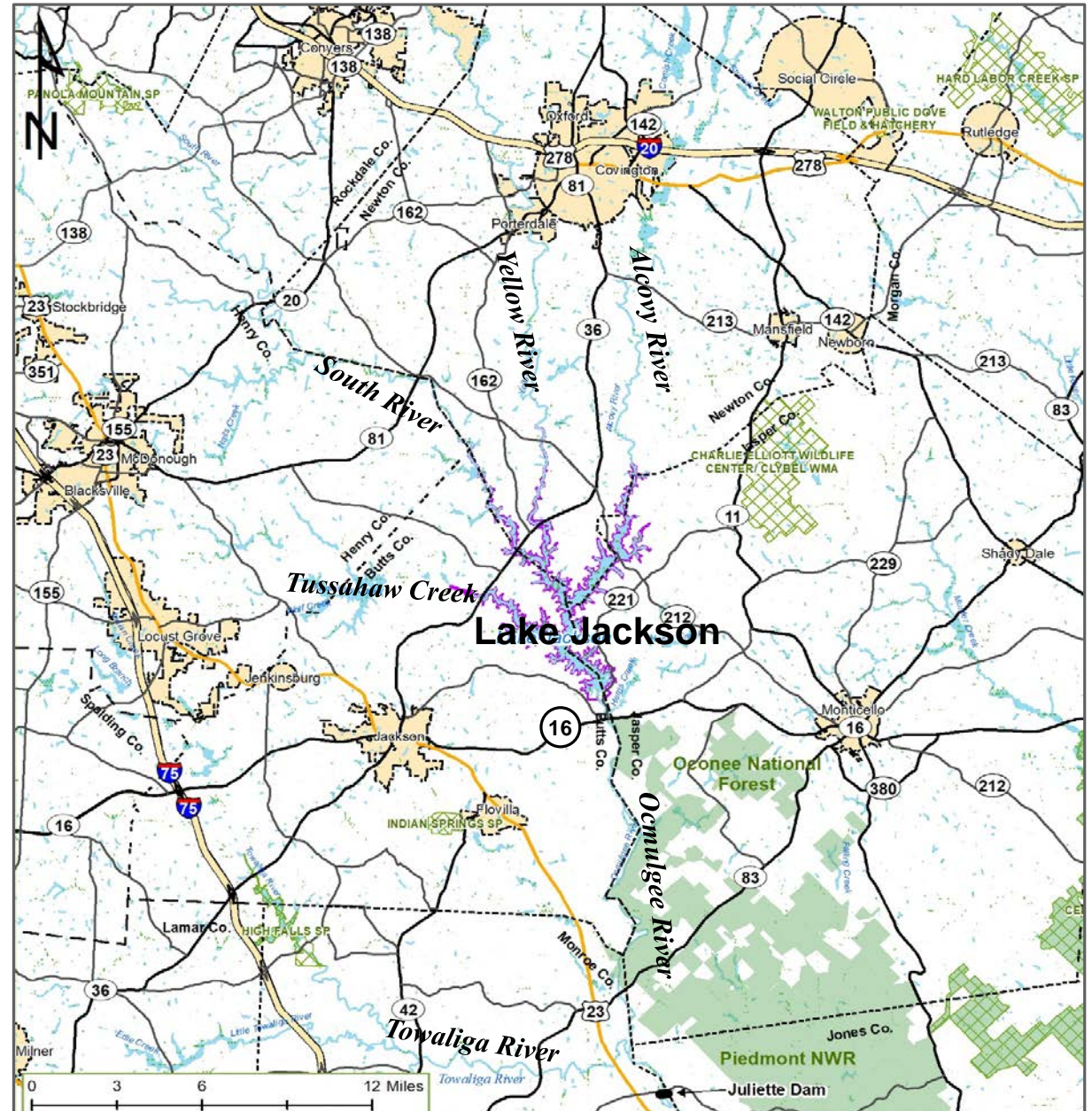
Study Objectives

- Review and analyze existing information and data and the findings of Georgia Power's water quality monitoring in project waters
- Characterize water use, availability, and water quality in the Lloyd Shoals Project study area
- Characterize the effects of continued project operation on water quality, including water temperature and DO concentrations, in Lake Jackson and the tailrace area

Study Area

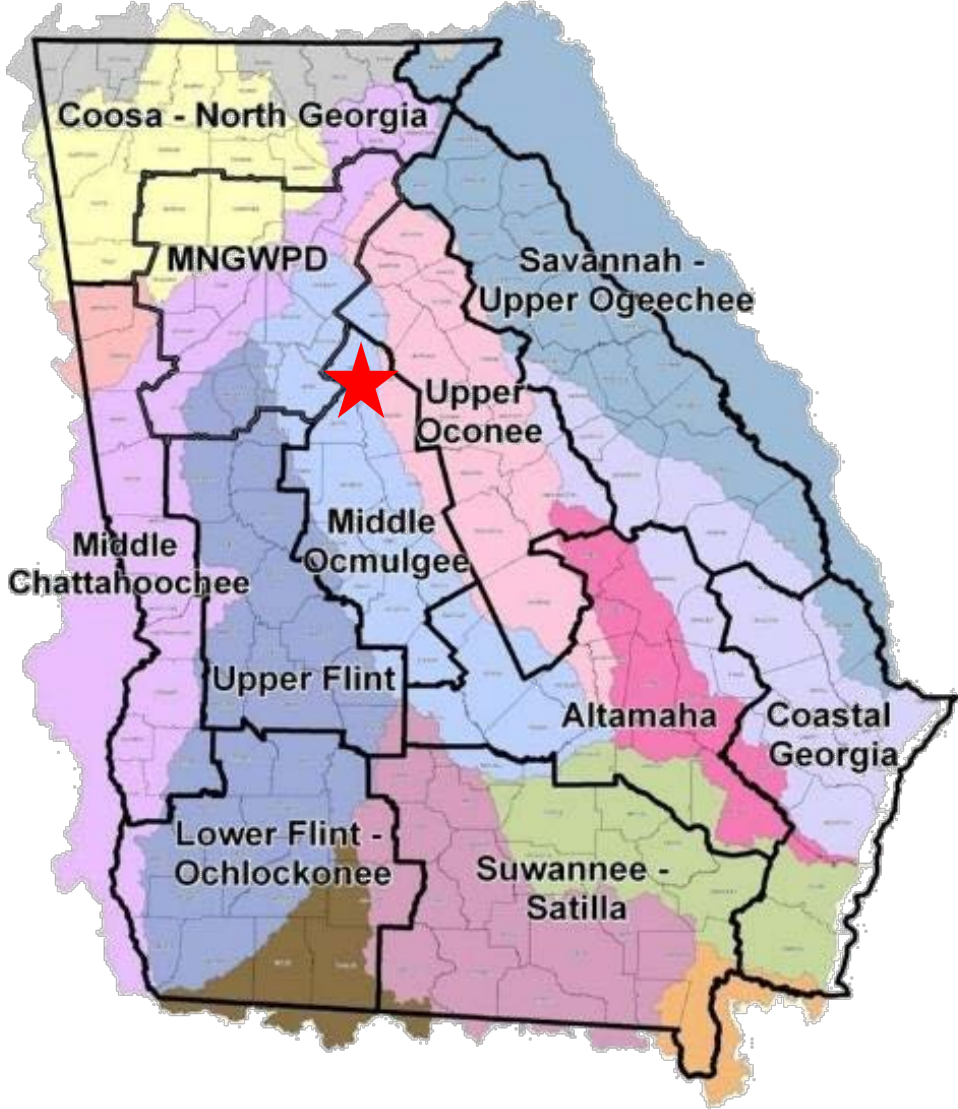
- Lake Jackson and the Lloyd Shoals tailrace area within the project boundary
- Tributary watersheds to Lake Jackson
- Tailrace area between the project boundary and the Georgia Hwy 16 bridge
- Ocmulgee River downstream

□ Project Boundary

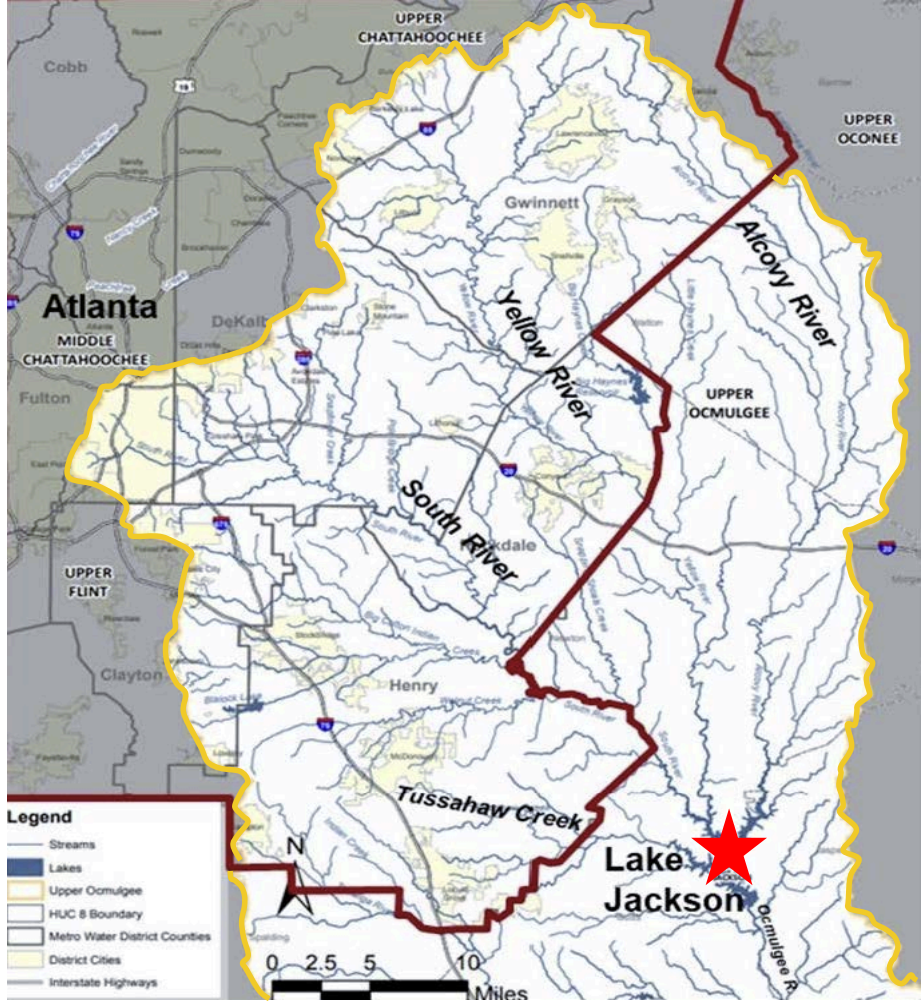


Project Location ★

Water Planning Regions



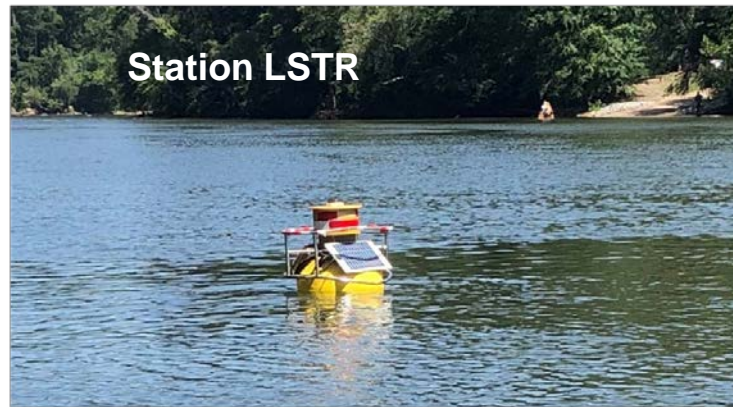
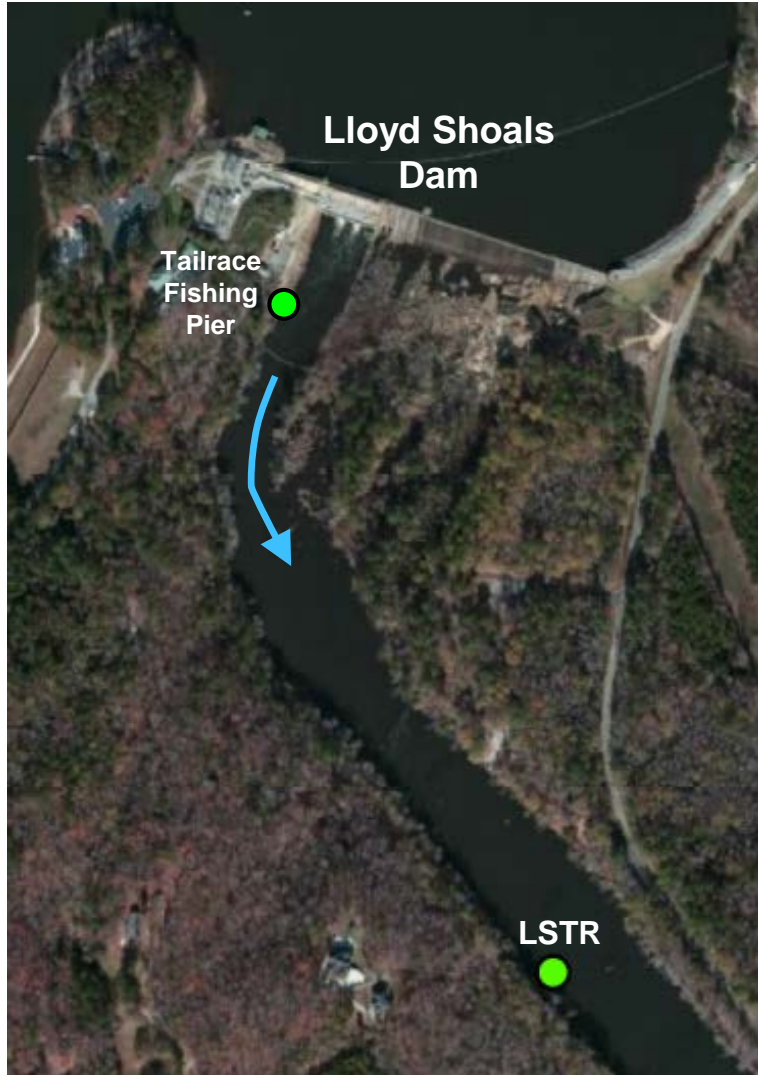
Upper Ocmulgee River Basin



Upper Ocmulgee Metro Water District

Study Methods

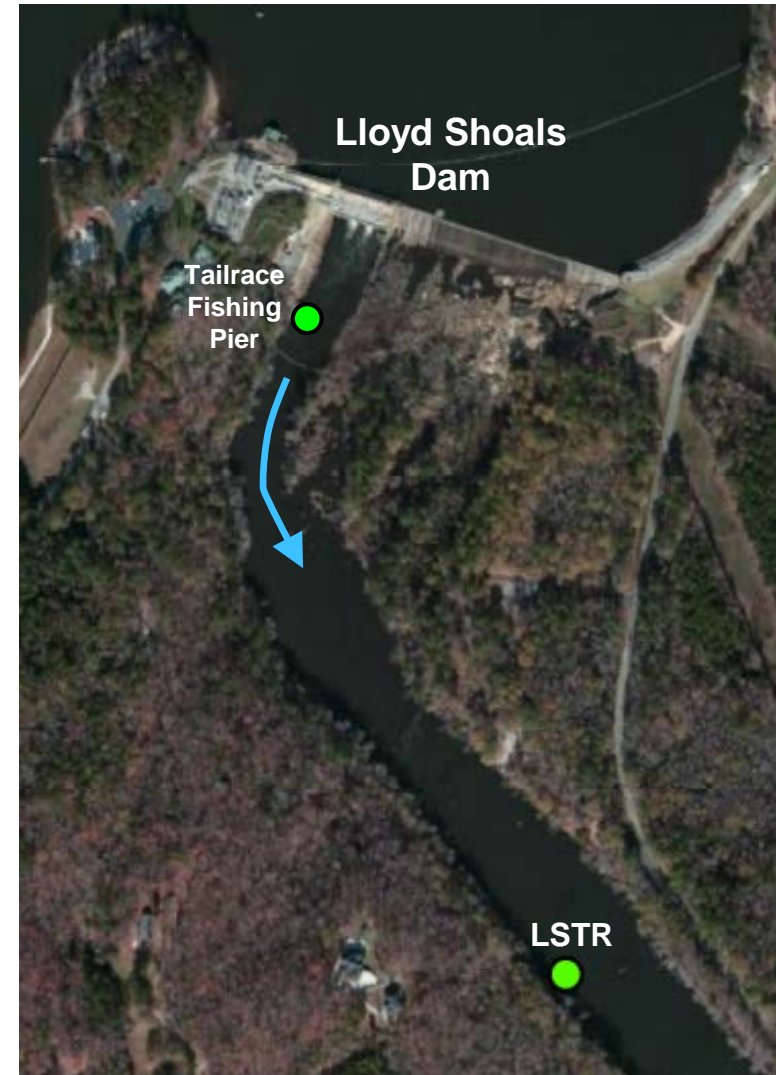
Methods – Tailrace Continuous Water Quality Monitoring



- Reconnaissance to choose monitoring station (LSTR)
- Buoy deployed July 2019
- Measurements at 1-m depth at hourly intervals:
 - Dissolved oxygen (DO), water temperature, pH, specific conductance, and turbidity
- *In-situ* measurements also taken at Tailrace Fishing Pier during 8 monthly buoy maintenance events (Jul-Nov, Jan-Mar)
- Monitoring continued through July 2020

Methods – Tailrace Monthly Water Chemistry Samples

- Grab samples collected at 1-m depth
- Sampling locations:
 - Monitoring buoy (Station LSTR)
 - Tailrace Fishing Pier during very high flows and Covid-19 social-distancing restrictions
- Parameters analyzed:
 - 5-day biochemical oxygen demand (BOD)
 - Ammonia
 - Inorganic nitrogen (nitrate-nitrite)
 - Total Kjeldahl nitrogen (TKN)
 - Ortho-phosphate
 - Total phosphorus
- Sampling continued through July 2020



Methods – Analysis of Existing Information

GEPD

- Georgia Environmental Monitoring and Assessment System (GOMAS) Lake and River Data

Georgia Power

- Monthly vertical lake profiles
- Algal reports and bloom investigations

Adopt-a-Lake

- Volunteer citizen monitoring data

Scientific Literature and Technical Reports

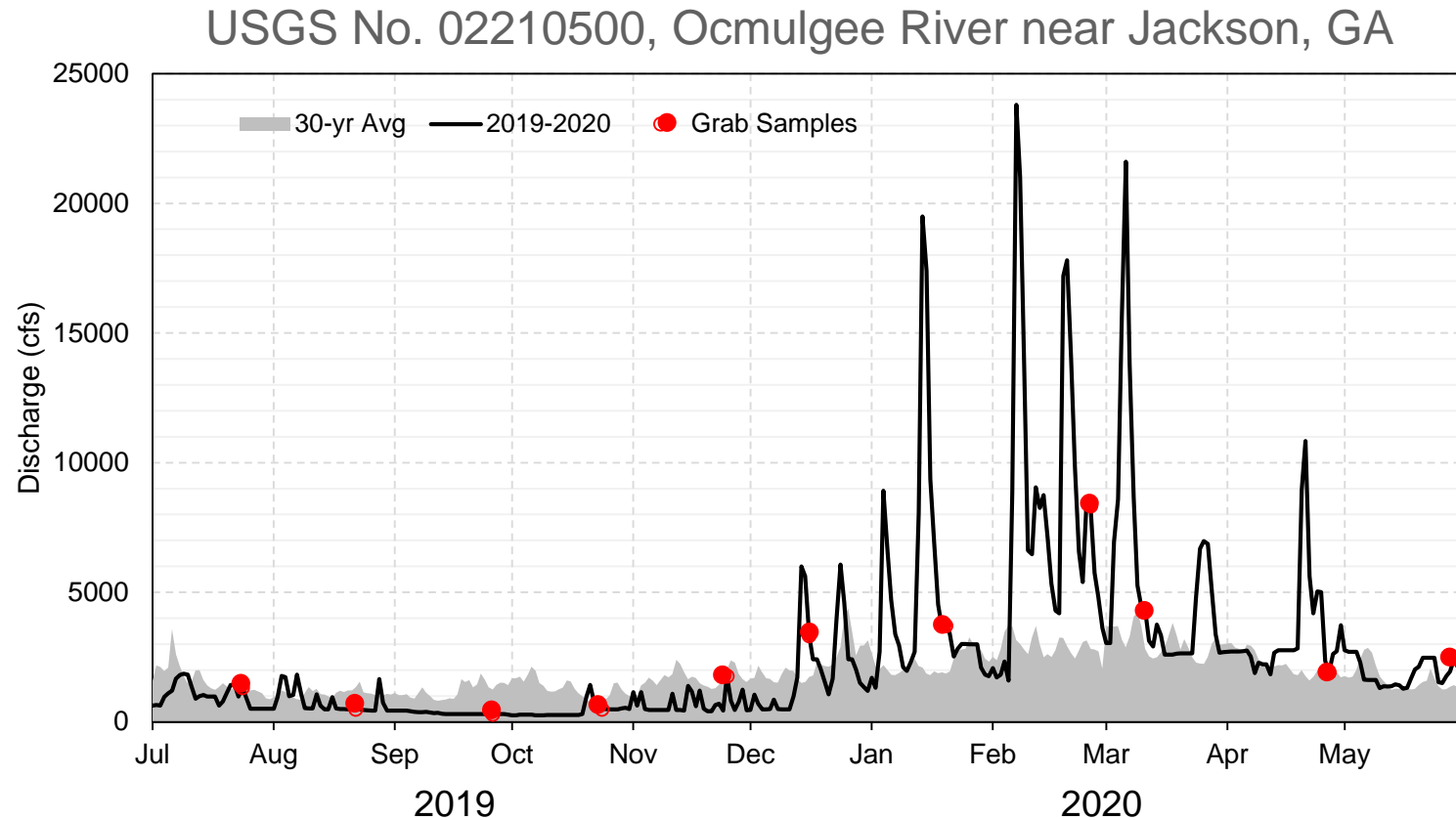
- Regional research publications
- Water use and availability reports

Study Results

Tailrace Water Quality Monitoring

Ocmulgee River Daily Average Discharge during Study Period

- Prolonged low-flow conditions in fall 2019
- Multiple high-flow events in winter and spring 2020



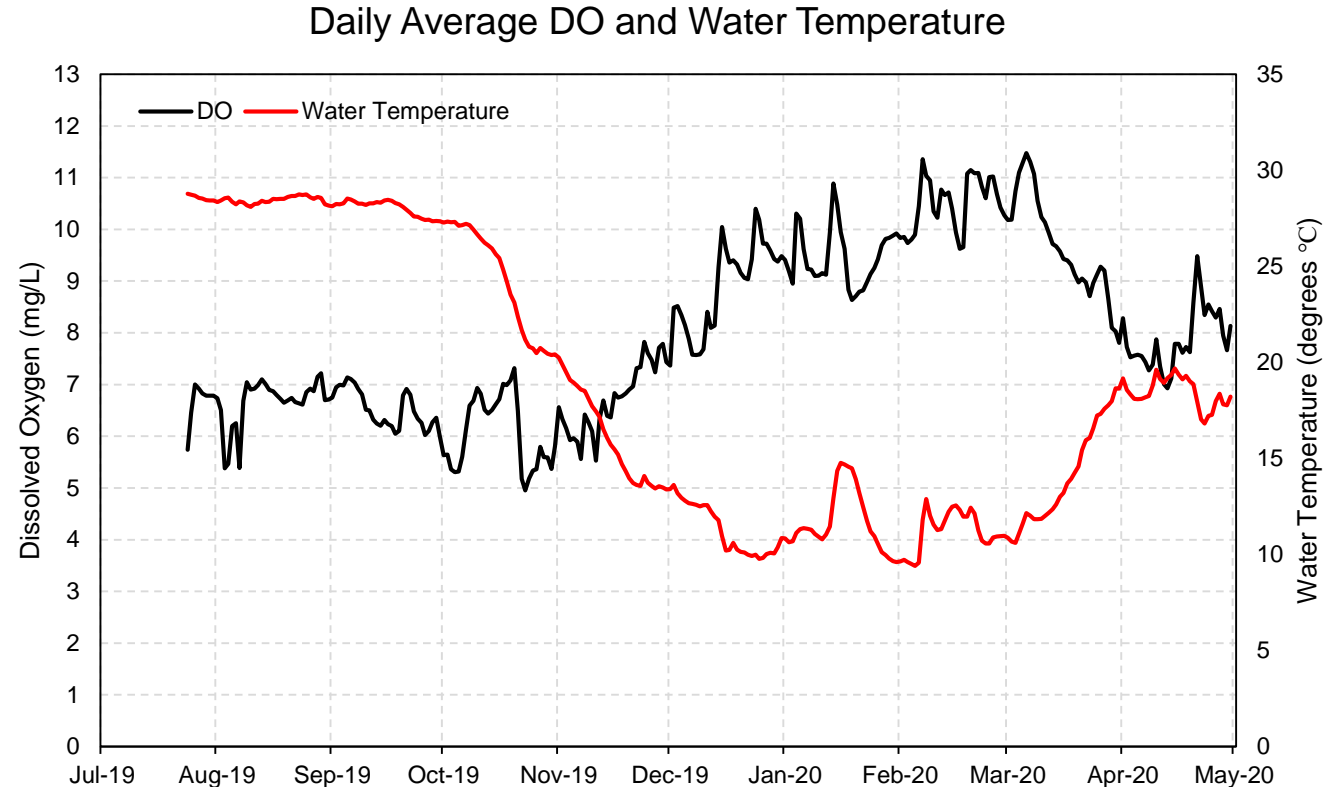
Draft Tube Aeration System Operation



- Passive draft tube aeration system installed for Units 2, 3, and 4 in 2006
- Improves and stabilizes summer DO levels in downstream releases
- Operated from May 15 through September, extending into October when low-flow conditions persist
- In 2019, draft tube aeration extended through mid-October

Results – Tailrace Continuous Monitoring

- Summer-early fall DO levels indicate effective performance of draft tube aeration system
 - All DO measurements > 4.0 mg/L
 - Daily average DO > 5.0 mg/L on all but one day (10/23/2019: 4.95 mg/L)
- Daily average water temperature
 - High: 28.77°C (7/24/2019)
 - Low: 9.41°C (2/5/2020)
- Relative percent difference between DO and temp readings at tailrace fishing platform and buoy were 4% and 1%, respectively



Results – Tailrace Water Chemistry Samples

- Levels of nitrate-nitrite and TKN similar to ecoregional* averages
- Levels of total phosphorus below ecoregional average

Sample Date	Ammonia (mg/L)	BOD (mg/L)	Nitrate-Nitrite (mg/L)	Ortho-phosphate (mg/L)	Total Phosphorus (mg/L)	TKN (mg/L)
7/24/2019	0.1	ND	0.71	ND	ND	0.29
8/22/2019	ND	ND	0.78	ND	ND	0.46
9/26/2019	0.33	ND	0.33	ND	ND	0.64
10/24/2019	0.22	ND	0.63	ND	ND	1.50
11/25/2019	0.21	ND	0.76	ND	ND	0.49
12/16/2019	0.12	ND	0.85	ND	ND	0.40
1/20/2020	ND	ND	0.43	ND	0.068	0.37
2/26/2020	ND	ND	0.48	ND	0.055	0.23
3/11/2020	ND	ND	0.45	ND	ND	0.31
4/27/2020	ND	ND	0.43	ND	0.073	0.33
5/29/2020	ND	ND	0.60	ND	ND	0.35
Region Avg	-	-	0.71 – 0.83	0.078 - 0.117	0.122 – 0.157	0.53 – 0.64

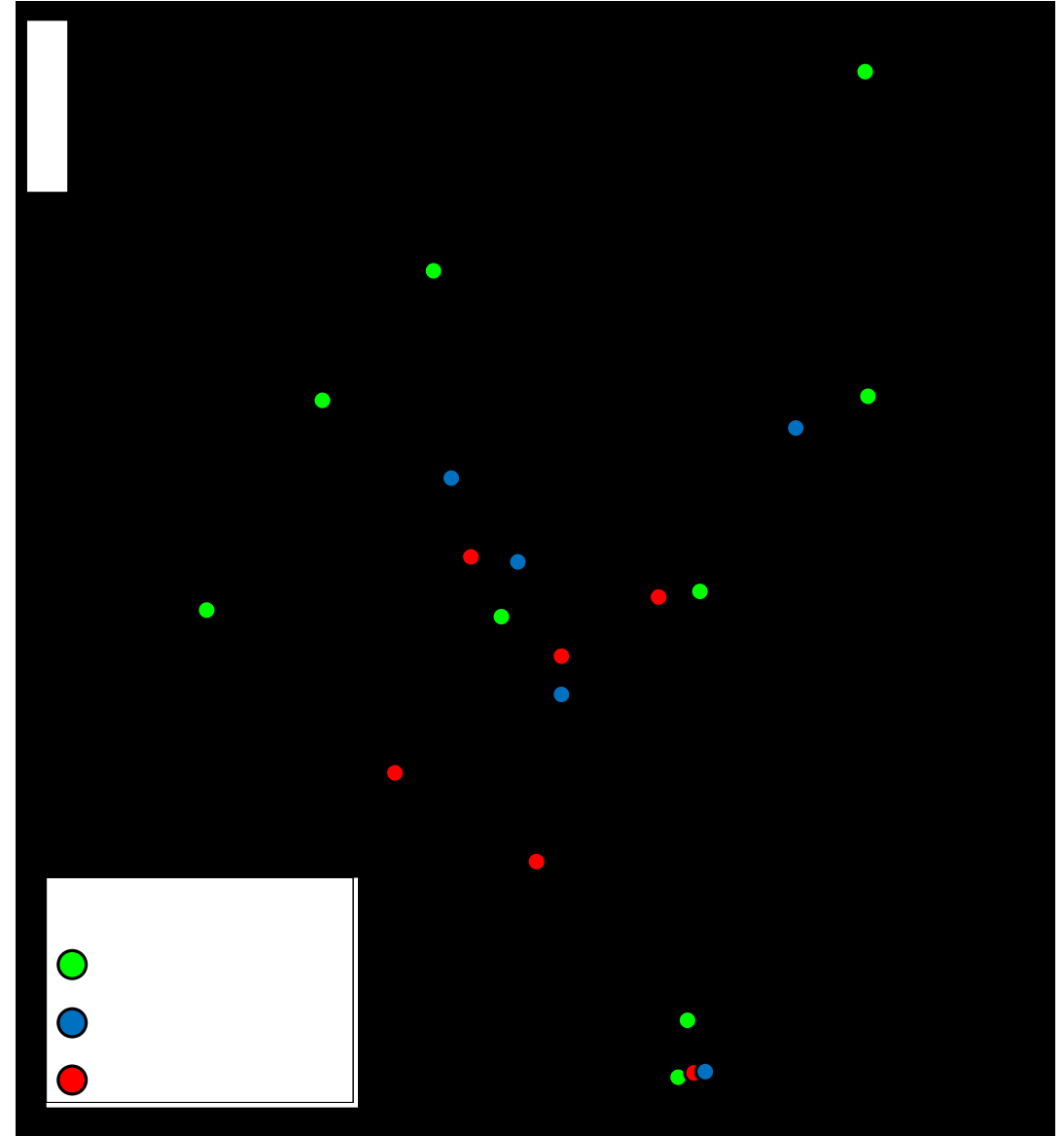
ND = not detected; *= USEPA 2000

Study Results

Water Quality in Lake Jackson

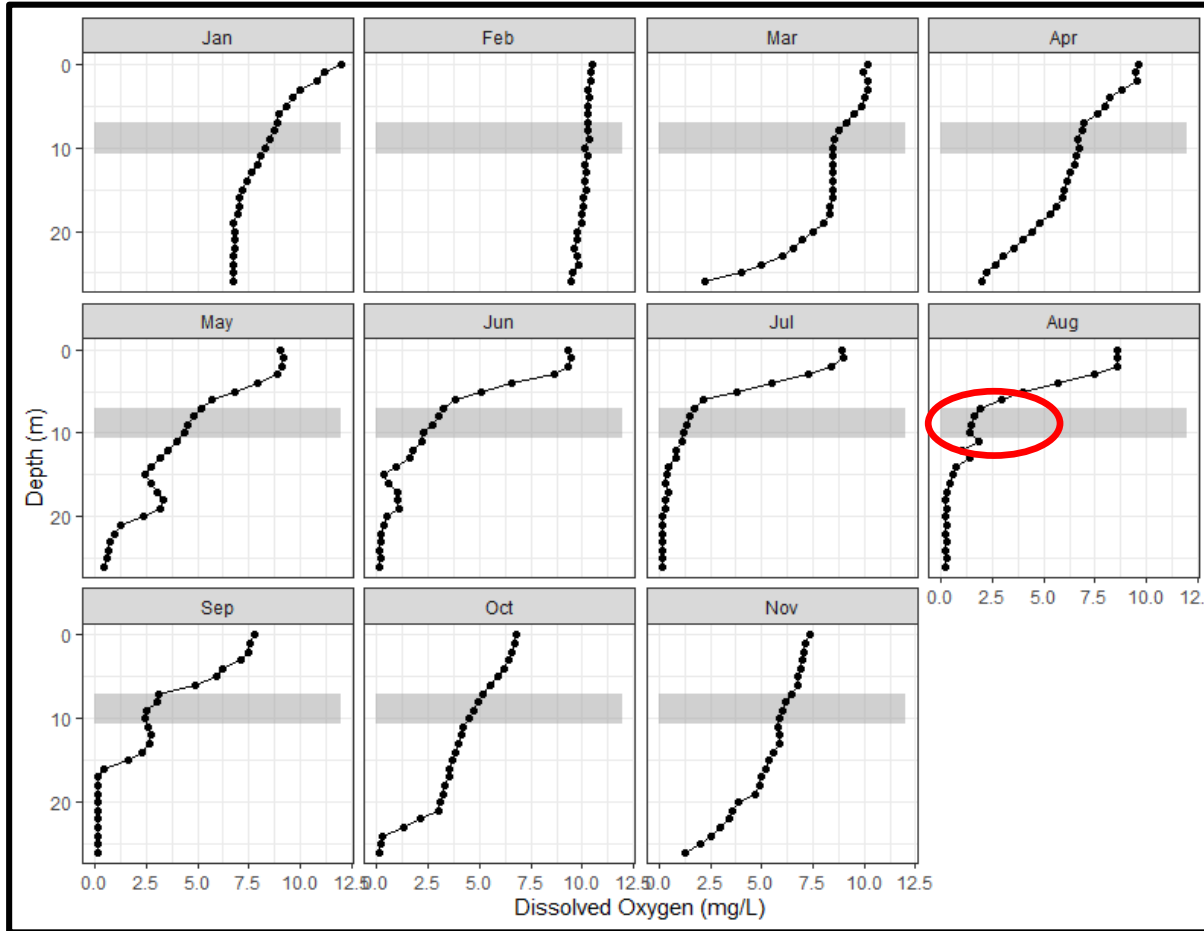
Existing Water Quality Data for Lake Jackson

- Georgia Power monthly forebay vertical profiles from 1986-2017
- GEPD monthly vertical profiles in forebay and mid-lake from 2011-2019
- Adopt-a-Lake citizen monitoring data from 2014-2019
- Algal bloom investigations from 2007-2015

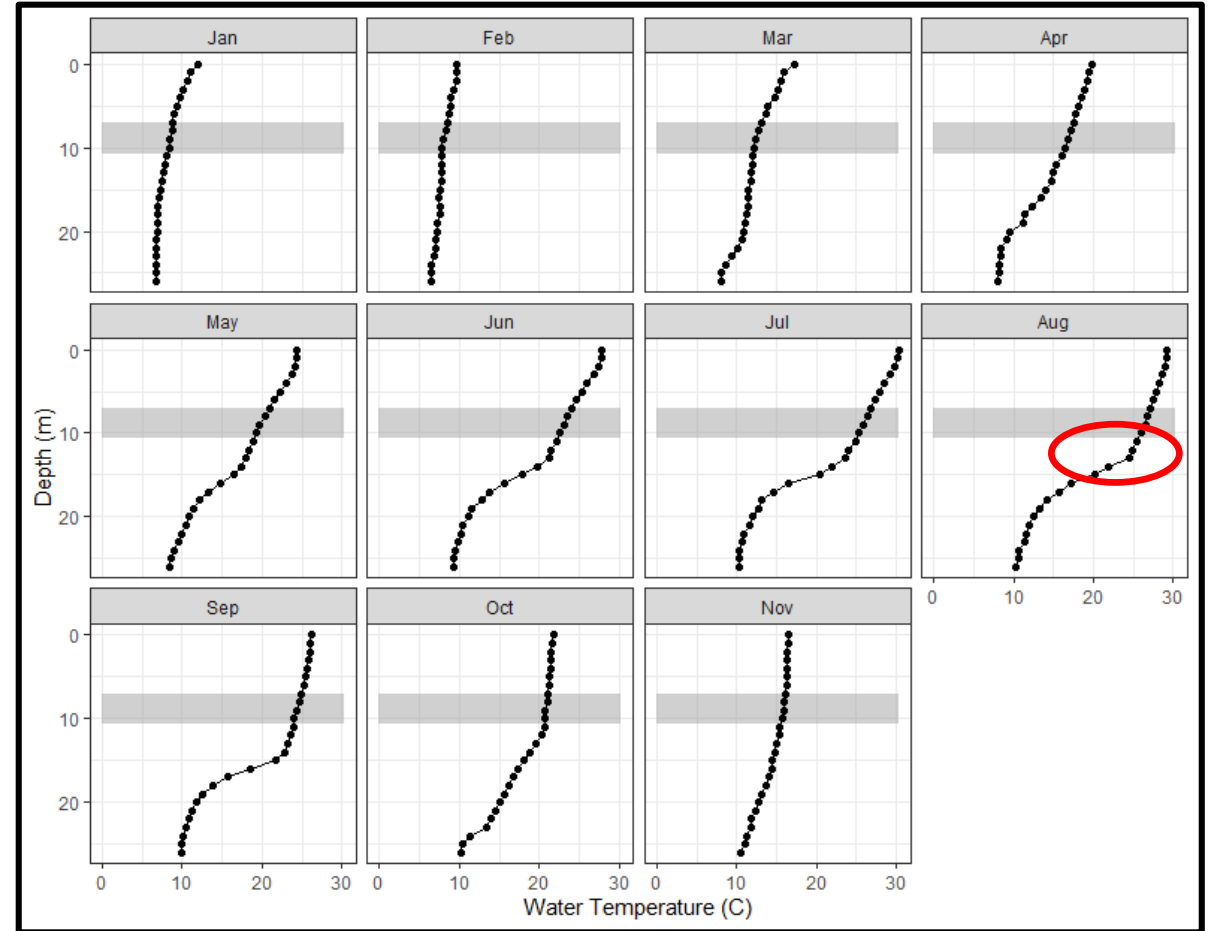


Georgia Power – Monthly Forebay Profiles, 1986-2017

DO



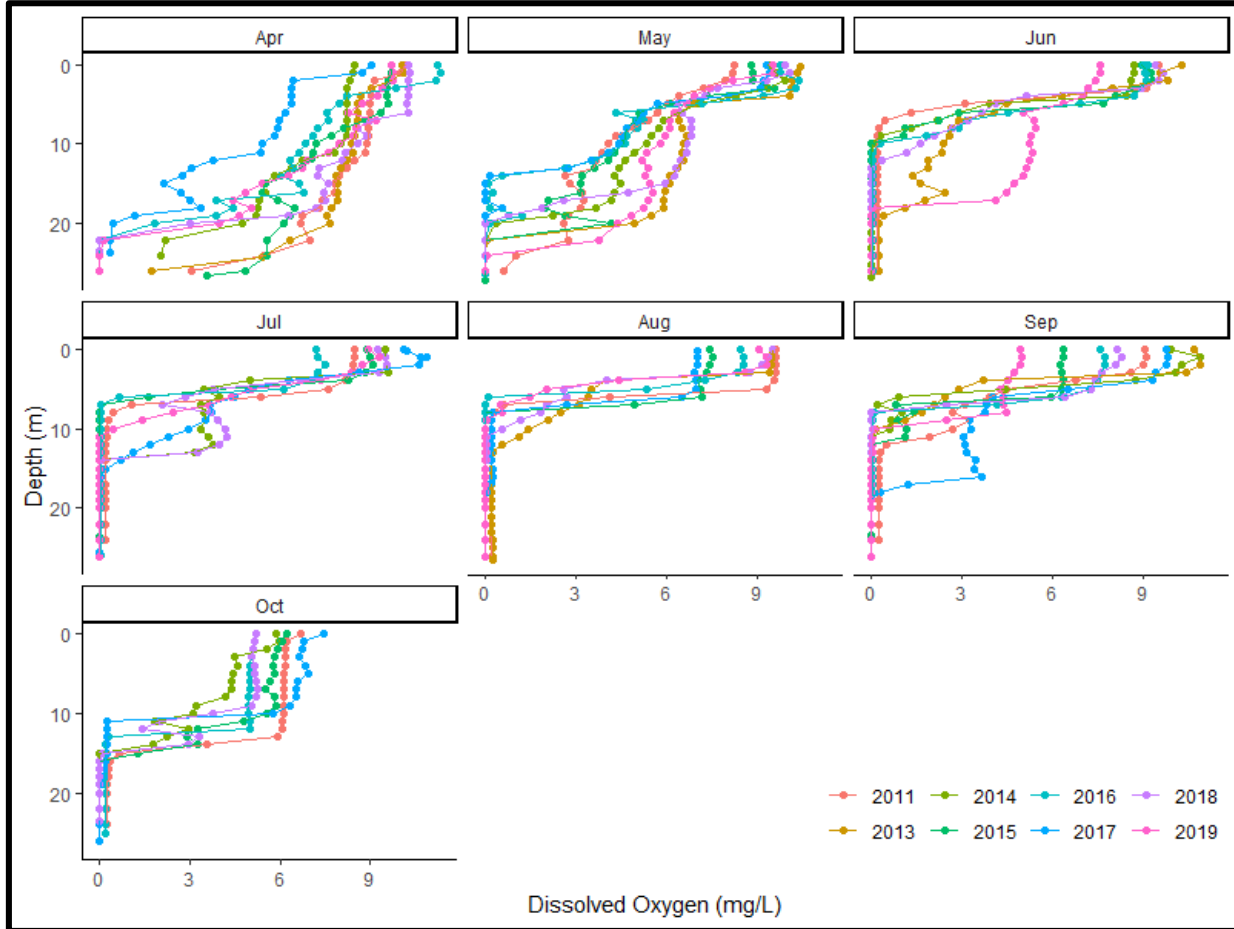
Water Temperature



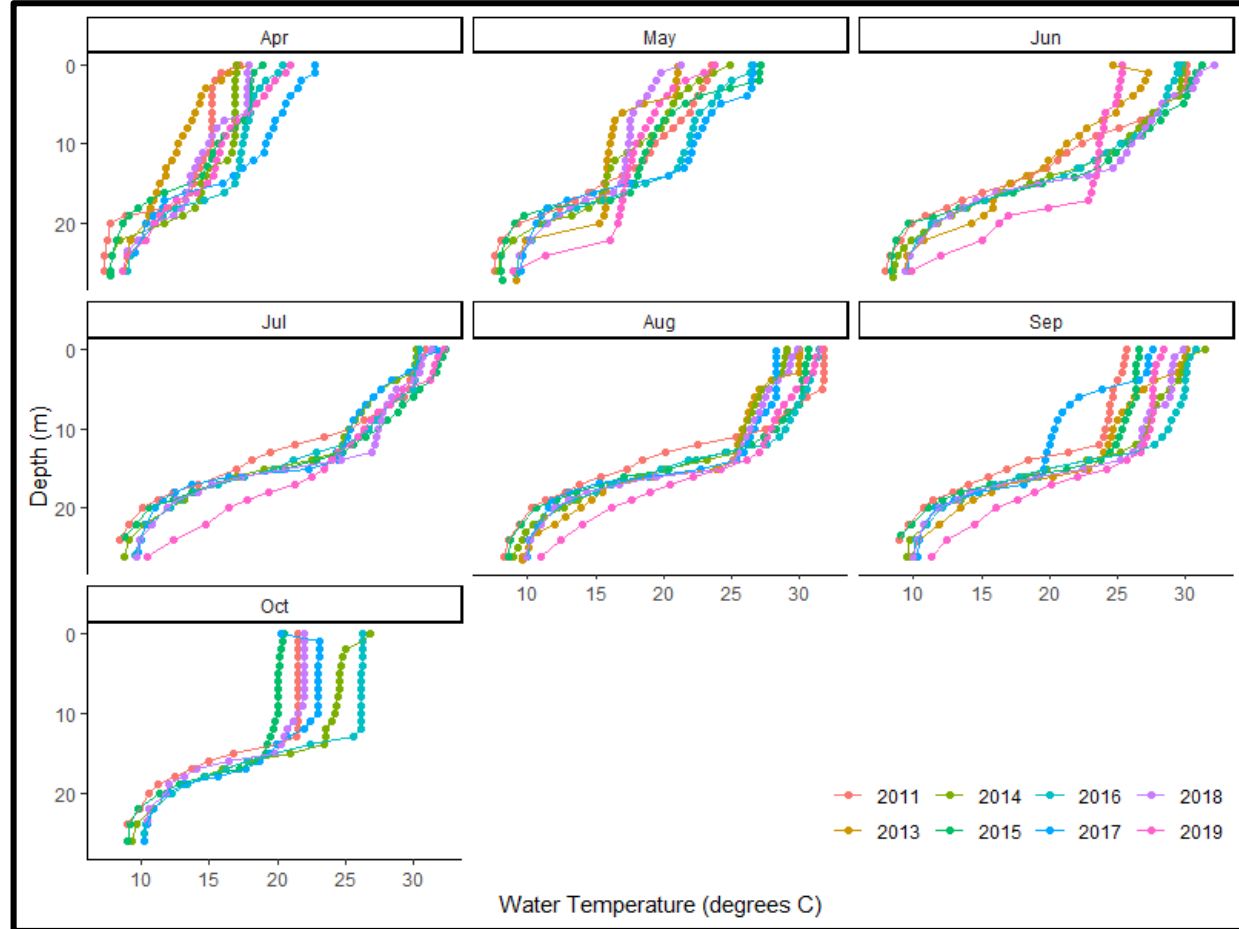
- Composite profiles based on Georgia Power data collected from 1986-2017
- Gray shading indicates the location of the intake in the water column

GEPD – Monthly Forebay Profiles, 2011-2019

DO

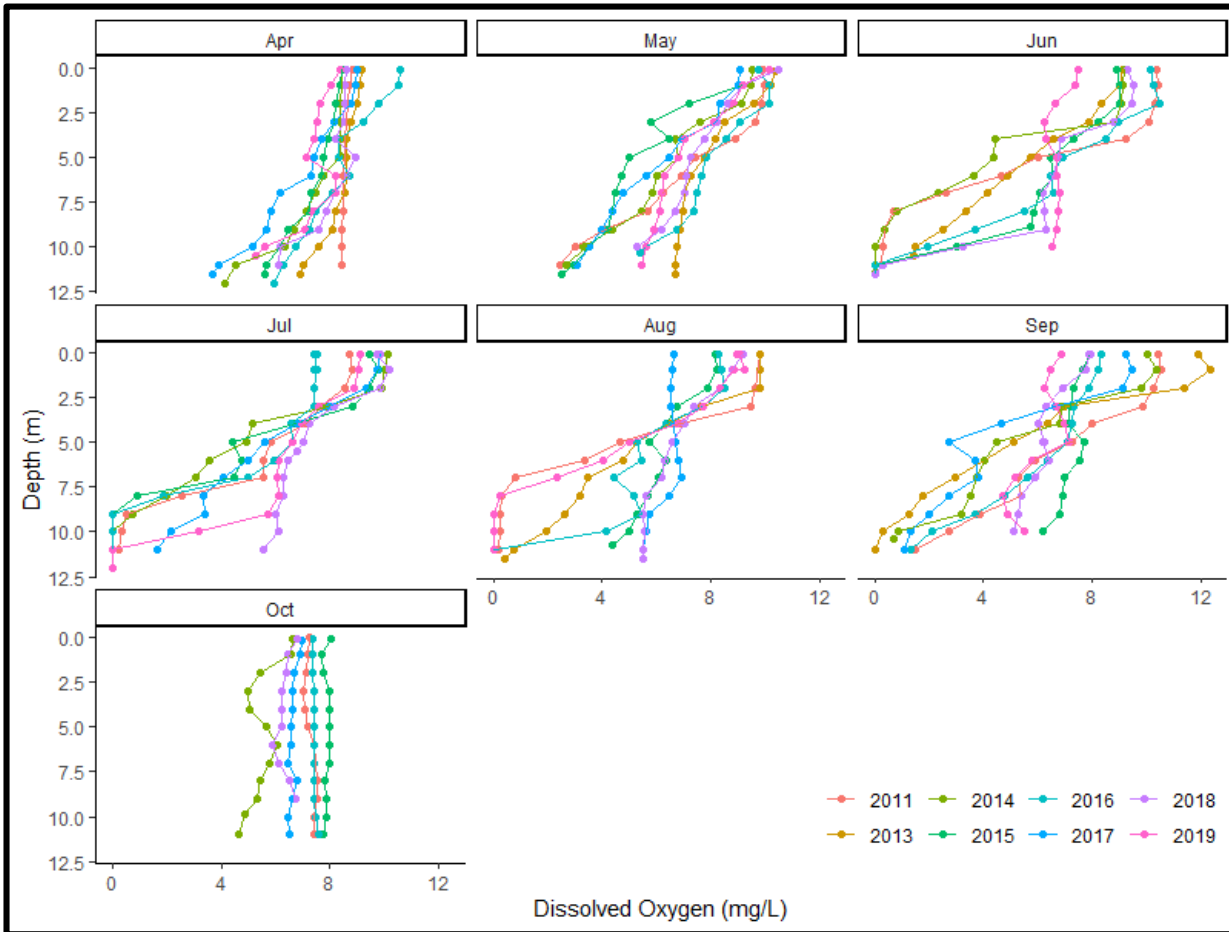


Water Temperature

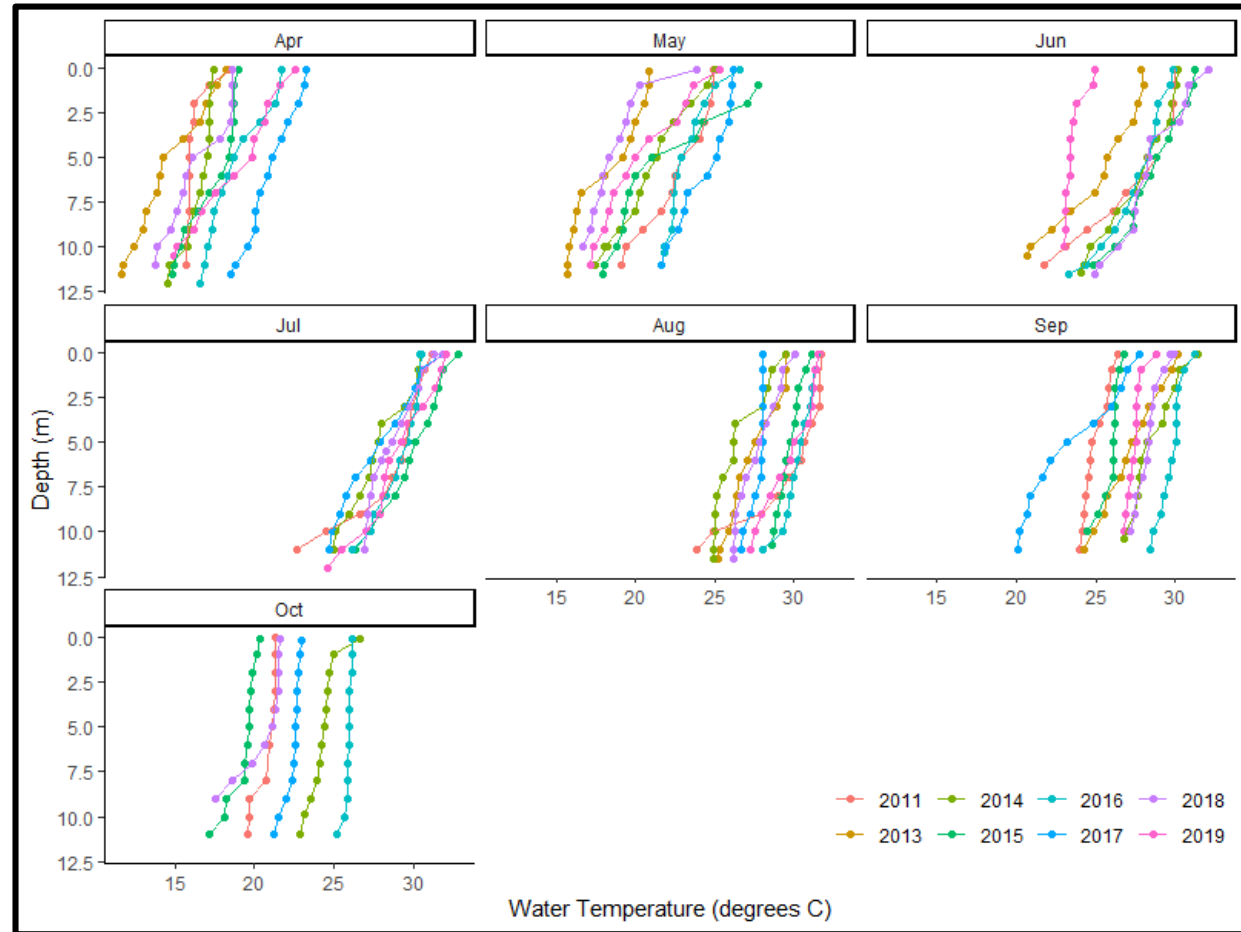


GEPD – Monthly Mid-Lake Profiles, 2011-2019

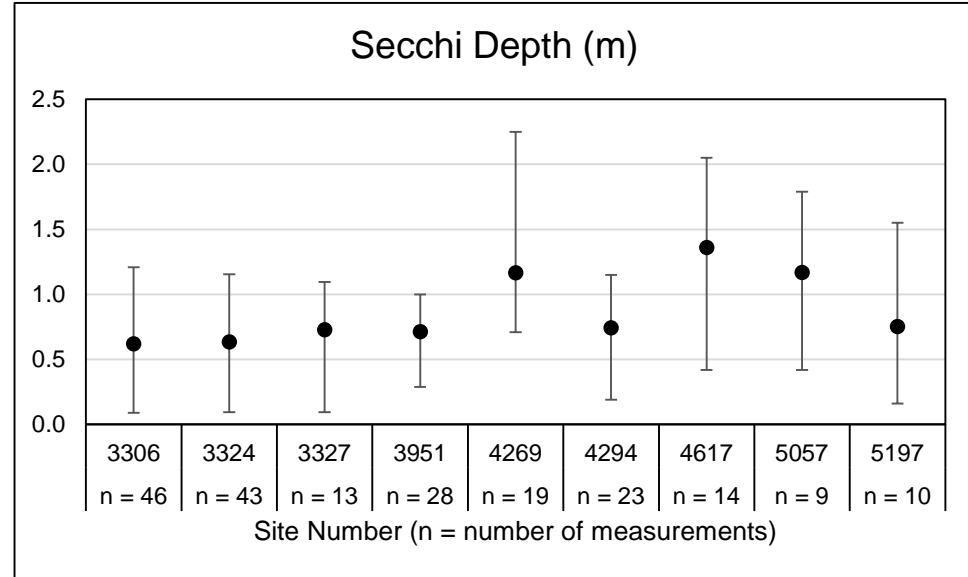
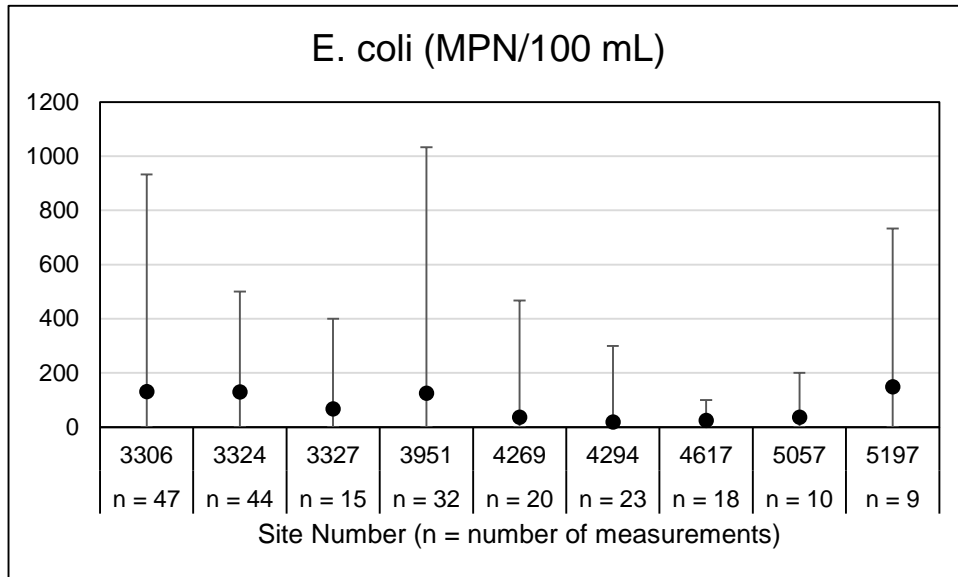
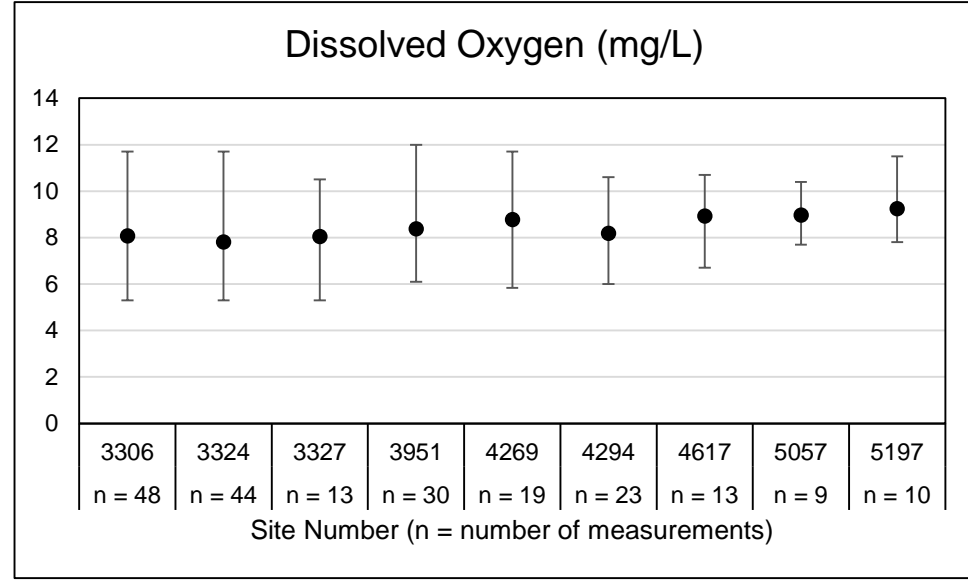
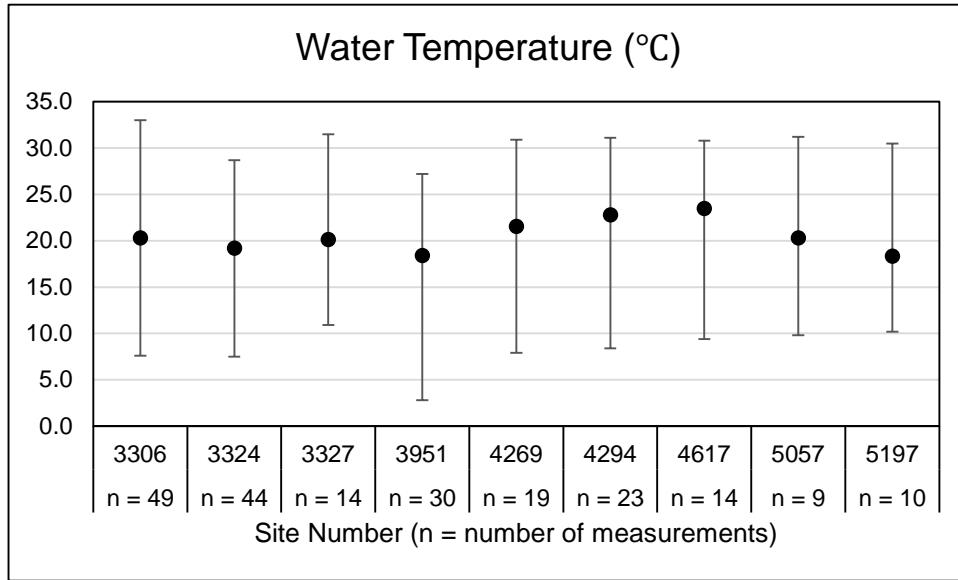
DO



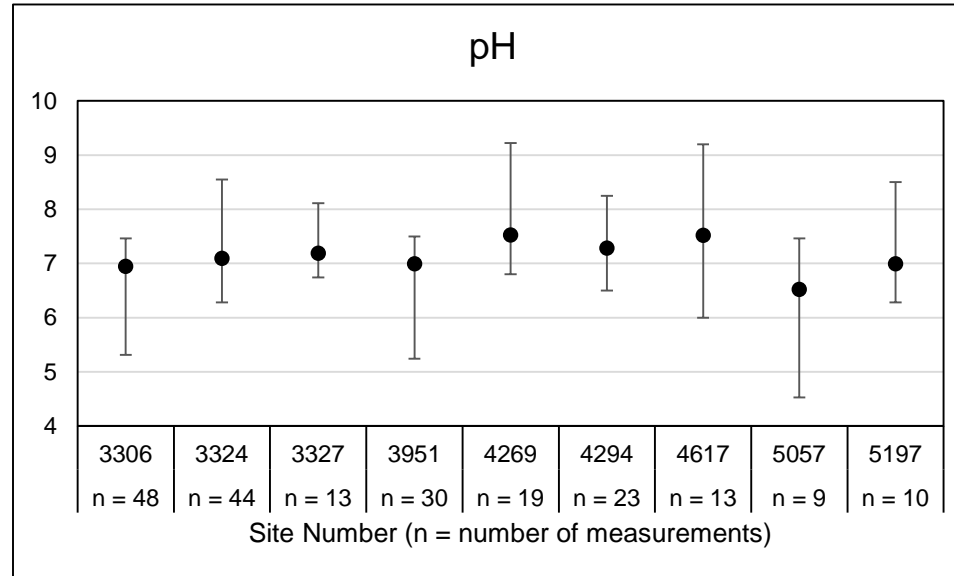
Water Temperature



Adopt-a-Lake Monitoring Data, 2014-2019

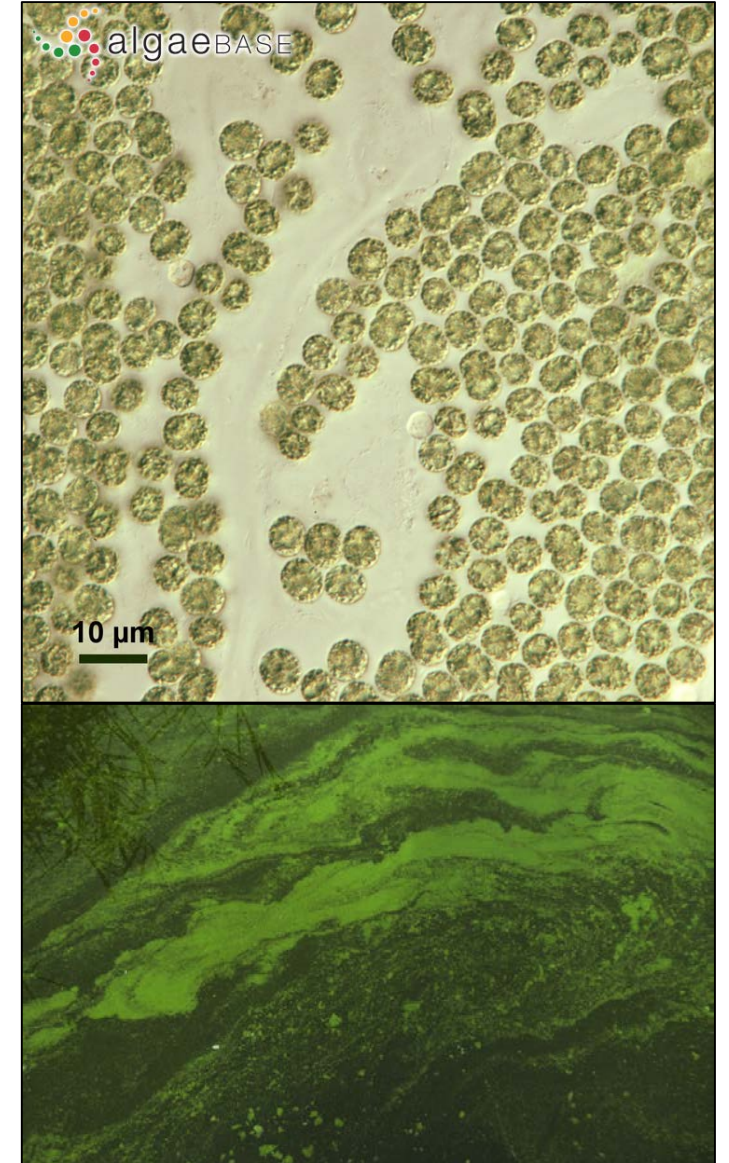


Adopt-a-Lake Monitoring Data, 2014-2019



Algal Blooms

- Nutrient enrichment from point and non-point sources can increase frequency, duration, and intensity
- Cyanobacteria blooms on Lake Jackson were reported in several years from 2007 to 2018
- Cyanobacteria blooms assessed in 2007, 2014, and 2015 contained *Microcystis* species, including *M. aeruginosa*
 - *M. aeruginosa* can produce the toxin microcystin
 - Samples assessed had cell densities below WHO guidelines
- Blooms were associated with drought, elevated water temperatures ($>30^{\circ}\text{C}$), and low reservoir inflows
- Wilson's bloom forecasting model predicts low risk for toxic bloom development for Lake Jackson, although extreme conditions (i.e., drought) increase risk
- Georgia Power implements a voluntary, visual-based cyanobacteria bloom assessment guideline on its lakes



Study Results

Ocmulgee River Downstream

Water Quality of Ocmulgee River Downstream

- Sources of water quality data:
 - Georgia Power tailrace data, 2019-2020
 - GEPD tailrace data, 2009
 - Seasonal data collected in 19-mile fishery study reach, 2010-2011 (Pruitt 2013)
 - GEPD data from Georgia Hwy 83, 14.5 miles downstream of Project, 2016 and 2018
- Analysis:
 - Downstream river meets applicable water quality criteria
 - GEPD lists the Ocmulgee River as supporting its designated uses from Lloyd Shoals Dam downstream 17 miles to confluence with the Towaliga River



Summary

Lloyd Shoals Tailrace Area

- Continuous monitoring demonstrated effective performance of draft tube aeration system in maintaining summer DO levels above applicable criteria
- Water chemistry analyses found nutrient levels similar to ecoregional averages

Lake Jackson

- Exhibits seasonal vertical stratification typical of southeastern reservoirs
- Water chemistry analyses indicate good overall water quality conditions
- Cyanobacteria blooms occur periodically during prolonged periods of high water temperature, low reservoir inflows, and increased retention time
- *Microcystis aeruginosa*, the dominant cyanobacterium in Lake Jackson, can produce toxins but modeling predicts low risk for development of toxic blooms

Summary (Continued)

Ocmulgee River Downstream of Project

- Water quality measurements in a 17-mile reach downstream of Lloyd Shoals Dam indicate the river is meeting applicable water quality criteria
- Tailrace water chemistry analyses indicate good overall water quality
- Surface water resources within the Middle Ocmulgee water planning region are considered adequate to meet future water demands (GEPD 2017)

Conclusion of First Season of Studies

- One year of tailrace continuous monitoring completed as of July 23, 2020
- An Updated Water Resources Study Report will be prepared by May 2021



Georgia
Power



Fish and Aquatic Resources

Presented by: Patrick O'Rourke

Study Results Meeting
Lloyd Shoals Project
July 29, 2020

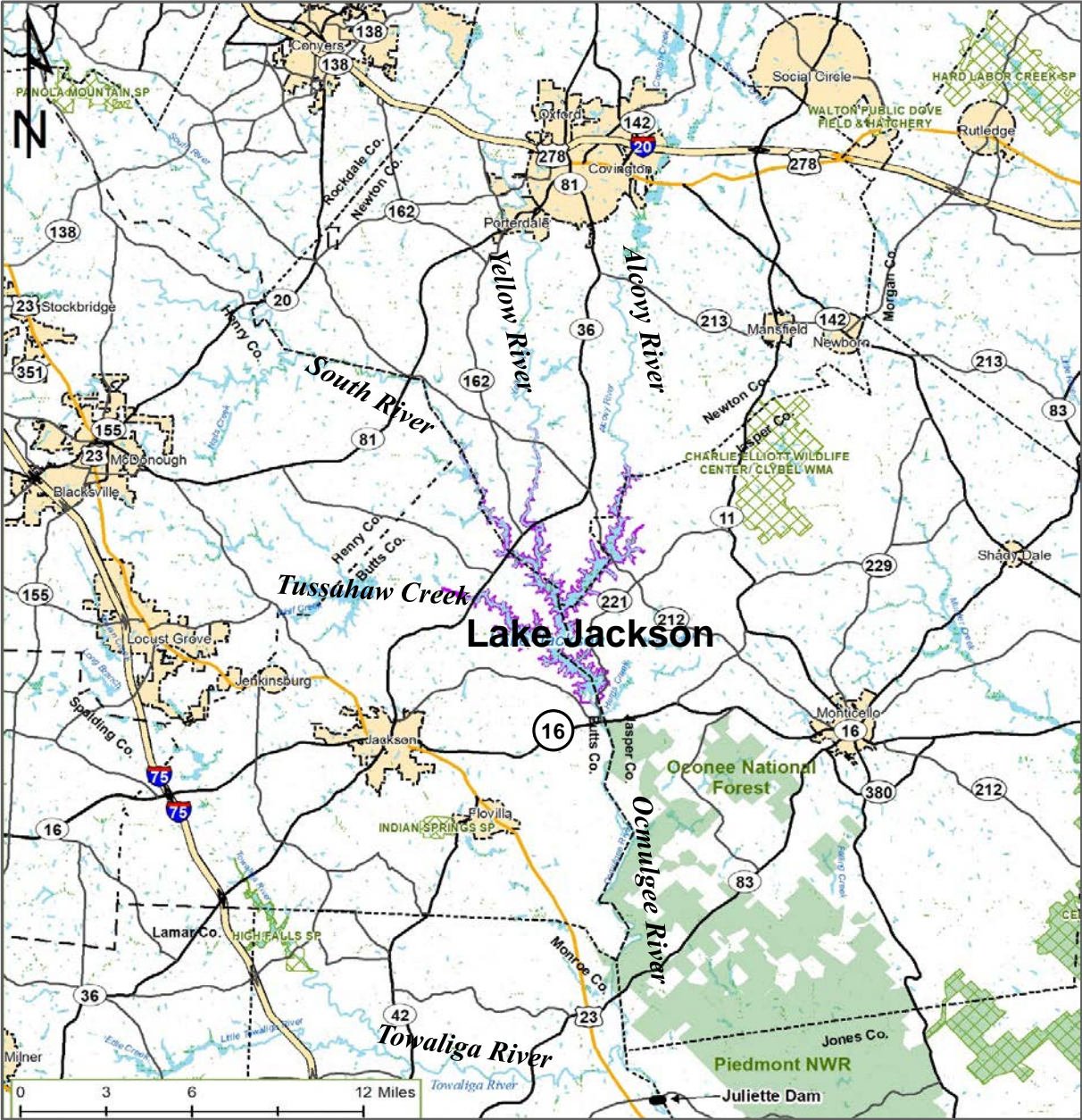
Study Objectives

- Characterize representative shoreline and littoral-zone aquatic habitats occurring in Lake Jackson
- Conduct a freshwater mollusk survey to characterize the occurrence and distribution of native mussels and aquatic snails
- Evaluate the effects of continued project operations on habitat for primary sport fish species in Lake Jackson, including Largemouth Bass and Striped Bass
- Evaluate the effects of continued project operations on riverine aquatic habitat downstream of the Project using existing information and data
- Evaluate the potential for fish entrainment and turbine-induced mortality by applying trends and data from entrainment studies completed at other hydroelectric projects

Study Area

- FERC project boundary around Lake Jackson and the Lloyd Shoals tailrace area
- Ocmulgee River downstream to Juliette Dam

□ Project Boundary



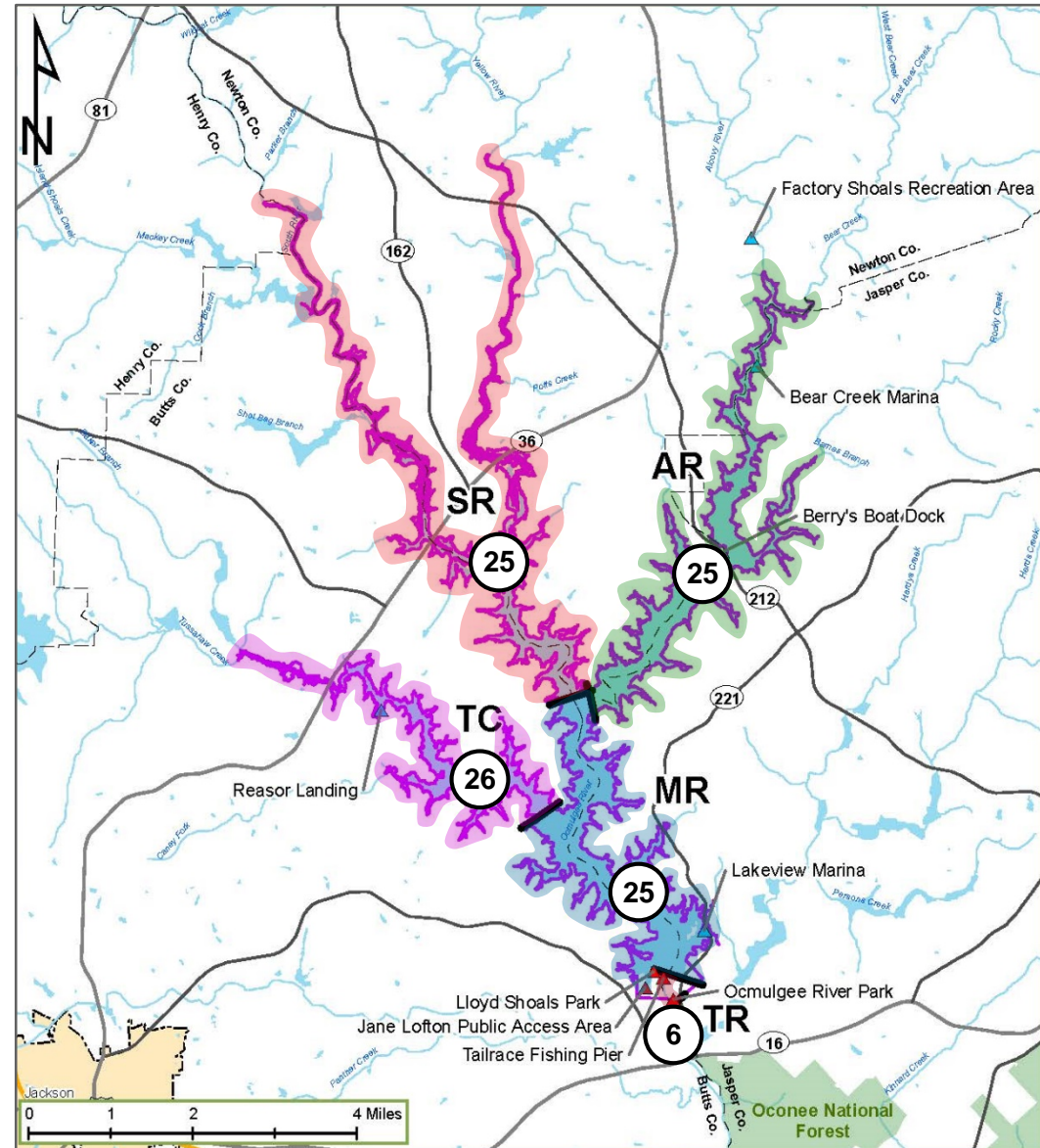
Key Study Elements

- Shoreline habitat survey (from Geology and Soils Study)
- Freshwater mollusk survey
- Fish entrainment evaluation using desktop methods
- Habitat for primary sport fish species
- Downstream riverine habitat

Shoreline Habitat Survey

Methods – Shoreline Habitat Survey

- Surveyed representative shoreline sites in August 2019
- Each site 500 feet long
- 107 total sites:
 - SR = South River (25)
 - AR = Alcovy River (25)
 - TC = Tussahaw Creek (26)
 - MR = Mainstem reservoir (25)
 - TR = Tailrace area (6)
- Identified sources of fish cover within 50 feet of shoreline and estimated proportional length



Methods – Shoreline Reconnaissance Survey

Site information

Riparian zone condition

Bank stability & protection

Stabilization practices

Potential erosion causes

Shoreline fish habitat

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.:		Date:	Time:
Waterbody: <input type="checkbox"/> Lake Jackson <input type="checkbox"/> Tailrace		County: <input type="checkbox"/> Butts <input type="checkbox"/> Henry <input type="checkbox"/> Jasper <input type="checkbox"/> Newton	
Site Description:			GPS?: <input type="checkbox"/> Yes <input type="checkbox"/> No
Adjacent Land Ownership: <input type="checkbox"/> GPC <input type="checkbox"/> Residential <input type="checkbox"/> Commercial <input type="checkbox"/> Other			
Weather:		Reservoir Pool Level: <input type="checkbox"/> Full <input type="checkbox"/> Medium <input type="checkbox"/> Low	
Investigators:			Photos Taken?: <input type="checkbox"/> Yes <input type="checkbox"/> No
Length of Assessment Site: <input type="checkbox"/> 500 feet <input type="checkbox"/> Other: _____ feet		Active Erosion Problem Present?: <input type="checkbox"/> Yes <input type="checkbox"/> No	
Shoreline Vegetative Buffer Zone Condition:	<input type="checkbox"/> Natural: heavily vegetated, less than 20 percent of natural vegetation removed		
	<input type="checkbox"/> Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining		
	<input type="checkbox"/> Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed		
Land Uses Adjacent to Shoreline (check all that apply):			
<input type="checkbox"/> Residential	<input type="checkbox"/> Forested	<input type="checkbox"/> Golf Course	<input type="checkbox"/> Open
<input type="checkbox"/> Recreation/access	<input type="checkbox"/> Agricultural	<input type="checkbox"/> Commercial	<input type="checkbox"/> Logging
<input type="checkbox"/> Other: _____			
Bank Stability:	<input type="checkbox"/> Stable; minimal erosion; <5% affected by erosion; low potential for future problems		
	<input type="checkbox"/> Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods		
	<input type="checkbox"/> Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods		
	<input type="checkbox"/> Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident		
Bank Vegetative Protection:	<input type="checkbox"/> >90% of bank surfaces covered by healthy, living vegetation		
	<input type="checkbox"/> 70-90% of bank covered by variety of vegetation; some open areas with disruption evident		
	<input type="checkbox"/> 50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible		
	<input type="checkbox"/> <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots		
Shoreline Structural Stabilization Practices Present? <input type="checkbox"/> Yes <input type="checkbox"/> No (check all that apply):			
<input type="checkbox"/> Seawall/bulkhead only (_____% of site)		<input type="checkbox"/> Seawall/bulkhead and riprap combined (_____% of site)	
<input type="checkbox"/> Riprap or other large stone only (_____% of site)		<input type="checkbox"/> Other armoring: _____ (_____% of site)	
Potential Sources of Active Shoreline Erosion (check all that apply):			
<input type="checkbox"/> Land-disturbing activity	<input type="checkbox"/> Residential landscape	<input type="checkbox"/> Reservoir fluctuations	<input type="checkbox"/> Wave action from watercraft/wind
<input type="checkbox"/> Impervious surfaces	<input type="checkbox"/> Roads and bridges	<input type="checkbox"/> Lack of buffer vegetation	<input type="checkbox"/> Tributary inflow
<input type="checkbox"/> Stormwater runoff	<input type="checkbox"/> Recreation/access	<input type="checkbox"/> Livestock activity	<input type="checkbox"/> Other: _____
Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):			
<input type="checkbox"/> Docks/piers/boatslips (_____% of shoreline length)		<input type="checkbox"/> Overhanging vegetation (_____% of shoreline length)	
<input type="checkbox"/> Riprap (_____% of shoreline length)		<input type="checkbox"/> Large woody debris (_____% of shoreline length)	
<input type="checkbox"/> Bedrock and boulders (_____% of shoreline length)		<input type="checkbox"/> Standing timber (_____% of shoreline length)	
<input type="checkbox"/> Emergent vegetation (_____% of shoreline length)		<input type="checkbox"/> Other: _____ (_____% of shoreline length)	
<input type="checkbox"/> Submersed vegetation (_____% of shoreline length)		<input type="checkbox"/> Other: _____ (_____% of shoreline length)	
Other Observations and Aquatic Habitat Notes:			

Littoral-zone Fish Cover by Study Area Section

Frequency of Occurrence (Percent):

Study Area Section	Docks and Piers	Riprap	Bedrock and Boulders	Emergent Vegetation	Submersed Vegetation	Overhanging Vegetation	Large Woody Debris	Standing Timber
South River (SR)	44	24	8	24	4	96	80	0
Alcovy River (AR)	84	52	28	16	0	84	36	24
Tussahaw Creek (TC)	69	62	12	8	0	73	62	8
Mainstem Reservoir (MR)	84	56	32	4	4	72	60	0
Tailrace Area (TR)	17	17	83	0	0	67	50	17
Total (N=107)	67	47	23	12	2	80	59	8

Littoral-zone Fish Cover by Study Area Section

Proportion of Surveyed Shoreline Length (Percent):

Study Area Section	Docks and Piers	Riprap	Bedrock and Boulders	Emergent Vegetation	Submersed Vegetation	Overhanging Vegetation	Large Woody Debris	Standing Timber
South River (SR)	3	9	<1	10	1	56	12	0
Alcovy River (AR)	7	15	2	6	0	13	3	2
Tussahaw Creek (TC)	6	31	<1	2	0	22	6	<1
Mainstem Reservoir (MR)	5	35	2	<1	<1	5	6	0
Tailrace Area (TR)	5	2	54	0	0	33	5	8
Total (53,500 ft)	5	21	4	4	<1	25	7	1

Littoral-zone Fish Cover by Vegetative Buffer Zone Condition

Proportion of Surveyed Shoreline Length (Percent):

Study Area Section	Docks and Piers	Riprap	Bedrock and Boulders	Emergent Vegetation	Submersed Vegetation	Overhanging Vegetation	Large Woody Debris	Standing Timber
Natural (17,500 ft)	<1	3	2	11	0	60	16	1
Landscaped-Natural (14,000 ft)	8	21	13	2	1	13	2	2
Landscaped (22,000 ft)	7	36	1	<1	0	4	3	<1
Total (53,500 ft)	5	21	4	4	<1	25	7	1

Shoreline Structural Stabilization Practices and Fish Habitat

- The Geology and Soils Study provides a literature review on the relationship between shoreline structural stabilization practices and littoral-zone fish habitat
- Literature sources included studies at other hydropower reservoirs in North and South Carolina (Barwick 2004) and Alabama (Purcell 2013)
- Key findings of literature review:
 - Greater habitat complexity of riprap provides for higher species richness, diversity, and abundance of littoral-zone fish assemblages
 - When erosion control is necessary, the use of riprap, either alone or in front of seawalls, provides better habitat than seawalls alone

Summary – Shoreline Habitat Survey

- The most frequently observed sources of littoral-zone fish cover across the study area were overhanging vegetation, docks and piers, large woody debris, riprap, and bedrock and boulders
- Based on proportional length, overhanging vegetation was the predominant source of fish cover, followed by riprap, large woody debris, and docks and piers
- Riprap was most prevalent in the mainstem, Tussahaw Creek, and Alcovy River sections of Lake Jackson, where residential development is widespread
- Overhanging vegetation was the predominant cover type in the South River section, followed by large woody debris and emergent vegetation

Freshwater Mollusk Survey



Altamaha Arcmussel – Photo by Brett Albanese

Study Methods – Freshwater Mussel Survey

- Surveys conducted by GDNR Wildlife Resource Division in Sep-Nov 2019
 - Lake Jackson – 22 survey sites
 - Tailrace area – 20 survey sites in 3-mile reach
 - Tailrace area to Juliette Dam – 7 survey sites in 16-mile reach
- Due to high flows this spring and Covid-19, additional surveys in Lake Jackson and a snail survey in the Alcovy River were postponed until summer-fall 2020



Photos by GDNR WRD

Results – Lake Jackson

- Survey yielded 295 specimens representing six native mussel species
- Two species listed as state threatened:
 - Savannah Lilliput – record extends known range 235 miles upstream in Ocmulgee River
 - Altamaha Arcmussel – collected as relict shell only; previously reported from Lake Jackson

Scientific Name	Common Name	Number of Mussels	Relative Abundance (Percent)	Frequency of Occurrence (Percent)
<i>Pyganodon gibbosa</i>	Inflated Floater	145	49.2	81.8
<i>Elliptio hopetonensis</i>	Altamaha Slabshell	103	34.9	36.4
<i>Utterbackia imbecillus</i>	Paper Pondshell	43	14.6	72.7
<i>Pyganodon cataracta</i>	Eastern Floater	2	0.7	9.1
<i>Toxolasma pullus</i>	Savannah Lilliput ^a	1	0.3	4.5
<i>Alasmidonta arcula</i>	Altamaha Arcmussel ^a	1 ^b	0.3	4.5
Total		295		

^a State threatened

^b Relict (dead) shell

Results – Lloyd Shoals Tailrace Area

- Survey yielded 528 specimens representing six native mussel species
- Four most abundant species also occurred in Lake Jackson
- Rayed Pink Fatmucket relatively uncommon in the Ocmulgee River

Scientific Name	Common Name	Number of Mussels	Relative Abundance (Percent)	Frequency of Occurrence (Percent)
<i>Elliptio hopetonensis</i>	Altamaha Slabshell	335	63.4	95.0
<i>Pyganodon cataracta</i>	Eastern Floater	96	18.2	75.0
<i>Utterbackia imbecillus</i>	Paper Pondshell	61	11.6	65.0
<i>Pyganodon gibbosa</i>	Inflated Floater	29	5.5	25.0
<i>Elliptio icterina</i>	Variable Spike	6	1.1	20.0
<i>Lampsilis spendida</i>	Rayed Pink Fatmucket	1	0.2	5.0
Total		528		

Results – Ocmulgee River, Hwy 16 to Juliette Dam

- Survey yielded 421 specimens representing four native mussel species
- All four species also collected in tailrace area upstream
 - Like tailrace area, Alabama Slabshell was the numerically dominant species

Scientific Name	Common Name	Number of Mussels	Relative Abundance (Percent)	Frequency of Occurrence (Percent)
<i>Elliptio hopetonensis</i>	Altamaha Slabshell	351	83.4	100.0
<i>Utterbackia imbecillus</i>	Paper Pondshell	47	11.2	28.6
<i>Elliptio icterina</i>	Variable Spike	12	2.9	42.9
<i>Pyganodon gibbosa</i>	Inflated Floater	11	2.6	28.6
Total		421		

Summary – Freshwater Mollusk Survey

- Mussel surveys in fall 2019 yielded 1,244 mussels representing eight native species
- Two state threatened species, Savannah Lilliput and Altamaha Arcmussel, were found in Lake Jackson
- Length-frequency distributions of the four most common species indicate successful reproduction and recruitment of young mussels
- Additional surveys for Lake Jackson and the Alcovy River are planned for summer-fall 2020



Inflated Floater – Photo by GDNR WRD

Fish Entrainment Evaluation



Methods – Fish Entrainment Evaluation

- Applied trends and data from other studied sites
 - 47 sites for entrainment
 - 15 sites for turbine-passage survival
- Characterized potential entrainment
 - Size distribution
 - Species composition and relative abundance
 - Seasonal distribution
- Total annual entrainment extrapolated using a representative southeastern site
- Characterized potential turbine-passage survival rates
 - Francis turbines; small, moderate-sized, and large fish
 - Derived estimate of total annual entrainment mortality
- Examined potential implications to fisheries management



Turbine Characteristics of Lloyd Shoals Powerhouse

- Physical characteristics determine size of clearances, passageways, and rotational speeds, which can be sources of fish injury
 - Blade strikes, grinding, pressure changes, shear stress, and turbulence

Unit	Unit Hydraulic Capacity (cfs)	Net Head (ft)	Number of Runners	Turbine Operating Speed (rpm)	Runner Diameter (inches)	Number of Blades per Runner	Runner Diameter at Inlet (inches)	Blade Spacing at Inlet (inches)	Runner Diameter at Discharge (inches)	Peripheral Runner Velocity (fps)
1	620	96.8	2	300	52.38	17	44.82	8.28	50.28	68.62
2	620	96.8	2	300	52.38	17	44.82	8.28	50.28	68.62
3	620	96.8	2	300	52.38	17	44.82	8.28	50.28	68.62
4	620	96.8	2	300	52.38	17	44.82	8.28	50.28	68.62
5	620	96.8	2	300	54.5	17	49.16	9.09	52.28	71.40
6	620	96.8	2	300	54.5	17	49.12	9.08	52.28	71.40

Potential Entrainment at Lloyd Shoals

Size Distribution

- Small and/or YOY fish less than 6 inches long
- Production of YOY fish in healthy reservoirs is often high
- Small fish dispersal and downstream transport

Species Composition and Relative Abundance

- Species of sunfish, shad, and catfish likely dominate
- Sunfish relative abundance is high in Lake Jackson
- Larger sport fish unlikely to be especially susceptible

Seasonal Distribution

- Peak rates most likely occur in spring and summer following spawning and rearing seasons
- Shad entrainment can be highest during coldest months

Percent Relative Abundance of Top Five Entrained Species at Nine Southeastern Hydroelectric Sites

FAMILY and Species Common Name	Savannah River Basin				Santee-Cooper River Basin				
	Abbeville	King Mill	Richard B. Russell	Stevens Creek	Buzzard's Roost	Gaston Shoals	Hollidays Bridge	Ninety-Nine Islands	Saluda
CLUPEIDAE (HERRINGS):									
Threadfin shad ◀	11.3	35.4	62.0	48.9	96.8	--	--	15.0	--
Gizzard shad ◀	--	5.4	--	--	--	--	29.7	11.9	18.3
Blueback herring	--	9.1	19.4	--	--	--	--	--	--
CENTRARCHIDAE (SUNFISHES):									
Bluegill ◀	29.2	7.9	2.6	18.0	0.6	15.5	24.3	22.6	49.6
Redbreast sunfish ◀	--	--	--	--	--	11.0	--	--	--
ICTALURIDAE (CATFISHES):									
Channel catfish ◀	--	--	--	--	--	13.1	11.7	18.0	--
White catfish ◀	2.0	--	3.1	--	0.3	8.6	6.3	--	2.6
Snail bullhead ◀	--	--	--	--	--	17.2	--	--	--
Brown bullhead ◀	7.8	--	--	--	--	--	--	--	--
PERCIDAE (PERCHES):									
Yellow perch ◀	44.4	--	8.2	7.1	1.5	--	--	--	--
Blackbanded darter ◀	--	--	--	4.3	--	--	--	--	--
CYPRINIDAE (MINNOWS):									
Spottail shiner ◀	--	12.8	--	--	--	--	--	--	6.1
Whitefin shiner	--	--	--	--	--	--	5.4	--	--
Sandbar shiner	--	--	--	--	--	--	--	--	6.5
CATOSTOMIDAE (SUCKERS):									
Striped jumprock ◀	--	--	--	--	--	--	--	5.3	--
MORONIDAE (TEMPERATE BASSES):									
White perch	--	--	--	--	0.3	--	--	--	--
ANGUILLIDAE (FRESHWATER EELS):									
American eel ◀	--	--	--	4.6	--	--	--	--	--
Total	94.7	70.6	95.3	82.9	99.5	65.4	77.4	72.8	83.1
◀ Species known to occur in Lake Jackson or the upper Ocmulgee River basin.									

Potentially Entrained Fish Community in Lake Jackson

- Similar rank order of relative abundance of top families between entrainment composition at other southeastern sites and fish community of Lake Jackson

Family	Median Percent Entrainment Composition at Six Sites in South Carolina and Georgia	Percent Composition of Total Catch in Lake Jackson
Centrarchidae (sunfishes)	31.2	87.8
Clupeidae (herrings and shads)	28.8	5.3
Ictaluridae (catfishes)	12.8	4.0
Cyprinidae (minnows)	6.4	0.1
Percidae (perches)	2.0	0.2
Catostomidae (suckers)	0.7	0.2
Moronidae (temperate basses)	0.2	1.7

Sources: EPRI for entrainment composition; GDNR for fish community composition

Lloyd Shoals Entrainment Extrapolation

- Based on entrainment rates applied from a representative site in South Carolina, total annual entrainment at Lloyd Shoals is estimated to be about 130,377 fish
- Average immediate turbine-passage survival based on 15 sites with range of head and Francis turbine characteristics bracketing those of Lloyd Shoals:

Small (≤ 6 inches)	86%
Moderate-sized ($>6, \leq 10$ inches)	81%
Large (> 10 inches)	83%

- Annual entrainment mortality is about 15%, or about 19,577 fish on average
- Latent survival may be at least 3 to 4% lower
- Indirect mortality may occur as a result of predation in tailrace by sport fish

Potential Implications for Fisheries Management

Striped Bass and Hybrid Bass

- Fingerlings and juveniles may be most susceptible to entrainment; school in open waters and may tend to migrate downstream
- Because of small size, majority entrained likely survive turbine passage; immediate survival may be on order of 90 percent

American Shad

- Average immediate survival of 86-93 percent from available limited testing
- Immediate survival at Lloyd Shoals could be lower due to smaller size of clearances and passageways in turbines

Summary – Fish Entrainment Evaluation

- Small and/or young fish likely comprise the majority of entrained fish
- Entrainment is likely to be dominated by sunfish, shad, and catfish species, with peak entrainment rates occurring in spring and summer for most species
- The majority of entrained fish, because of their small size, are likely to survive turbine passage into downstream habitats
- Overall, Lake Jackson supports a healthy fishery; continued project operation is likely to result in only minor impacts to fish populations and fishing opportunities

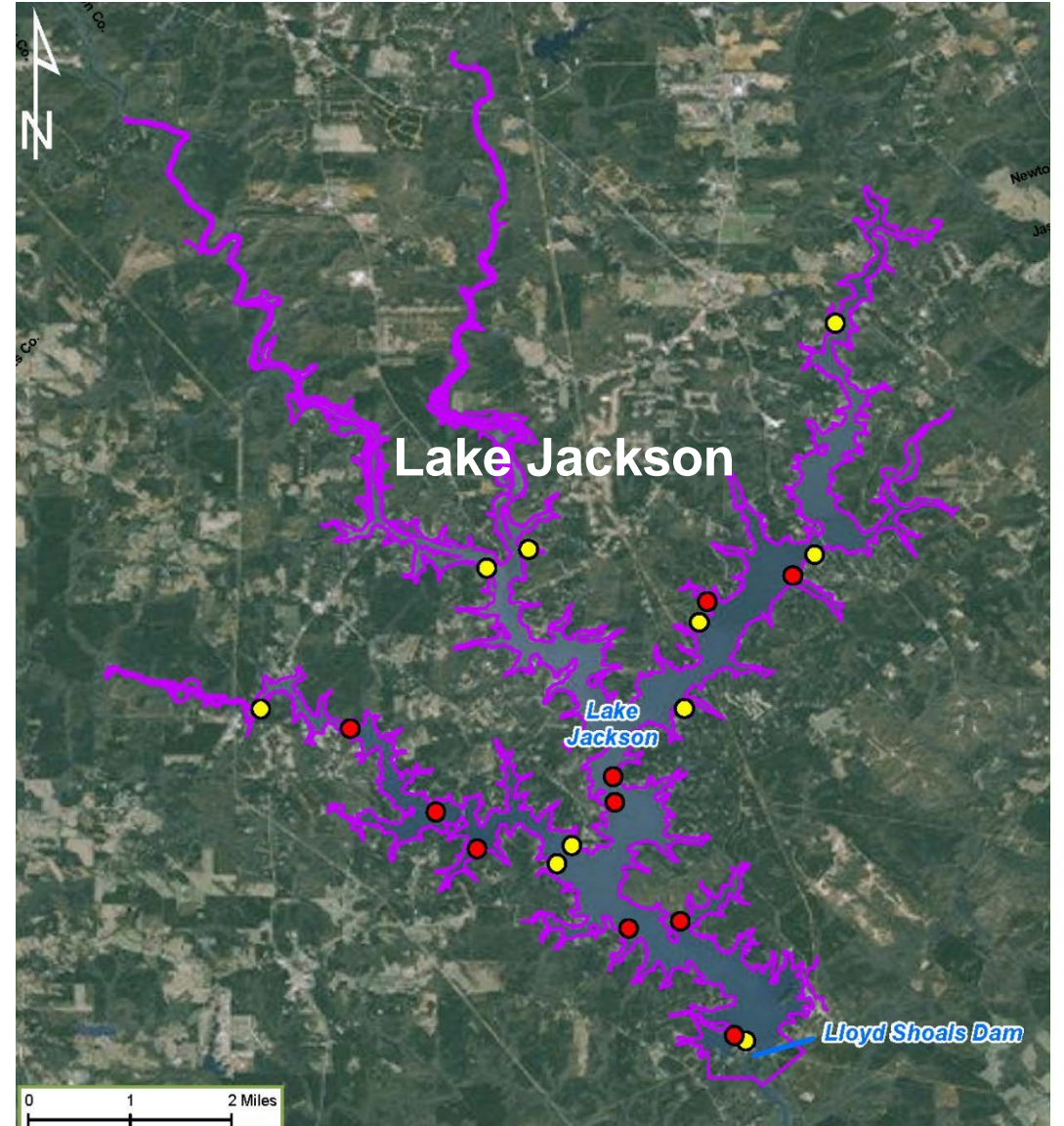
Habitat for Primary Sport Fish Species



Methods – Sport Fish Habitat

- GDNR standardized fisheries survey data from 2007-2019 analyzed for:
 - Largemouth Bass
 - Striped Bass
 - Other sport fish
- Population attributes characterized:
 - Catch rates
 - Average relative condition
 - Length-frequency distributions
 - Proportional size distribution

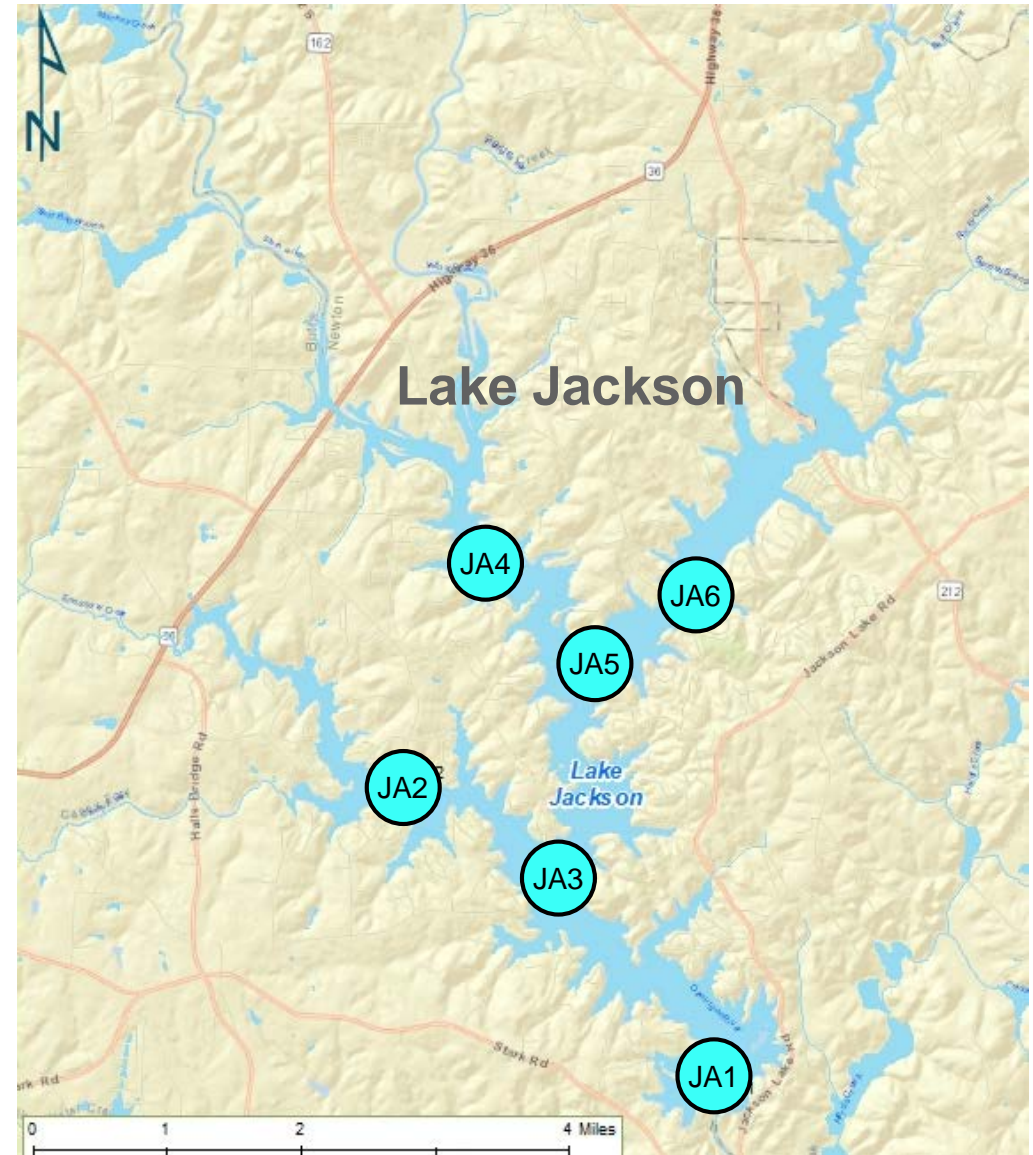
- Electrofishing Stations
- Gillnetting Stations



Methods – Summer Water Quality for Sport Fish

- Georgia Power seasonal/monthly vertical profile data compiled for months Apr-Sep 2000-2017
- Analyzed for spatial and temporal extent of summer vertical stratification
- Habitat suitability evaluated based on ranges of water temperature and dissolved oxygen (DO)

 Georgia Power Water Quality Monitoring Stations

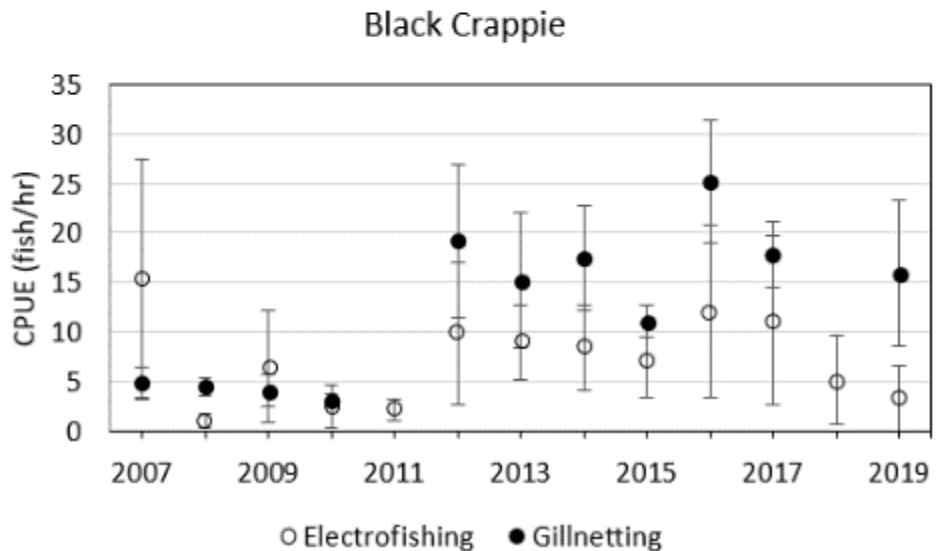
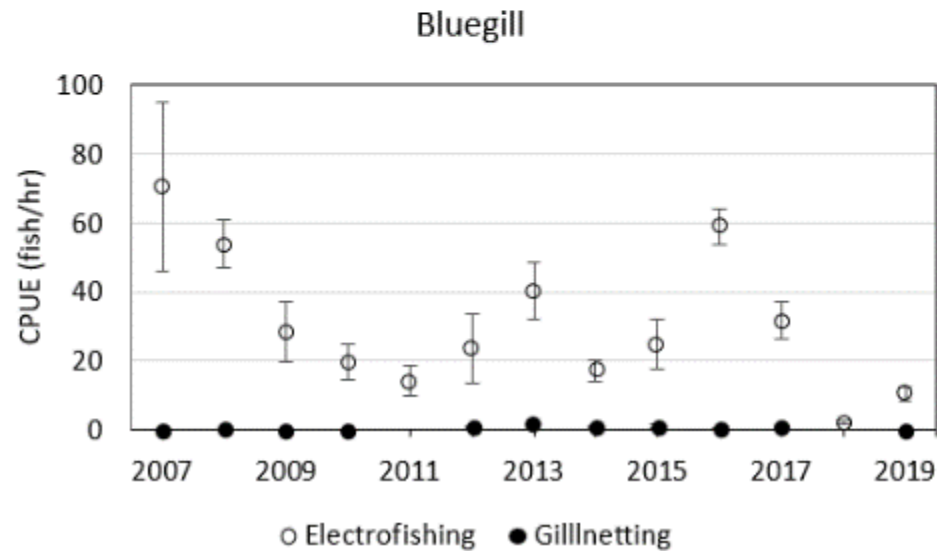
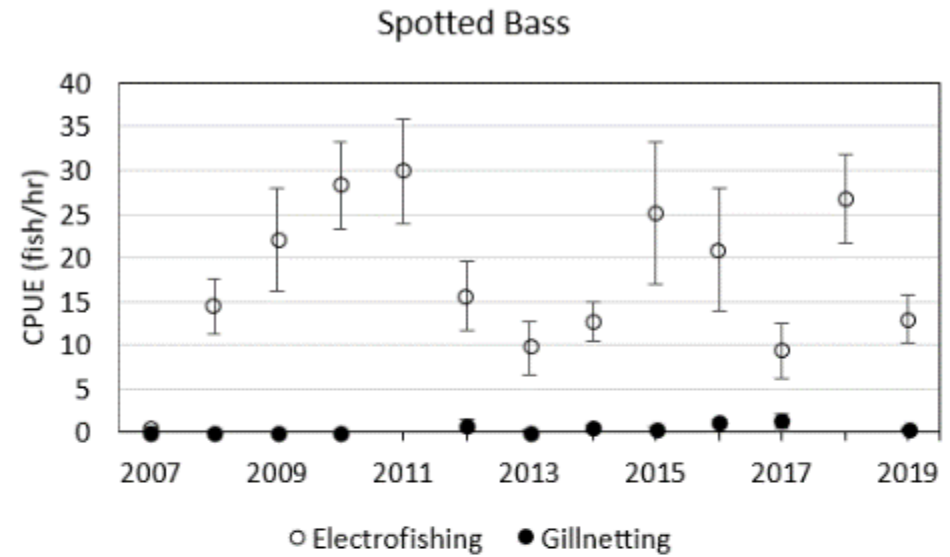
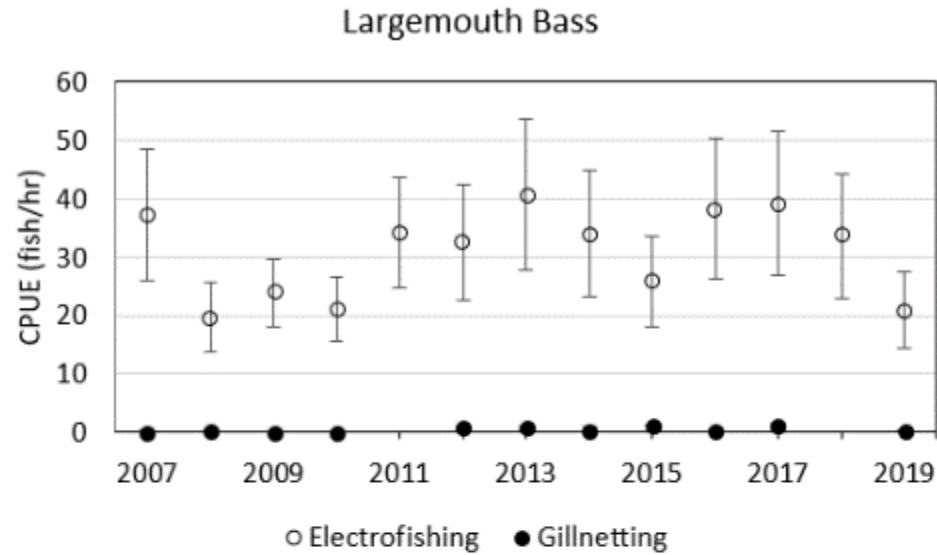


Lake Jackson Sport Fish Stocking

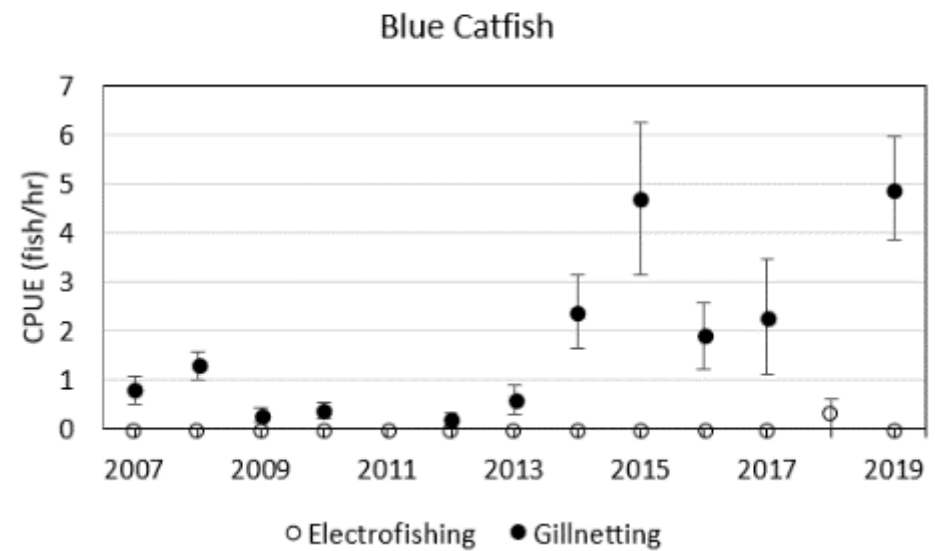
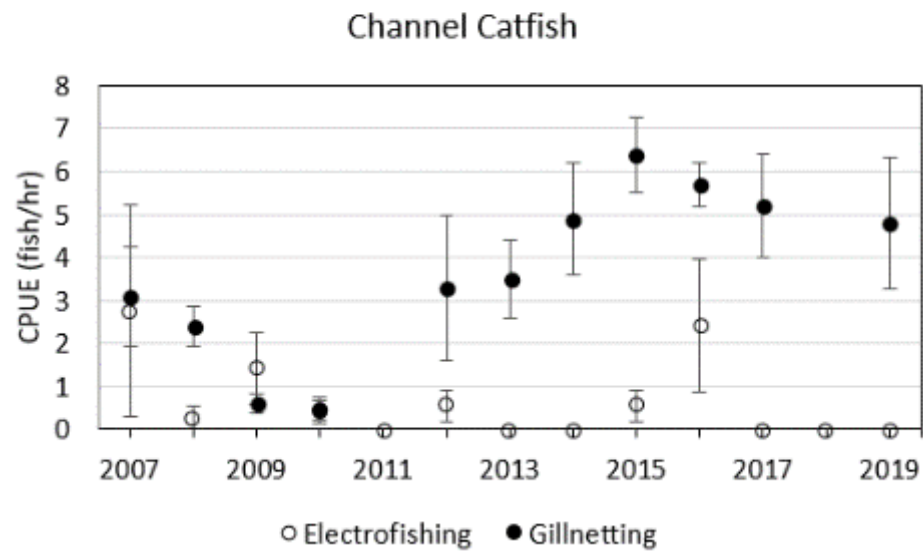
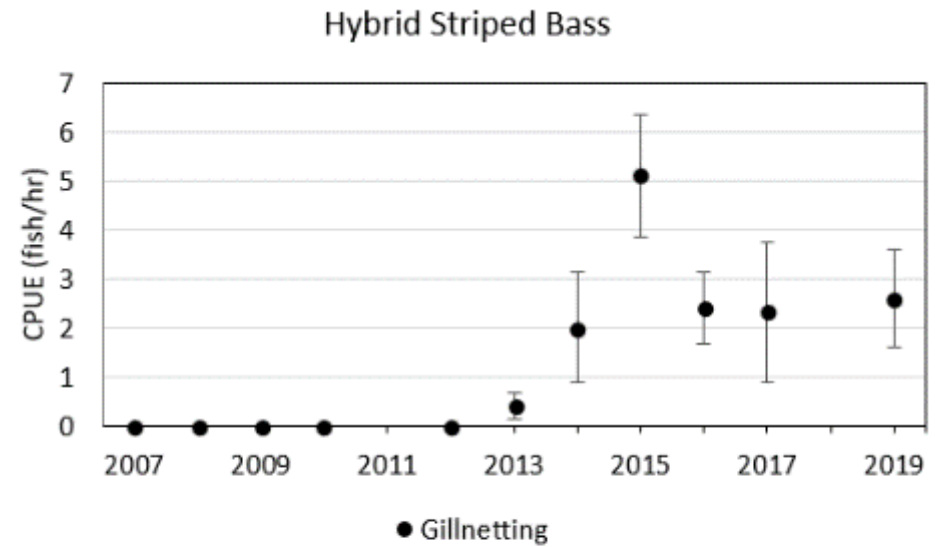
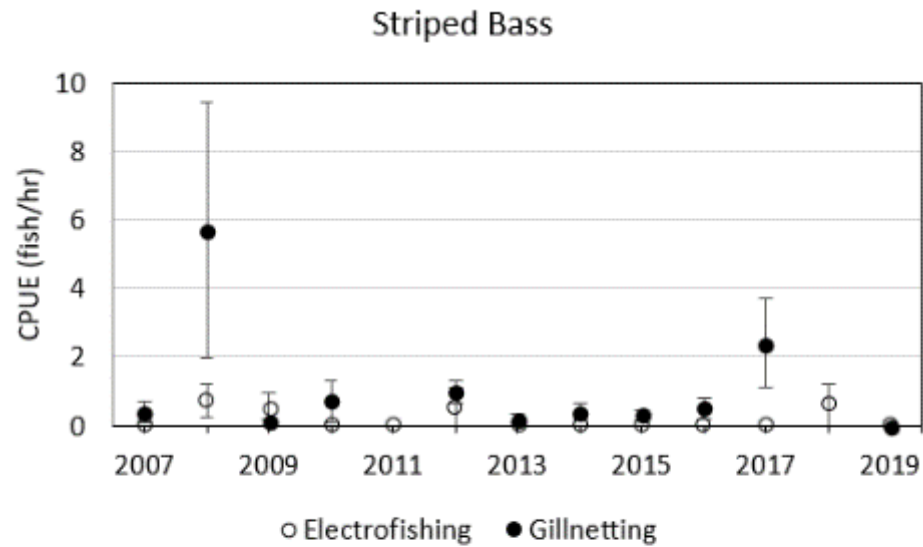
- GDNR stocks both Striped Bass and Hybrid Bass annually
- Largemouth Bass also stocked recently
- Experimental stocking of American Shad, a migratory species, began in 2016 as part of basin-wide efforts to conserve the Altamaha River stock

Year	Striped Bass Number	Striped Bass Fish per Acre	Hybrid Bass Number	Hybrid Bass Fish per Acre	Largemouth Bass Number	Largemouth Bass Fish per Acre
2015	14,414	3	33,250	7	--	--
2016	14,498	3	33,200	7	--	--
2017	14,288	3	33,525	7	395,407	83
2018	21,503	5	42,850	9	36,479	8
2019	25,254	5	42,250	9	76,390	16
Average	17,991		37,015		169,425	

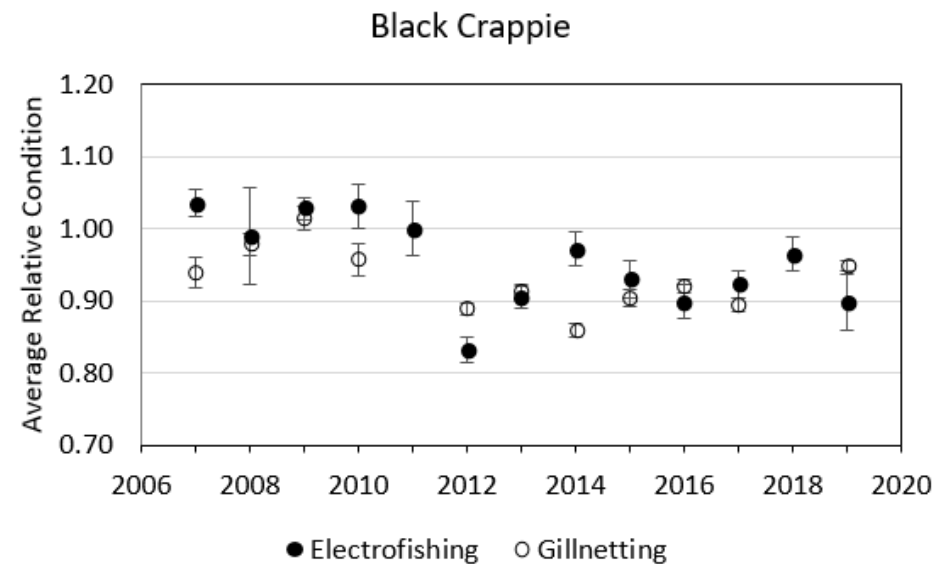
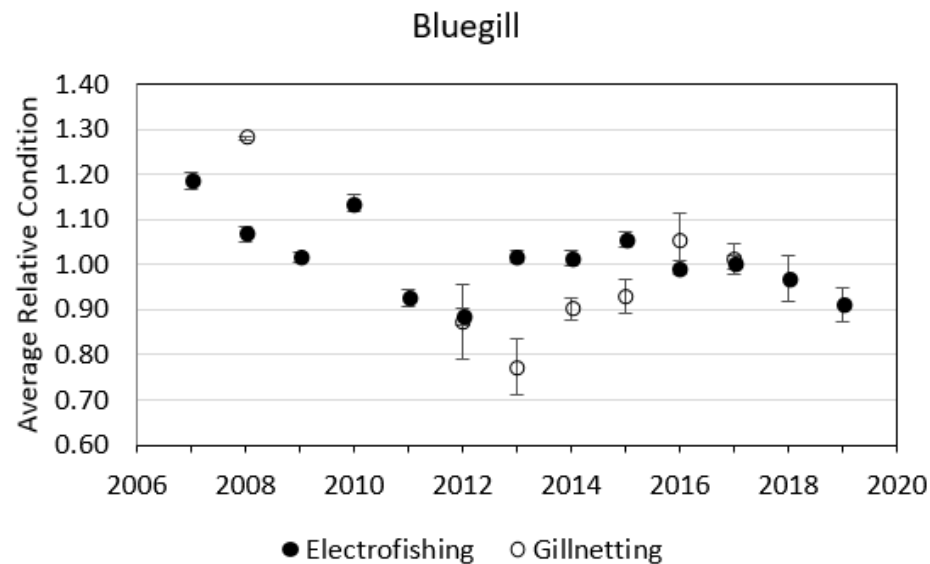
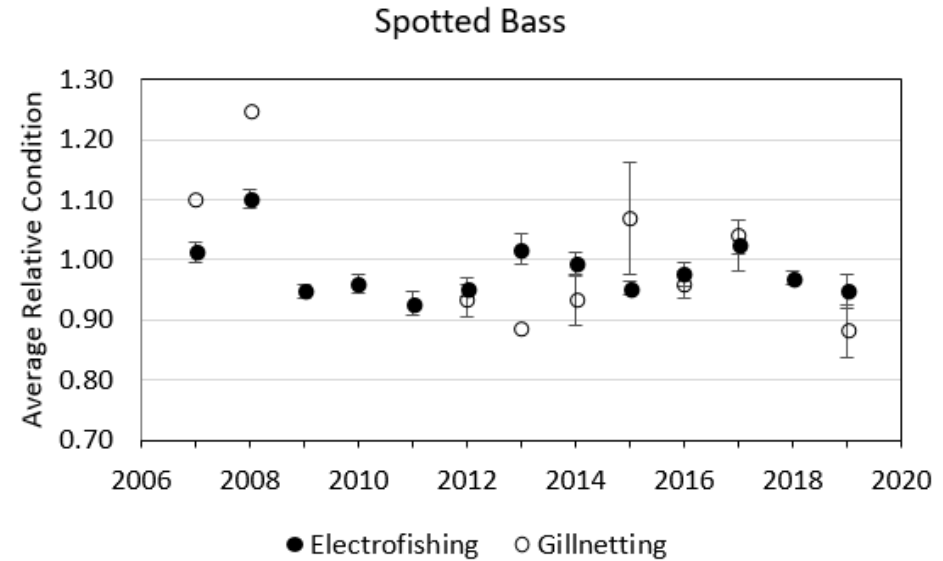
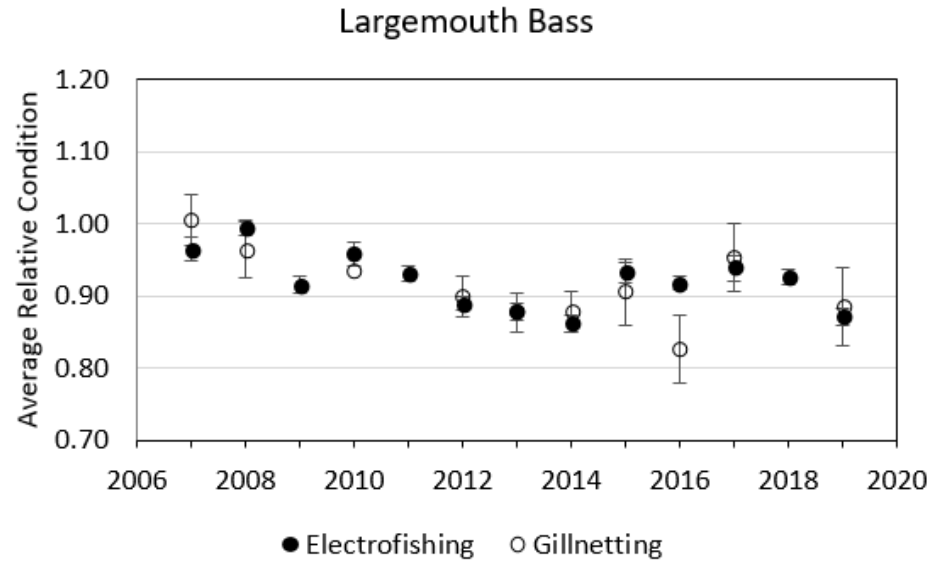
Catch Rates – Largemouth Bass & Other Sunfish



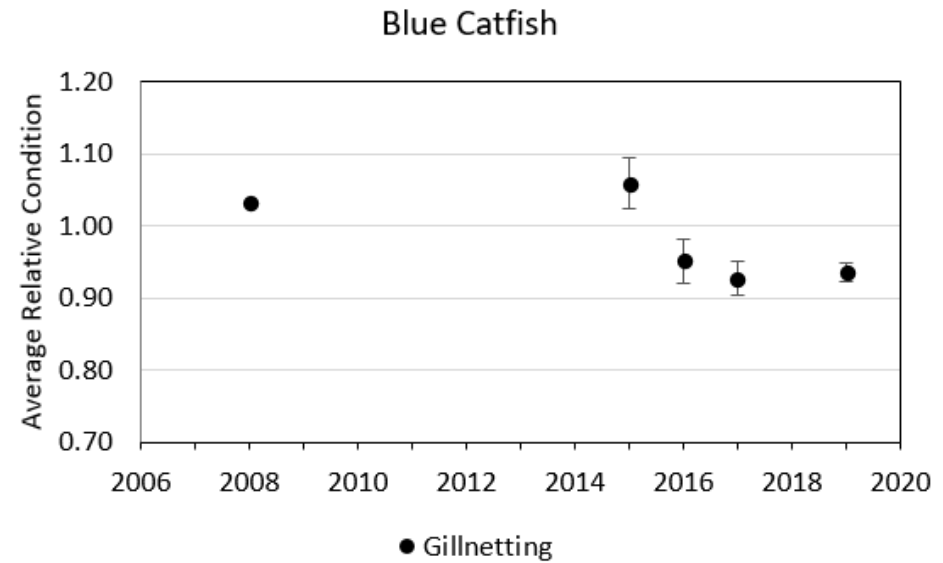
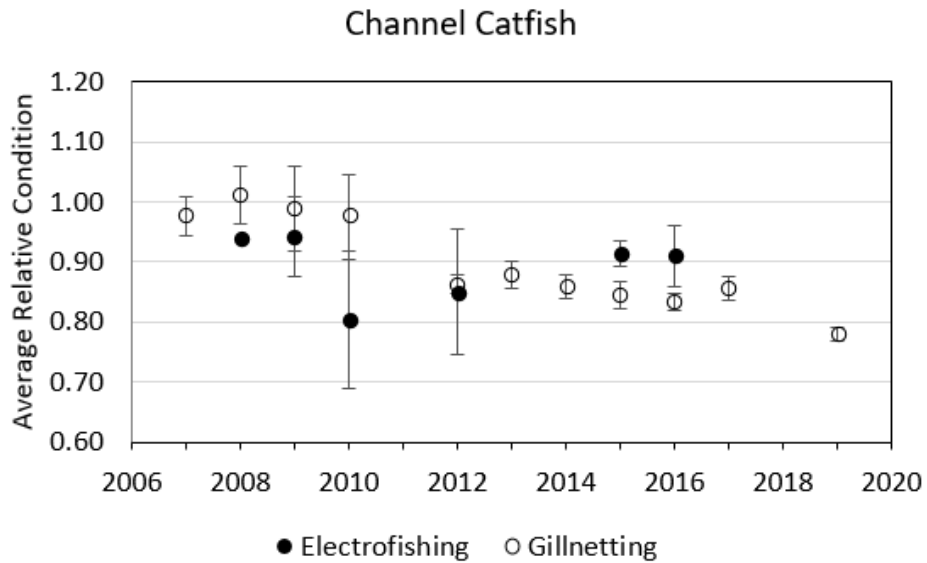
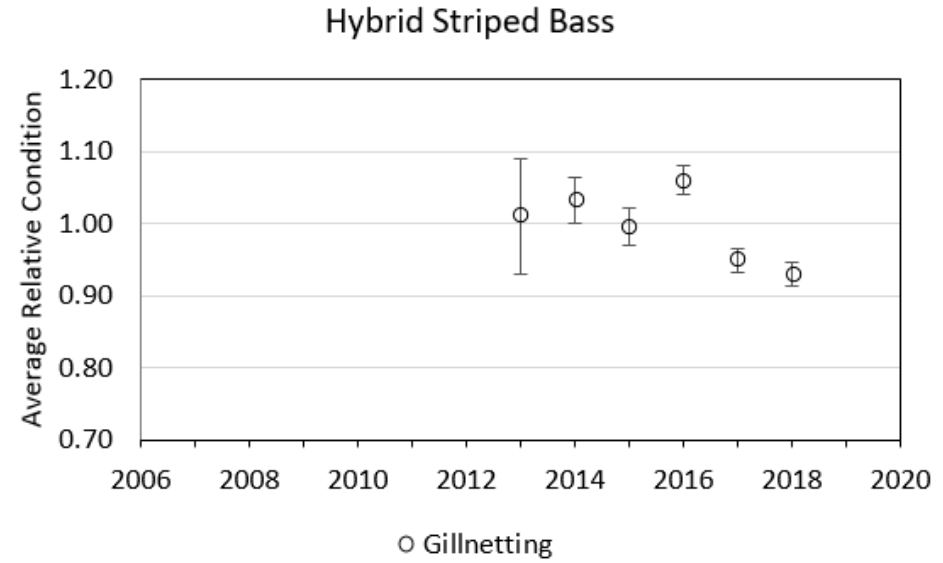
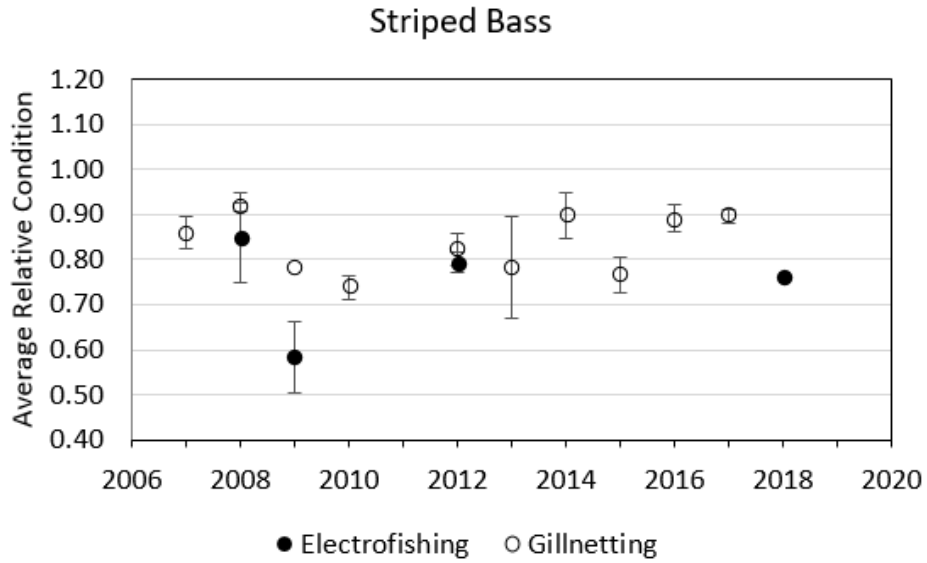
Catch Rates – Striped Bass, Hybrid Bass & Catfish



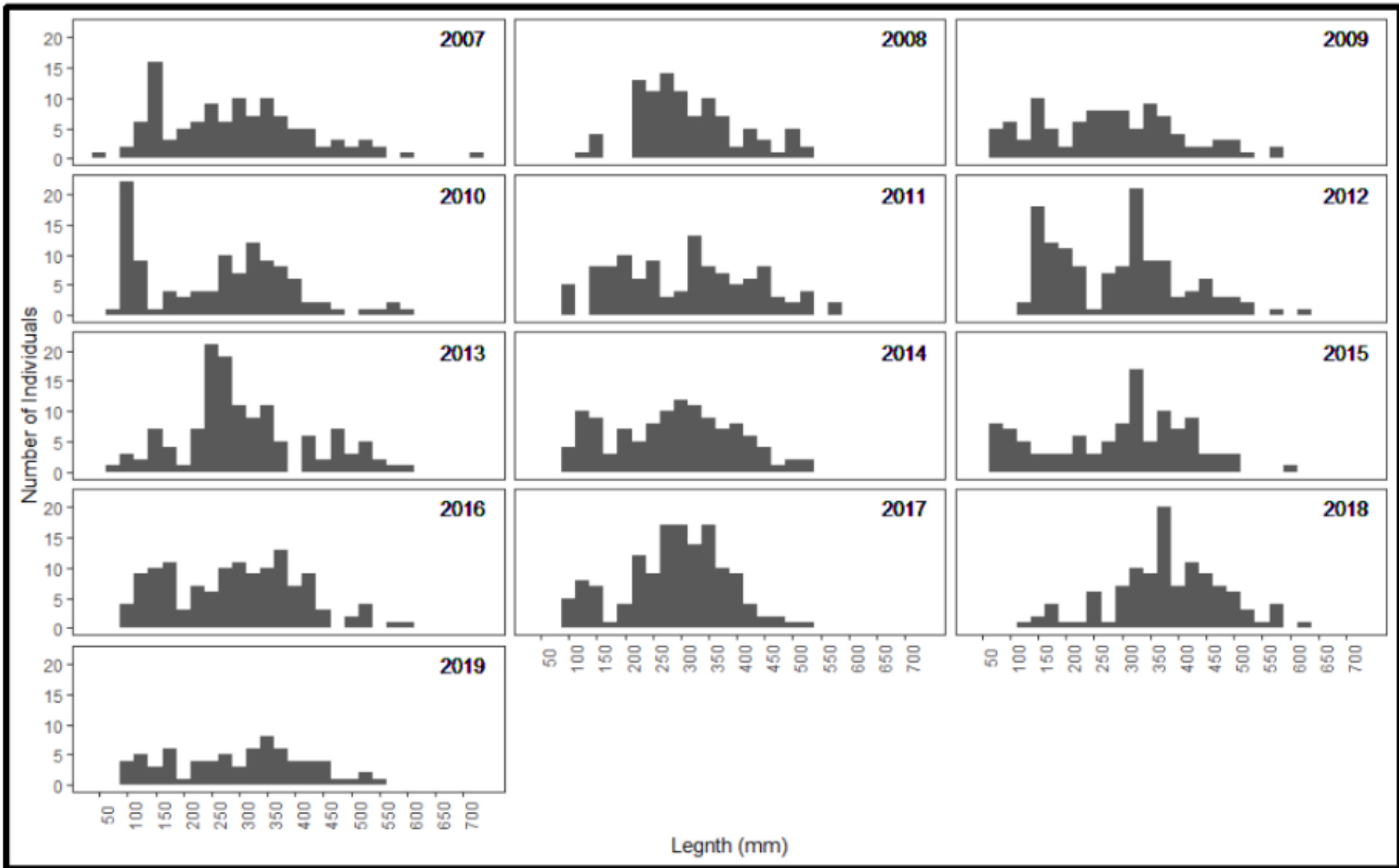
Relative Condition – Largemouth Bass & Other Sunfish



Relative Condition – Striped Bass, Hybrid Bass & Catfish



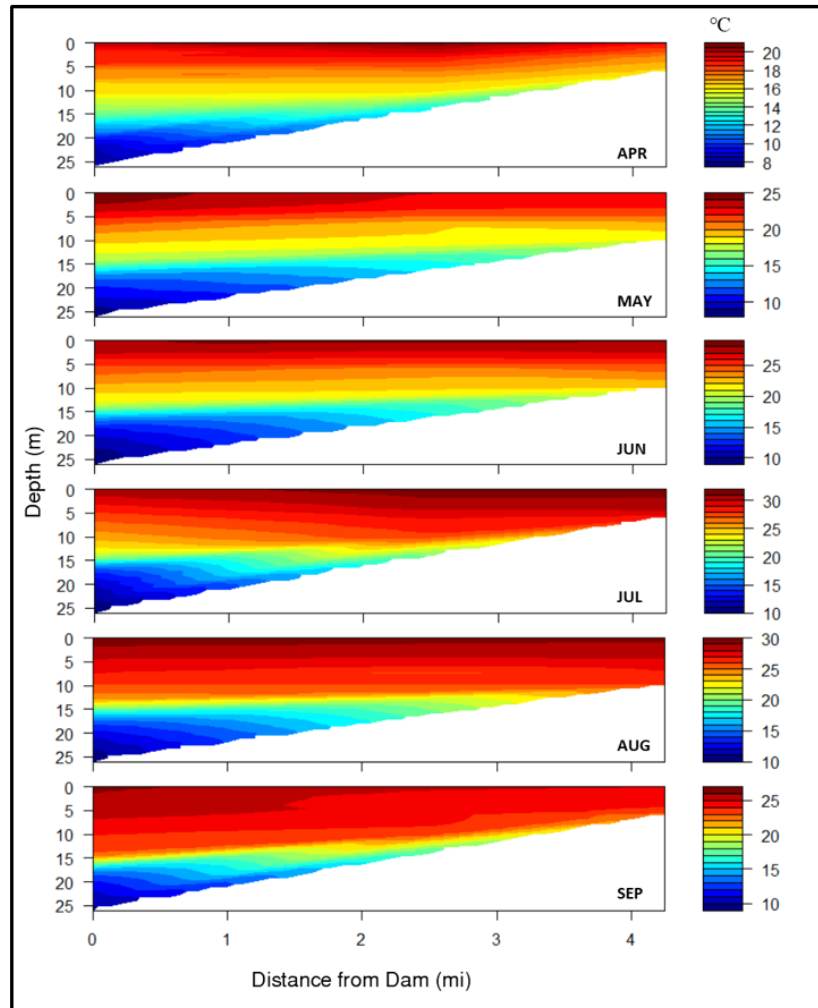
Length-Frequency – Largemouth Bass



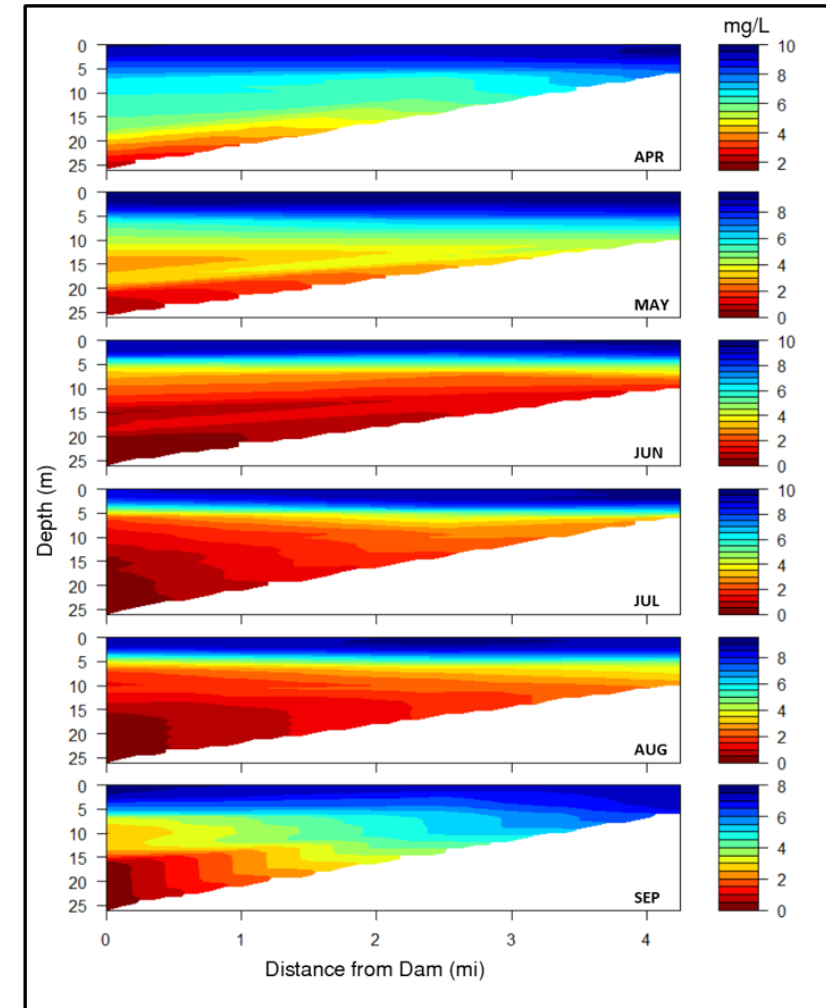
Lake Jackson Vertical Profile – Longitudinal View

Data from Forebay (JA1), Mid-lake (JA3), and Upper Lake (JA5):

Temperature (°C)



Dissolved Oxygen (mg/L)



Summary – Habitat for Primary Sport Fish Species

- GDNR standardized fishery survey data indicate an overall healthy and balanced fish community typical of southeastern Piedmont reservoirs
- Water quality monitoring data show that water temperature and DO conditions remain within acceptable ranges for Largemouth Bass and most other resident sport fish species throughout the year
- Low catch rates and relative condition of Striped Bass reflect limiting availability of suitable habitat in the summer, as a result of seasonal vertical stratification
 - Upper water column with stressful or lethal temperature (~28C and higher)
 - Lower water column with DO levels less than 3 mg/L
- Hybrid Bass, which tolerate warmer temperatures than Striped Bass, exhibited higher relative condition

Downstream Riverine Habitat

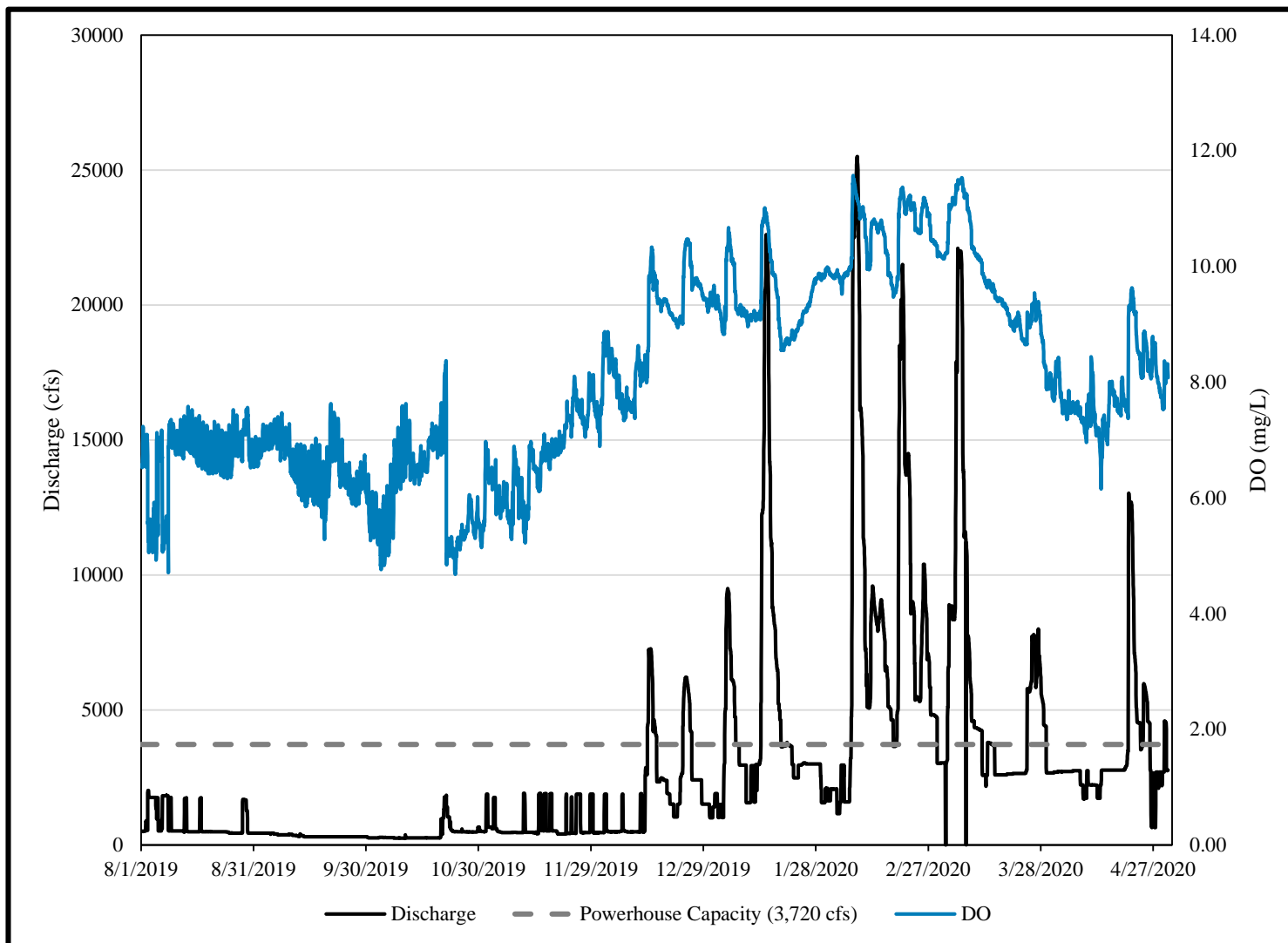
Methods – Downstream Riverine Habitat

- Continuous water temperature and DO monitoring data evaluated against generation flows
- Review existing instream flow study; evaluate potential for changes in channel stability that could influence habitat-discharge relationships
- Review existing information on Robust Redhorse, other riverine species, and diadromous fish



Results – Downstream Water Quality

- Continuous tailrace monitoring data and GEPD data show that water temperature, DO, and pH meet applicable criteria
- The summer 2019 continuous DO data demonstrate effective performance of the draft tube aeration system



Instream Flow Study

- Instream Flow Incremental Methodology (IFIM) used to evaluate habitat-discharge relationships for fish species and life stages of interest
- Conducted in consultation with GDNR and USFWS
- 17-mile study reach of Ocmulgee River
- 12 species/life stages
- Habitat suitability criteria derived from site-specific field studies
- Physical Habitat Simulation Model (PHABSIM) produced habitat versus discharge relationships for each species life stage

Altamaha shiner



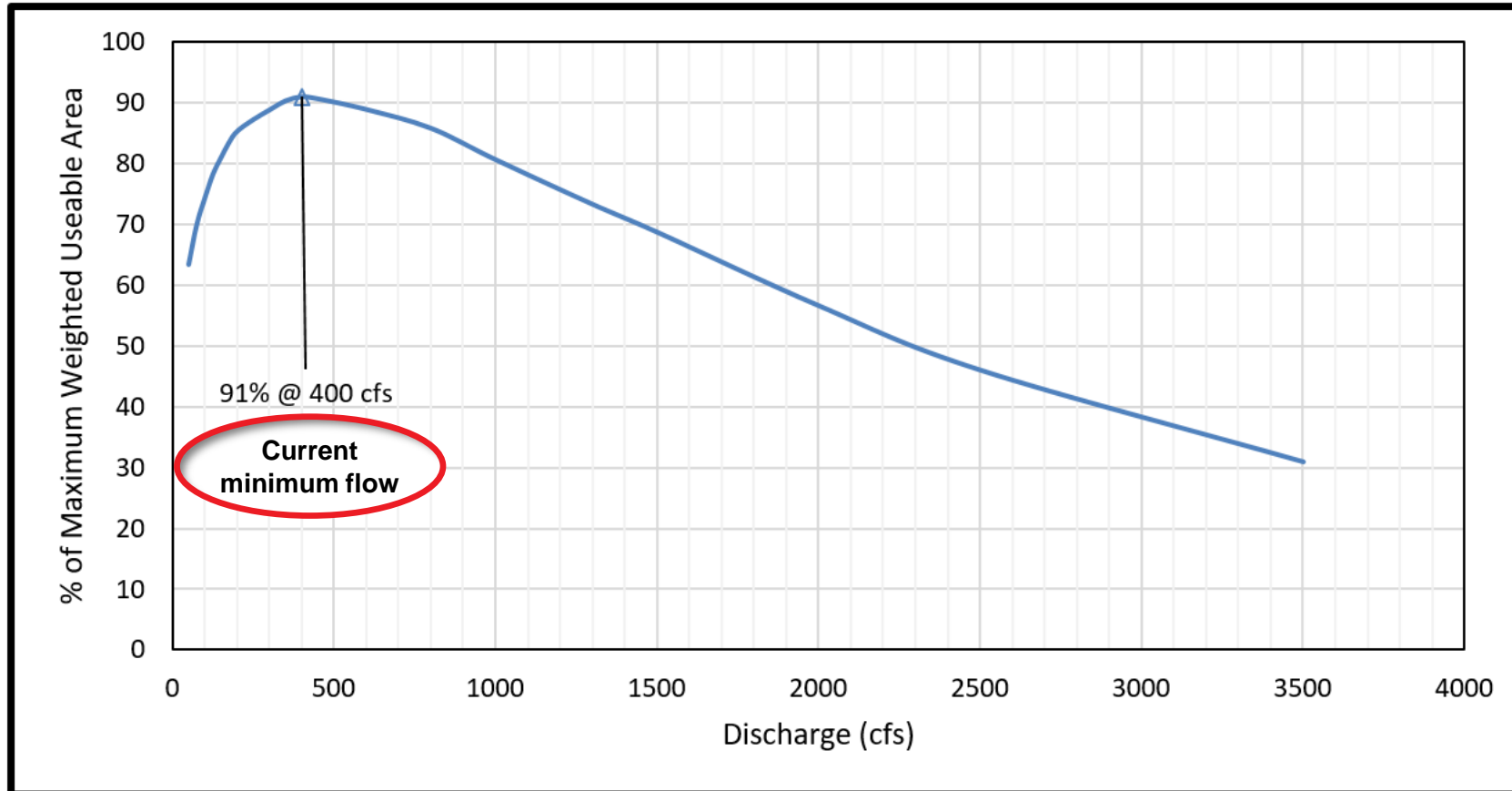
Nate Tessler, NANFA.org

Species	Life Stage
Altamaha Shiner	Juvenile
	Adult
Redeye Bass	YOY
	Juvenile
	Adult
Shoal Bass	YOY
	Adult
Redbreast Sunfish	Spawning
	Adult
Striped Jumprock	Juvenile
	Adult
Notchlip Redhorse ^a	Adult

^a Previously referred to as Silver Redhorse

Instream Flow Study – PHABSIM Results

- Discharge versus percent maximum weighted usable area for all species and life stages within the spawning and non-spawning seasons



Matrix Analysis of Optimum Minimum Flow

Habitat Expressed as Percent Maximum Weighted Usable Area

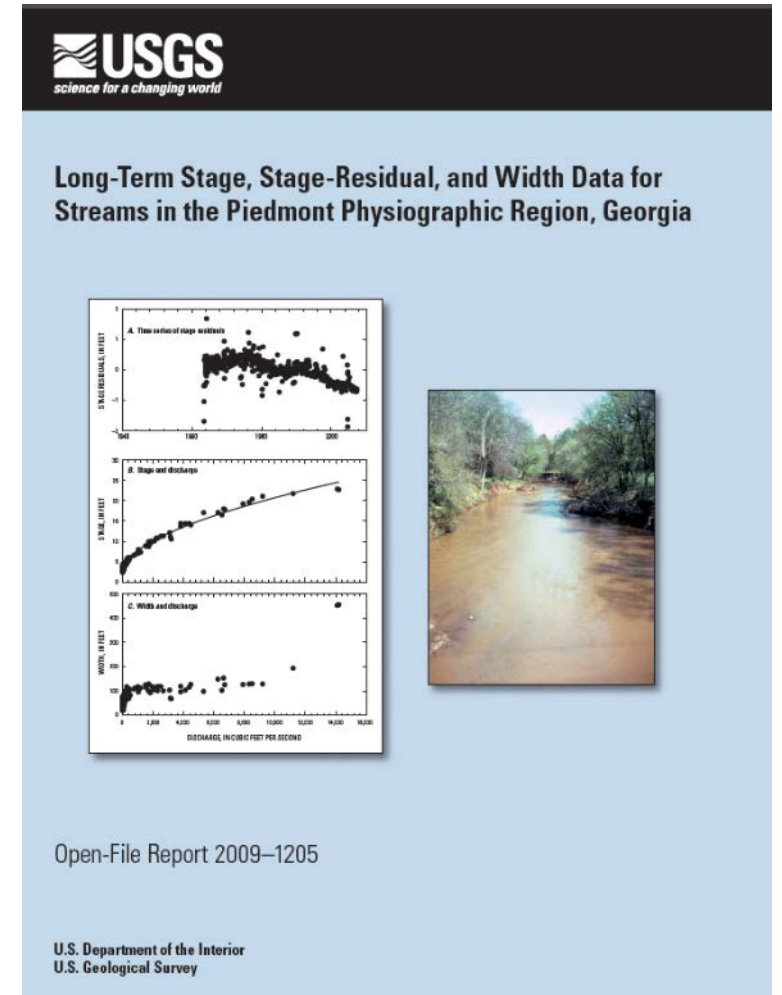
Species – Life Stage	Discharge (cfs)													
	50	100	150	200	250	300	350	400	450	600	800	1,000	1,500	3,500
Altamaha Shiner – YOY	52	71	81	86	91	95	97	99	100	97	93	83	64	20
Altamaha Shiner – adult	48	64	76	83	88	92	96	98	97	100	97	92	75	33
Redeye Bass – YOY	90	97	99	100	99	98	96	94	91	83	74	66	51	21
Redeye Bass – juvenile	65	73	80	84	87	90	94	95	96	100	100	98	87	34
Redeye Bass – adult	39	53	63	71	75	77	82	86	89	94	98	100	93	55
Redbreast Sunfish – spawn	84	93	98	100	100	100	98	97	96	87	78	69	54	31
Redbreast Sunfish – adult	67	77	84	89	92	93	95	97	98	100	100	98	85	29
Shoal Bass – YOY	93	98	99	96	92	88	86	82	77	65	52	42	26	11
Shoal Bass – adult	41	54	62	70	76	82	87	91	93	97	100	97	86	41
Striped Jumprock – YOY	98	99	99	96	90	84	81	75	69	54	39	27	17	8
Striped Jumprock – adult	45	61	71	79	85	90	92	95	97	99	100	97	87	39
Notchlip Redhorse – adult	39	52	60	67	72	77	80	83	85	91	99	99	99	50
Overall Average	63.4	74.3	81.0	85.1	87.3	88.8	90.3	91.0	90.7	88.9	85.8	80.7	68.7	31.0

Lowest flow release
in recent years

Current
minimum flow,
or inflow

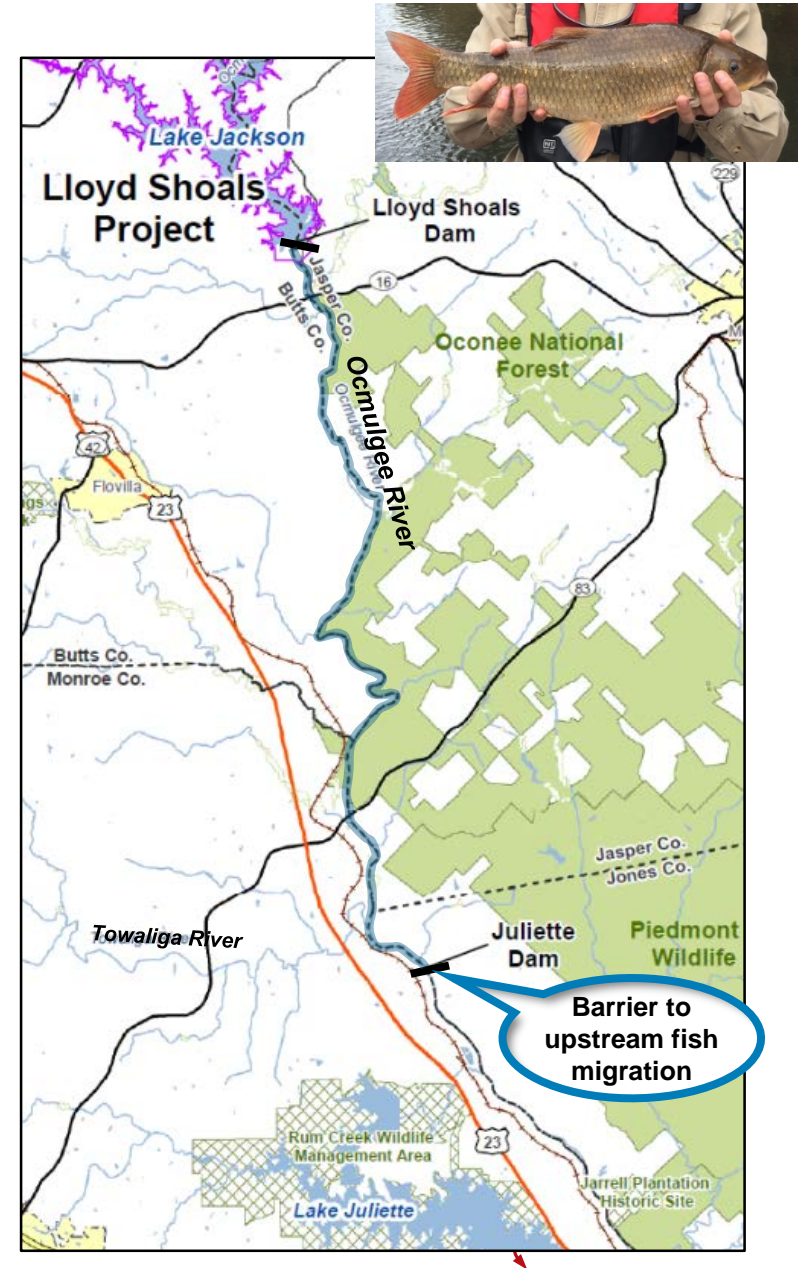
Evidence for Stability of River Channel

- USGS geomorphic analysis (2009) found the Ocmulgee River near Jackson to exhibit channel stability over a 32-year period
- IFIM habitat mapping revealed bedrock to be the dominant or subdominant substrate at the majority of mapped river sections
- Aerial imagery indicates little change in land use and adjacent floodplains since the IFIM study
- Flow contribution of tributaries small compared to Lloyd Shoals releases (<5% of minimum flow)



Robust Redhorse Conservation

- Candidate Conservation Agreement with Assurances (CCAA) for Robust Redhorse
 - Species reintroduced to Ocmulgee River below Lloyd Shoals Dam in 2002-2005
 - Georgia Power funds studies and monitoring of movements, habitat use, spawning, and recruitment
- Spawning activities reported in Lloyd Shoals tailrace in 2010-2011 but recruitment not confirmed
- In 2014, GDNR captured juvenile far downstream in Coastal Plain, documenting successful recruitment



Summary – Downstream Riverine Habitat

- Continuous tailrace monitoring data and data collected by GEPD farther downstream indicate adequate water quality for riverine species
- Review of the IFIM study indicates that the current minimum flow of 400 cfs, or inflow, whichever is less, would continue to protect habitat for a variety of representative riverine species and life stages downstream of the Project
- Georgia Power is currently working with partners USFWS and GDNR to renew the CCAA for Robust Redhorse beyond its current term



Georgia
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American Eel Abundance and Upstream Movements

Presented by: Patrick O'Rourke

Study Results Meeting
Lloyd Shoals Project
July 29, 2020

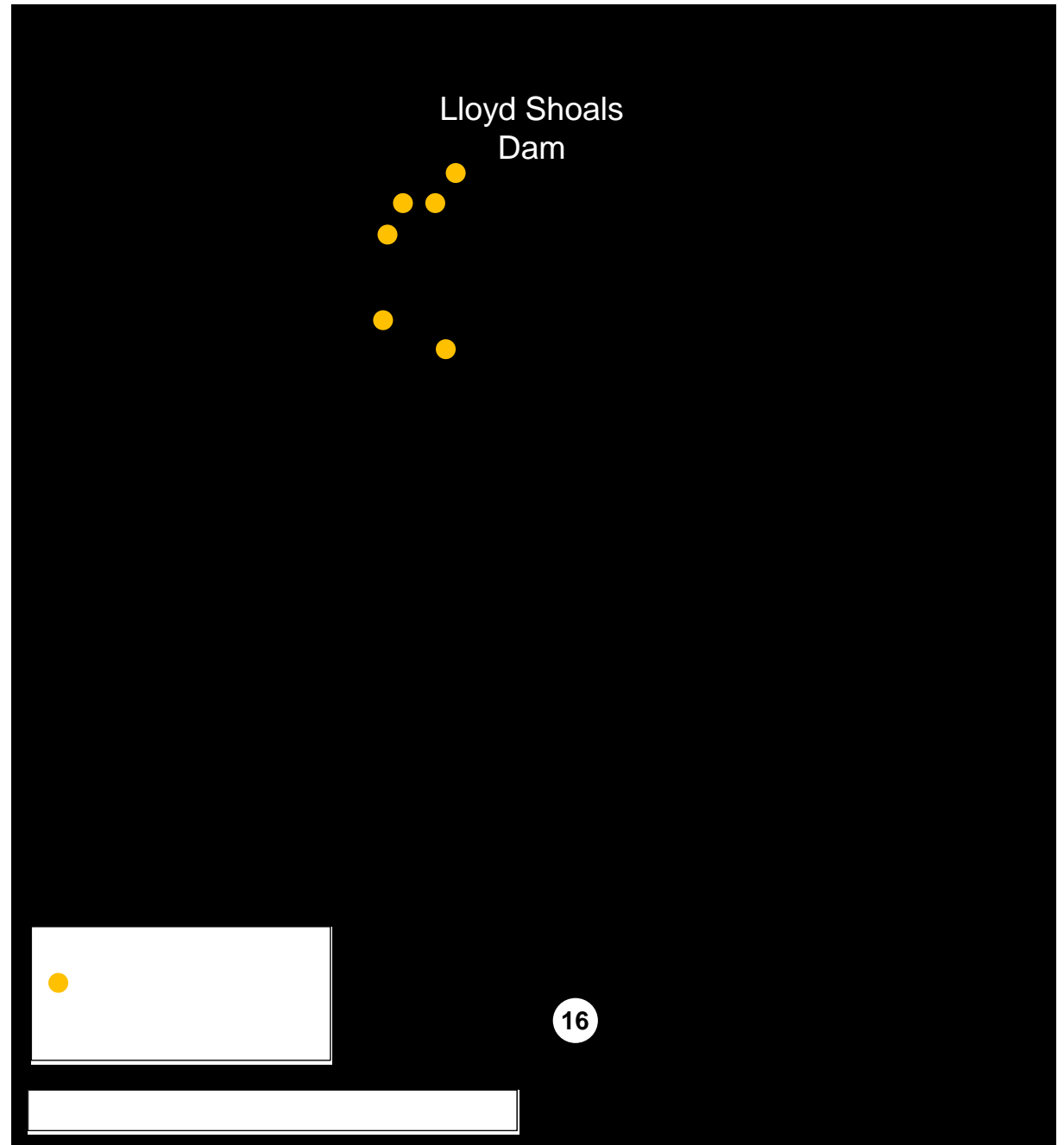
Study Objectives

- Identify the life stage and size range of American Eel migrating to Lloyd Shoals Dam
- Identify the timing of upstream movements of American Eel migrating to Lloyd Shoals Dam in terms of seasonality and correlation to environmental variables, including discharge, water temperature, and the percent of moon illumination
- Calculate indices of abundance of American Eel migrating to Lloyd Shoals Dam



Study Area

- Ocmulgee River from Lloyd Shoals Dam downstream to Georgia Hwy 16 bridge (1.2 miles)



Study Methods

American Eel Study Methods

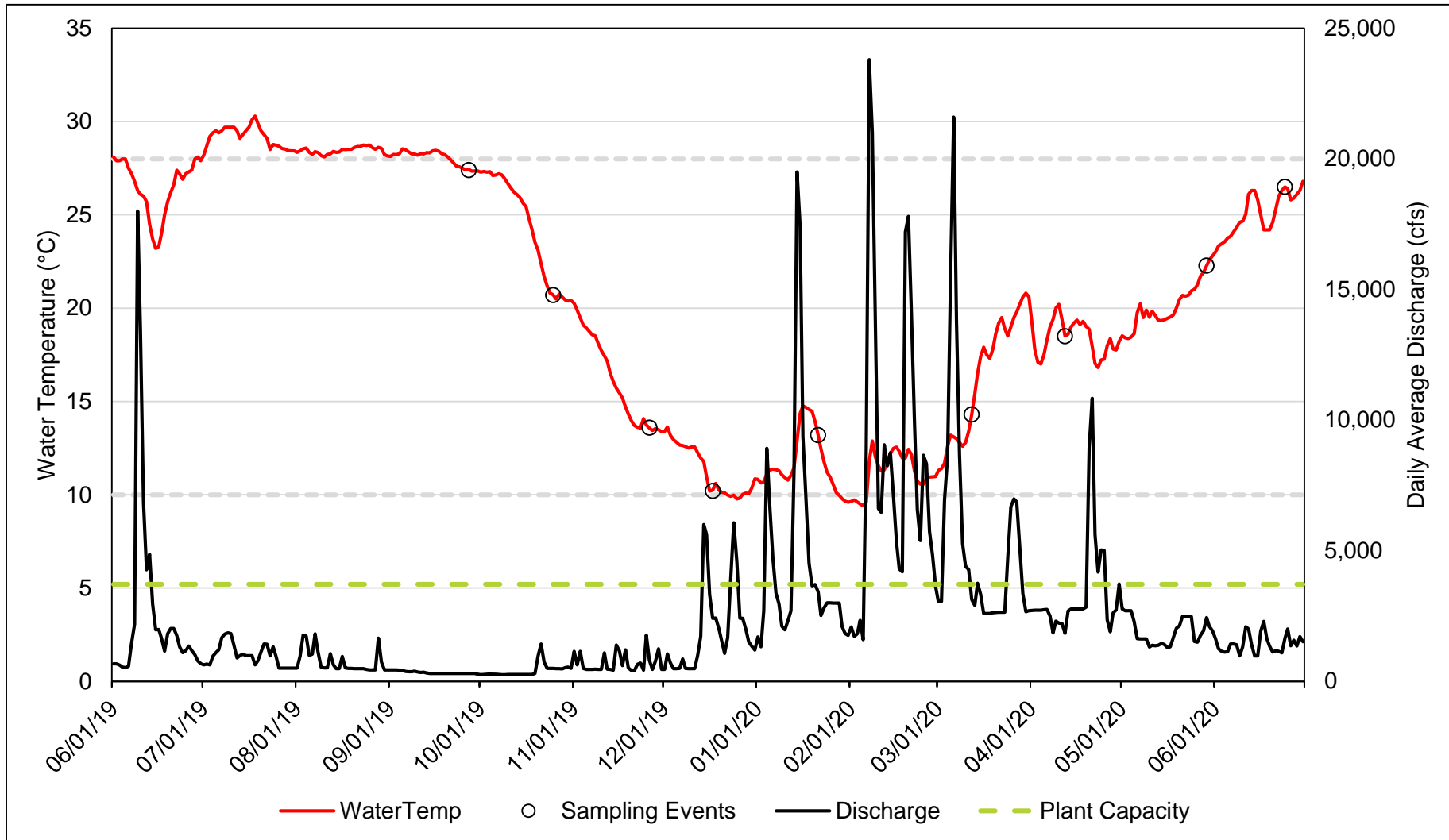


- Sampling once per month when water temperatures are between 10-28°C
- Boat electrofishing – 2 hours effort
- Backpack electrofishing – 1 hour effort
- Trapping – 2 consecutive nights



Study Results

River Discharge and Water Temperature



----- 10-28°C Water Temperature Range

American Eel Capture Data by Sampling Event



Length (mm)
Minimum: 130
Maximum: 575

Weight (g)
Minimum: 15
Maximum: 468

DATE	DISCHARGE (CFS)	WATER TEMPERATURE (°C)	TOTAL EELS CAPTURED OR OBSERVED		
			BOAT	BACKPACK	TRAP
09/27/2019	299	27.4	0	0	0 ³
10/25/2019	493	20.8	1	1	0 ³
11/26/2019	1,288	13.7	1	0	0 ³
12/17/2019	2,870	10.2	0	NSF ¹	0 ³
01/21/2020	3,565	13.6	6	NSF	0 ³
03/12/2020	3,020	13.9	1	NSF	0
04/10/2020	2,230	20.2	NSC ²	NSC	0
05/29/2020	2,440	22.3	10	NSF	0
06/24/2020	1,640	26.5	3	NSF	0
07/22/2020	658	29.7	7	26	1

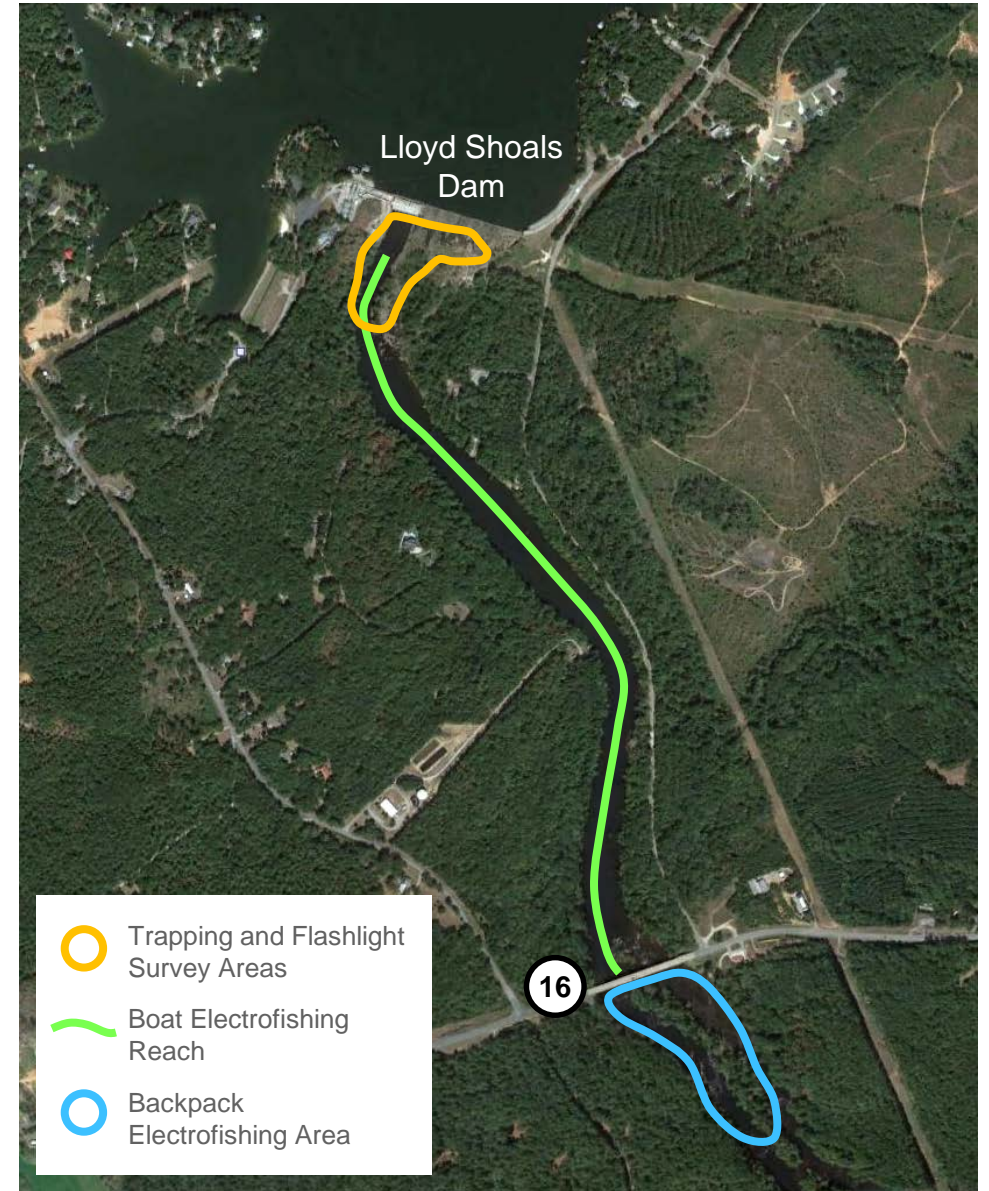
¹ Not Sampled due to high flows

² Not Sampled due to COVID-19

³ Traps vandalized

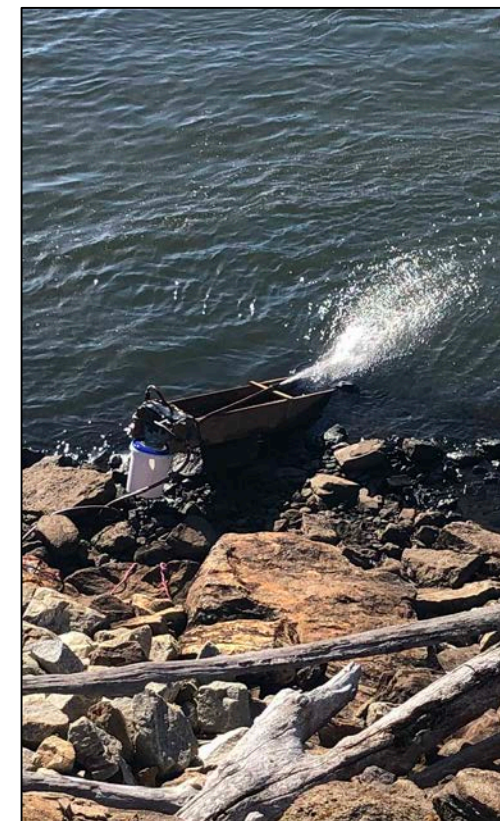
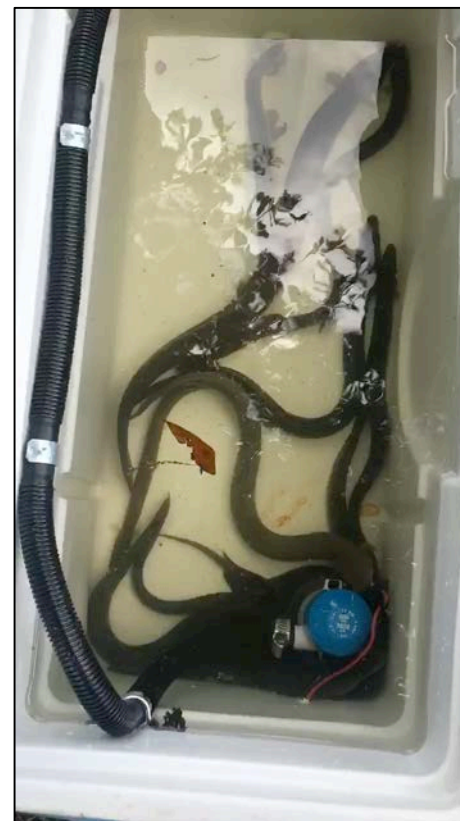
Modifications to First Season of Study

- Extend monthly sampling to October 2020
- Extend study area to shoal complex just downstream of Georgia Hwy 16 and focus backpack electrofishing efforts there to improve sampling access to shallow-water habitats
- Deploy ramp trap on west side of powerhouse
- Perform nighttime observations in tailrace and spillway area using flashlights to enhance detection of eels migrating to base of dam



July 22-23, 2020 Sampling

- Deployed ramp trap on west side of powerhouse (*no eels captured*)
- Conducted backpack electrofishing in shoals downstream of Hwy 16 (*34 eels captured/observed*)
- Perform nighttime observations in tailrace and spillway area using flashlights to enhance detection of eels migrating to base of dam (*one eel observed*)



Summary

- The size range of eels captured (130 – 450 mm) indicates a range of year-classes are present (est. age 1 – 9 years)
- Sampling effectiveness has been impacted by high flows and COVID-19
- Catch rates of American Eel have been low compared to previous studies
- Sampling will be extended to October 2020 and include the shoals below Hwy 16 which were sampled in the previous study
- Additional methods will be employed to provide more robust information

NOTE: Nighttime flashlight surveys on June 24 and July 22 detected the presence of at least four eels in pools immediately below the spillway.



Georgia
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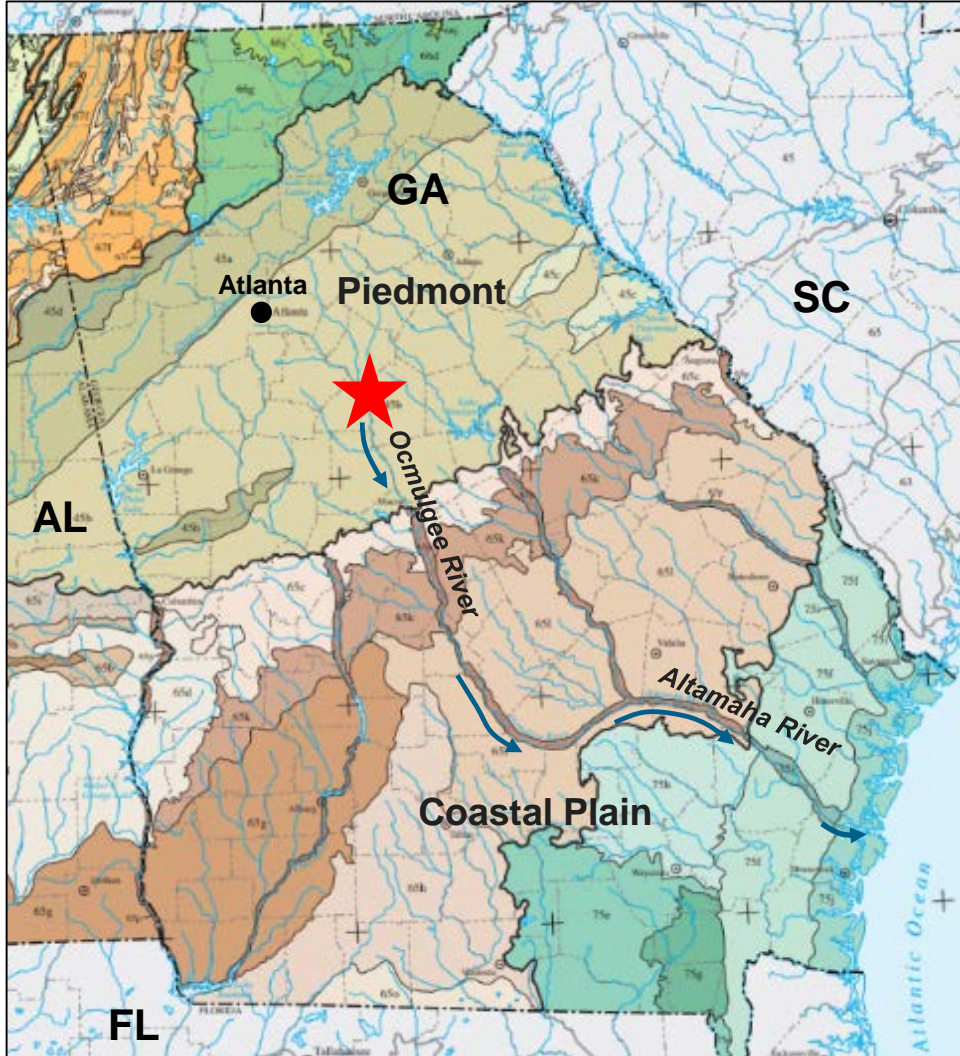
Geology and Soils

Presented by: Steve Layman, Kleinschmidt Associates

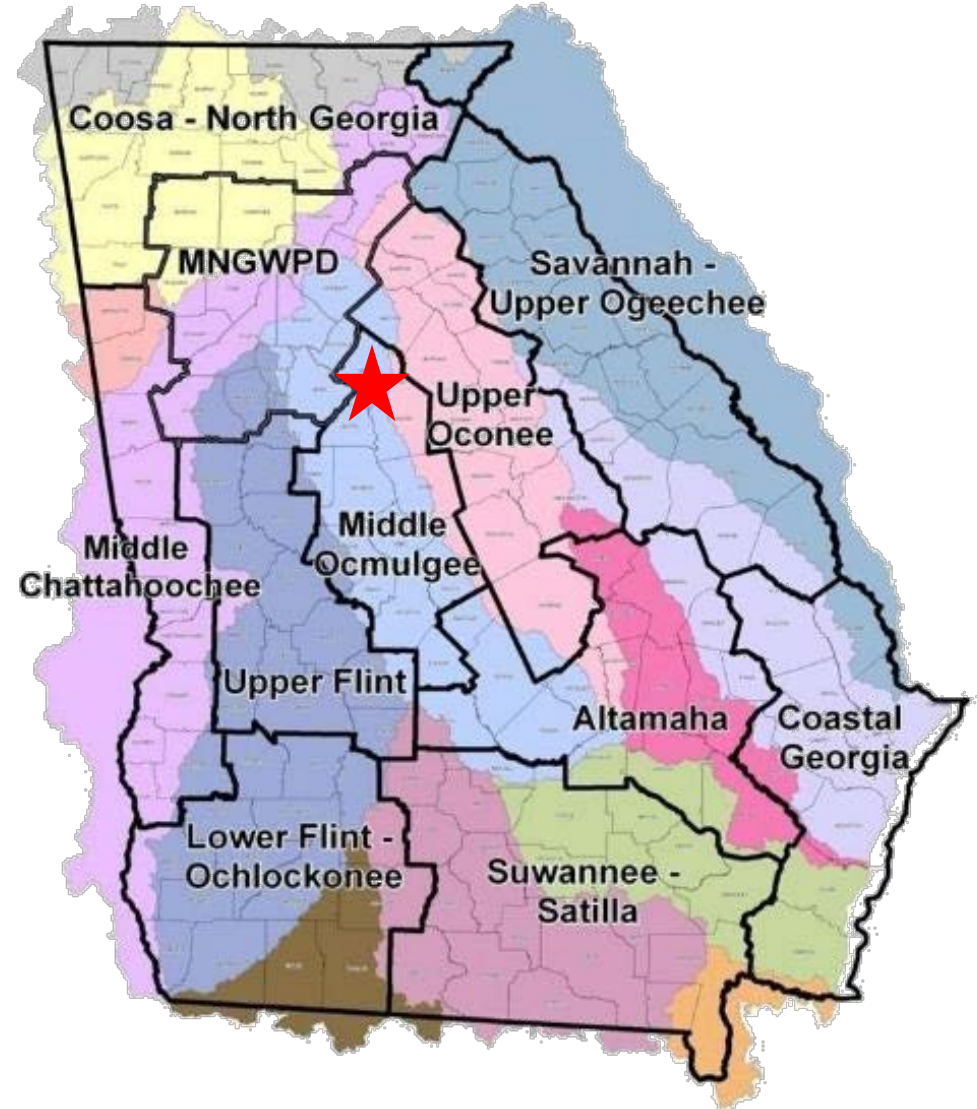
Study Results Meeting
Lloyd Shoals Project
July 29, 2020

Project Location (★)

Ecoregions



Water Planning Regions



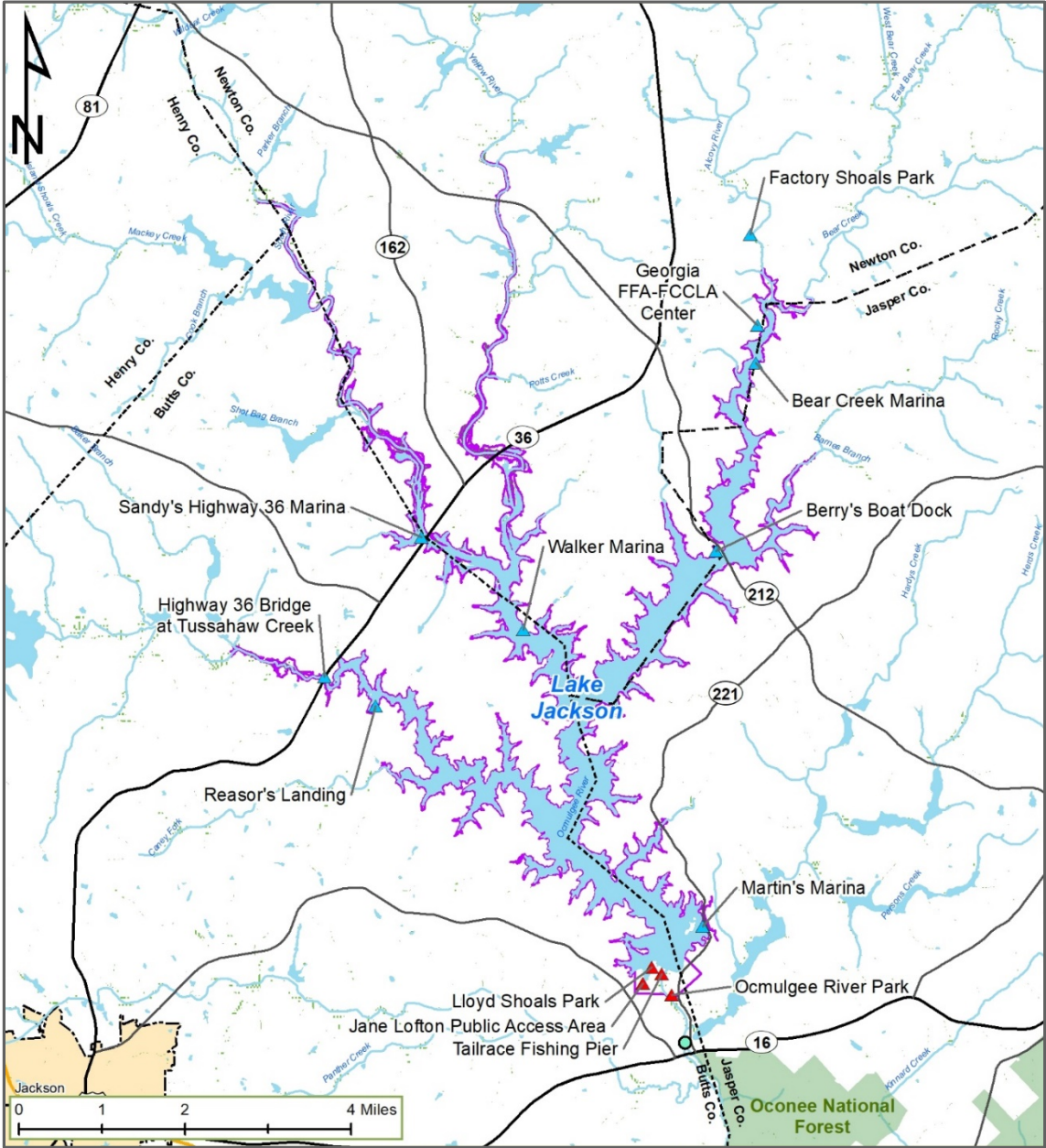
Study Objectives

- Characterize existing shoreline conditions with respect to erosion and sedimentation in Lake Jackson and the Lloyd Shoals tailrace
- Evaluate the effects of continued project operation and project-related recreation on shoreline erosion and sedimentation
- Evaluate the effects of continued project operation on sediment transport and accumulation, including contaminated sediment
- Conduct a shoreline aquatic habitat survey and literature review on the effects of shoreline stabilization structures on littoral-zone aquatic habitat

Study Area

- FERC project boundary around Lake Jackson and tailrace area downstream, including the project recreation facilities

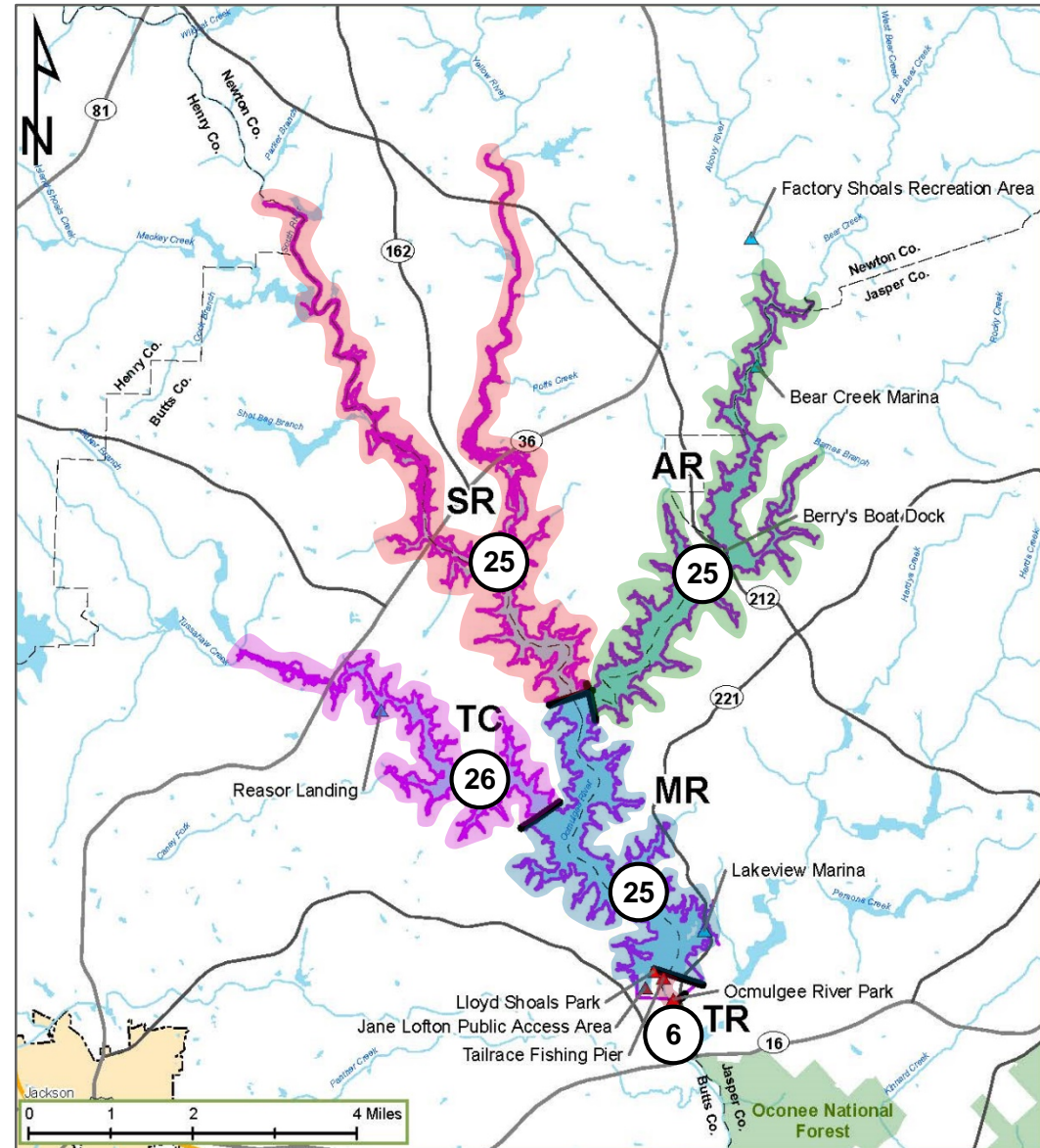
- Project Boundary
- ▲ Project Recreation Facilities



Study Methods

Methods – Shoreline Reconnaissance Survey

- Stratified random selection of 500-ft shoreline segments
- 107 total sites:
 - SR = South River
 - AR = Alcovy River
 - TC = Tussahaw Creek
 - MR = Mainstem reservoir
 - TR = Tailrace area



Methods – Shoreline Reconnaissance Survey

- Site information
- Shoreline vegetative buffer zone condition
- Land uses
- Bank stability & vegetative protection
- Stabilization practices
- Potential sources of erosion (project & non-project related)
- Shoreline fish cover/habitat

Figure 2-2. Shoreline Reconnaissance Survey Form – Lloyd Shoals Project (FERC No. 2336)
Georgia Power Company

Site ID No.:		Date:	Time:
Waterbody: <input type="checkbox"/> Lake Jackson <input type="checkbox"/> Tallrace		County: <input type="checkbox"/> Butts <input type="checkbox"/> Henry <input type="checkbox"/> Jasper <input type="checkbox"/> Newton	
Site Description:			GPS?: <input type="checkbox"/> Yes <input type="checkbox"/> No
Adjacent Land Ownership: <input type="checkbox"/> GPC <input type="checkbox"/> Residential <input type="checkbox"/> Commercial <input type="checkbox"/> Other			
Weather:		Reservoir Pool Level: <input type="checkbox"/> Full <input type="checkbox"/> Medium <input type="checkbox"/> Low	
Investigators:			Photos Taken?: <input type="checkbox"/> Yes <input type="checkbox"/> No

Length of Assessment Site: <input type="checkbox"/> 500 feet <input type="checkbox"/> Other: _____ feet		Active Erosion Problem Present?: <input type="checkbox"/> Yes <input type="checkbox"/> No
Shoreline Vegetative Buffer Zone Condition:	<input type="checkbox"/> Natural: heavily vegetated, less than 20 percent of natural vegetation removed	
	<input type="checkbox"/> Landscaped-Natural: disturbed and cleared up to 50 percent; some trees & understory remaining	
	<input type="checkbox"/> Landscaped: cleared of more than 50 percent natural vegetation or underbrush completely removed	
Land Uses Adjacent to Shoreline (check all that apply):		
<input type="checkbox"/> Residential	<input type="checkbox"/> Forested	<input type="checkbox"/> Golf Course
<input type="checkbox"/> Recreation/access	<input type="checkbox"/> Agricultural	<input type="checkbox"/> Commercial
<input type="checkbox"/> Open	<input type="checkbox"/> Logging	<input type="checkbox"/> Transportation
<input type="checkbox"/> Other: _____		

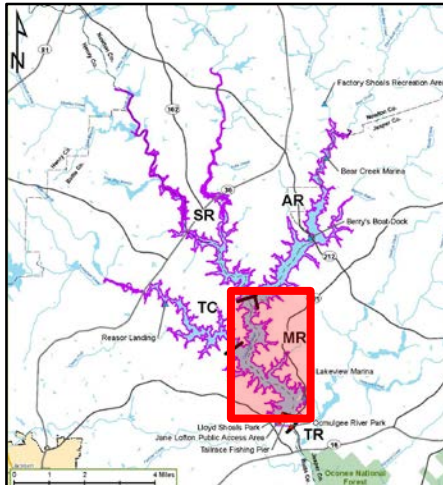
Bank Stability:	<input type="checkbox"/> Stable; minimal erosion; <5% affected by erosion; low potential for future problems
	<input type="checkbox"/> Moderately stable; 5-30% affected by erosion or slumping; slight erosion potential during floods
	<input type="checkbox"/> Moderately unstable; 30-70% affected by erosion or slumping; high erosion potential during floods
	<input type="checkbox"/> Unstable; >70% affected by erosion or slumping; mass erosion and bank failure evident
Bank Vegetative Protection:	<input type="checkbox"/> >90% of bank surfaces covered by healthy, living vegetation
	<input type="checkbox"/> 70-90% of bank covered by variety of vegetation; some open areas with disruption evident
	<input type="checkbox"/> 50-70% of bank covered by vegetation; scattered shrubs, grasses, and forbs; bare spots visible
	<input type="checkbox"/> <50% of bank with vegetative cover; any shrubs or trees are widely scattered; many bare spots

Shoreline Structural Stabilization Practices Present? <input type="checkbox"/> Yes <input type="checkbox"/> No (check all that apply):	
<input type="checkbox"/> Seawall/bulkhead only (_____% of site)	<input type="checkbox"/> Seawall/bulkhead and riprap combined (_____% of site)
<input type="checkbox"/> Riprap or other large stone only (_____% of site)	<input type="checkbox"/> Other armoring: _____ (_____% of site)
Potential Sources of Active Shoreline Erosion (check all that apply):	
<input type="checkbox"/> Land-disturbing activity	<input type="checkbox"/> Residential landscape
<input type="checkbox"/> Impervious surfaces	<input type="checkbox"/> Roads and bridges
<input type="checkbox"/> Stormwater runoff	<input type="checkbox"/> Recreation/access
<input type="checkbox"/> Reservoir fluctuations	<input type="checkbox"/> Wave action from watercraft/wind
<input type="checkbox"/> Lack of buffer vegetation	<input type="checkbox"/> Tributary inflow
<input type="checkbox"/> Livestock activity	<input type="checkbox"/> Other: _____

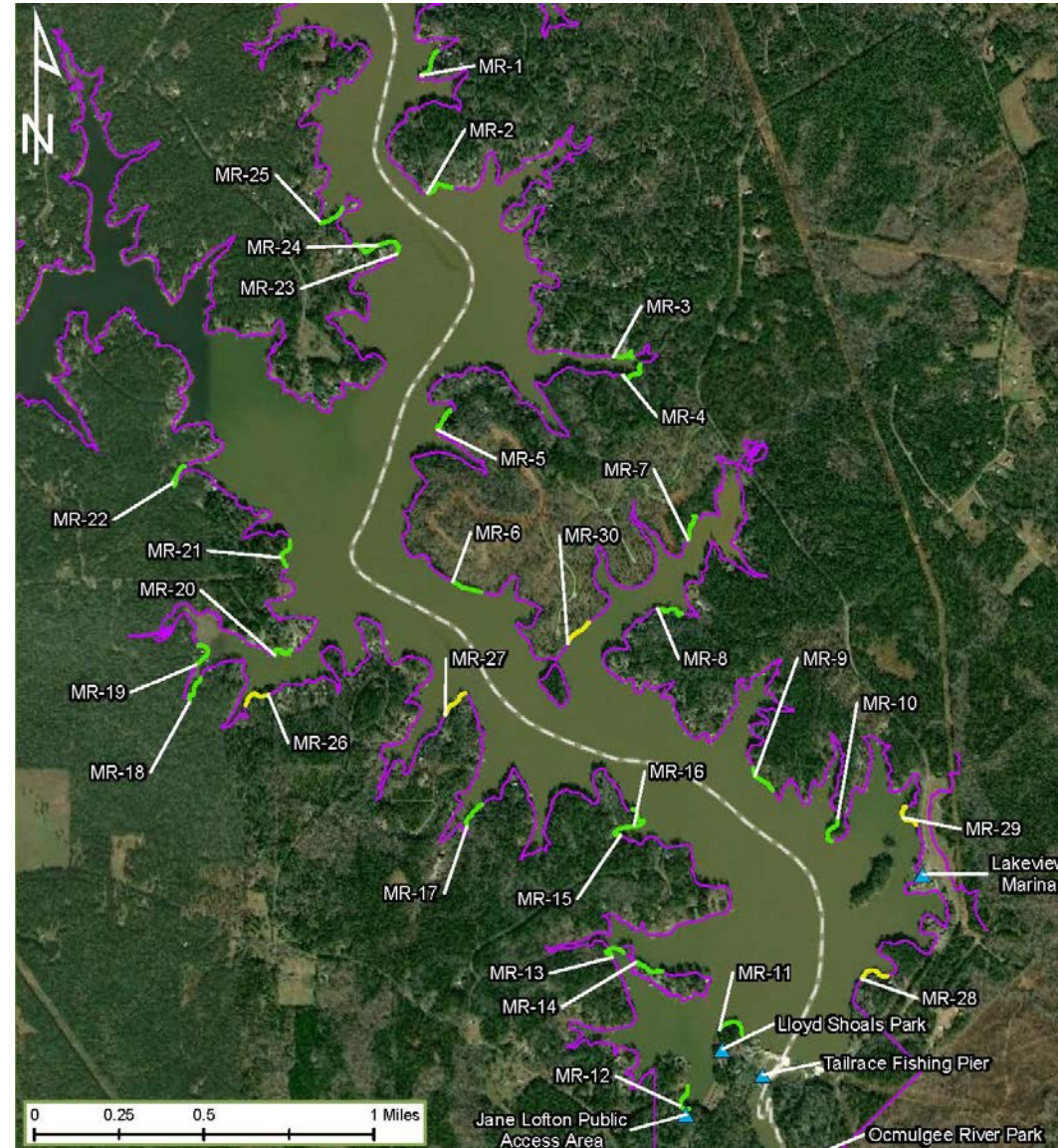
Sources of Shoreline Fish Cover/Habitat to 50 feet from Shoreline (check all that apply):	
<input type="checkbox"/> Docks/piers/boatslips (_____% of shoreline length)	<input type="checkbox"/> Overhanging vegetation (_____% of shoreline length)
<input type="checkbox"/> Riprap (_____% of shoreline length)	<input type="checkbox"/> Large woody debris (_____% of shoreline length)
<input type="checkbox"/> Bedrock and boulders (_____% of shoreline length)	<input type="checkbox"/> Standing timber (_____% of shoreline length)
<input type="checkbox"/> Emergent vegetation (_____% of shoreline length)	<input type="checkbox"/> Other: _____ (_____% of shoreline length)
<input type="checkbox"/> Submersed vegetation (_____% of shoreline length)	<input type="checkbox"/> Other: _____ (_____% of shoreline length)

Other Observations and Aquatic Habitat Notes:

Survey Sites – Mainstem Reservoir (MR)





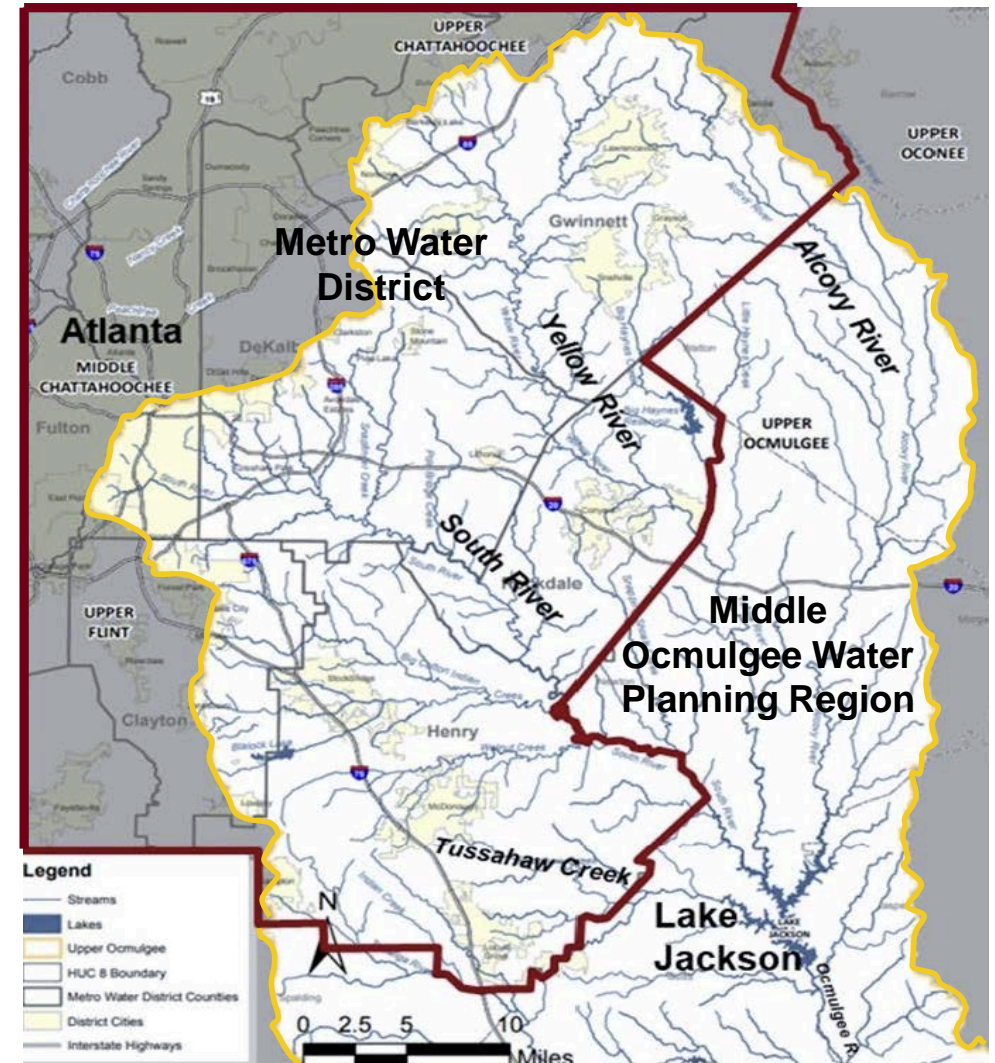
- Project Boundary
- Survey Sites



Methods – Sediment Transport and Deposition



- Review existing watershed information and data for upper Ocmulgee River basin
 - Metropolitan North Georgia Water Planning District (Metro Water District)
 - Middle Ocmulgee Regional Water Plan
 - Total Maximum Daily Load (TMDL) evaluations
 - Fish consumption guidelines
- Summarize small dredging permits issued at Project under current license

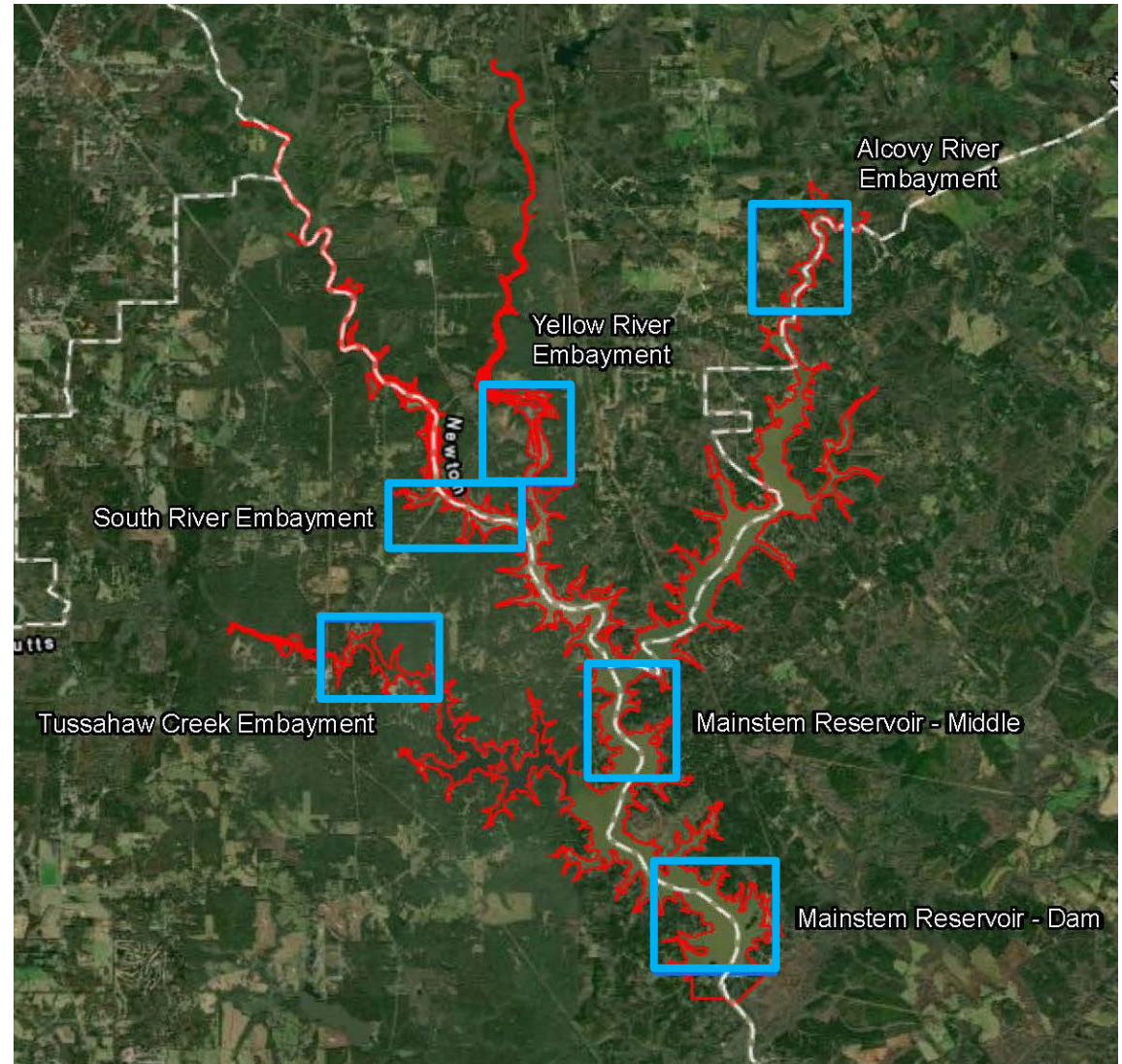
-  Upper Ocmulgee
-  Metro Water District



Methods – Shoreline Temporal Change Analysis

- Qualitatively compare shoreline conditions over time using existing aerial photography
- Six representative areas
- Four years compared:
 - 1993, 1999, 2010, 2019

-  Project Boundary
-  Areas Analyzed



Methods – Analysis of Existing Information and Data

- Evaluate effects of project operation on shoreline erosion and sedimentation
 - Findings of shoreline reconnaissance survey
 - Operational data characterizing reservoir fluctuation frequency
- Literature review on shoreline structural stabilization practices (seawalls, riprap, etc.) and their effects on littoral-zone aquatic habitat



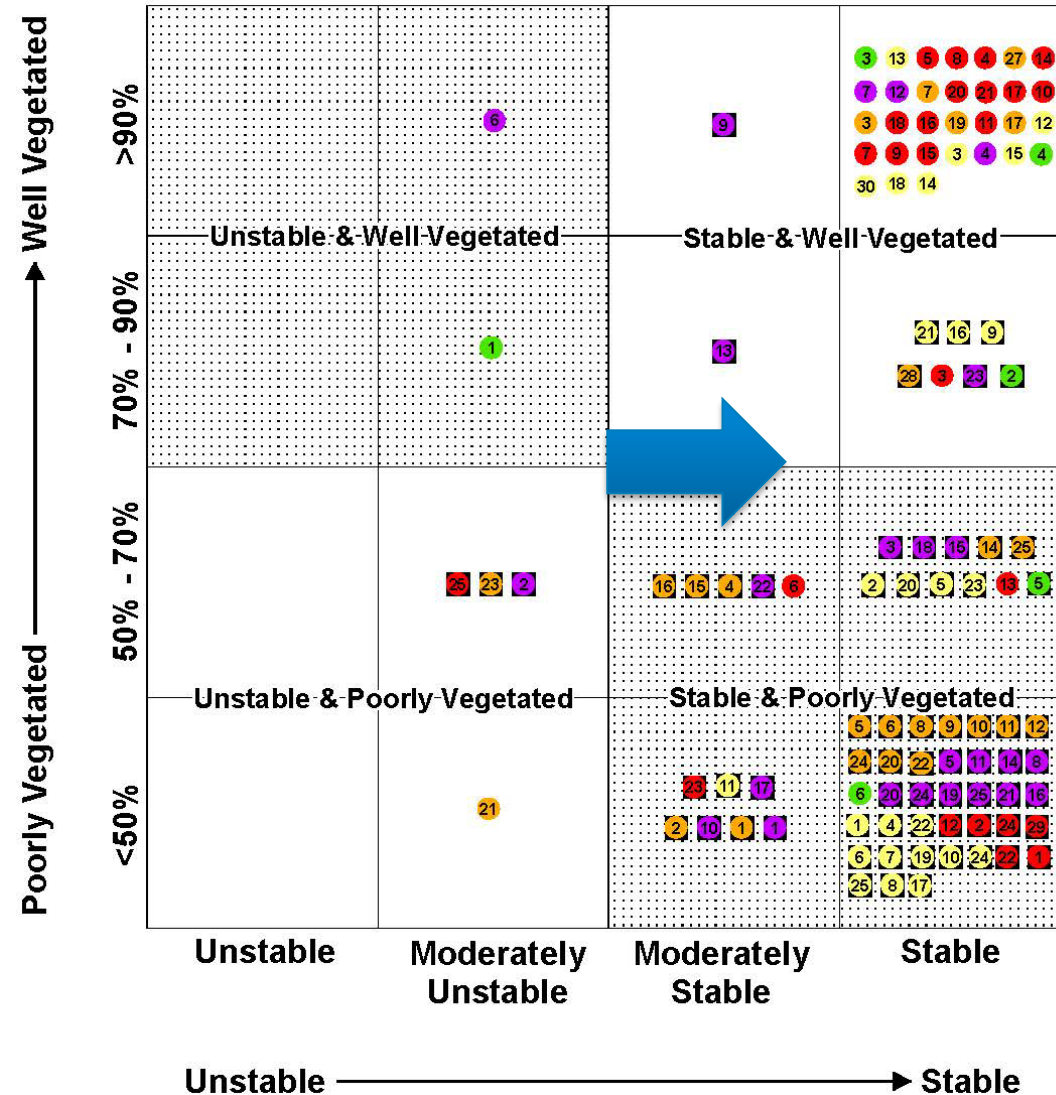
Study Results

Shoreline Reconnaissance Survey Findings

	South River	Alcovy River	Tussahaw Creek	Mainstem Reservoir	Tailrace Area	Total
Shoreline Vegetative Buffer Zone Condition:						
Natural	14	5	8	5	3	35 (33%)
Landscaped-Natural	5	12	4	4	3	28 (26%)
Landscaped	6	8	14	16	--	44 (41%)
Bank Stability:						
Stable	22	18	25	17	5	87 (81%)
Moderately Stable	2	5	1	6	--	14 (13%)
Moderately Unstable	1	2	--	2	1	6 (6%)
Unstable	--	--	--	--	--	--
Shoreline Structural Stabilization:						
Present	8	19	19	21	2	69 (64%)
Absent	17	6	7	4	4	38 (36%)

Bank Stability and Vegetative Protection Ratings

- Majority of sites had stable or moderately stable banks
- Majority of sites with poorly vegetated banks had seawalls and/or riprap for stabilization

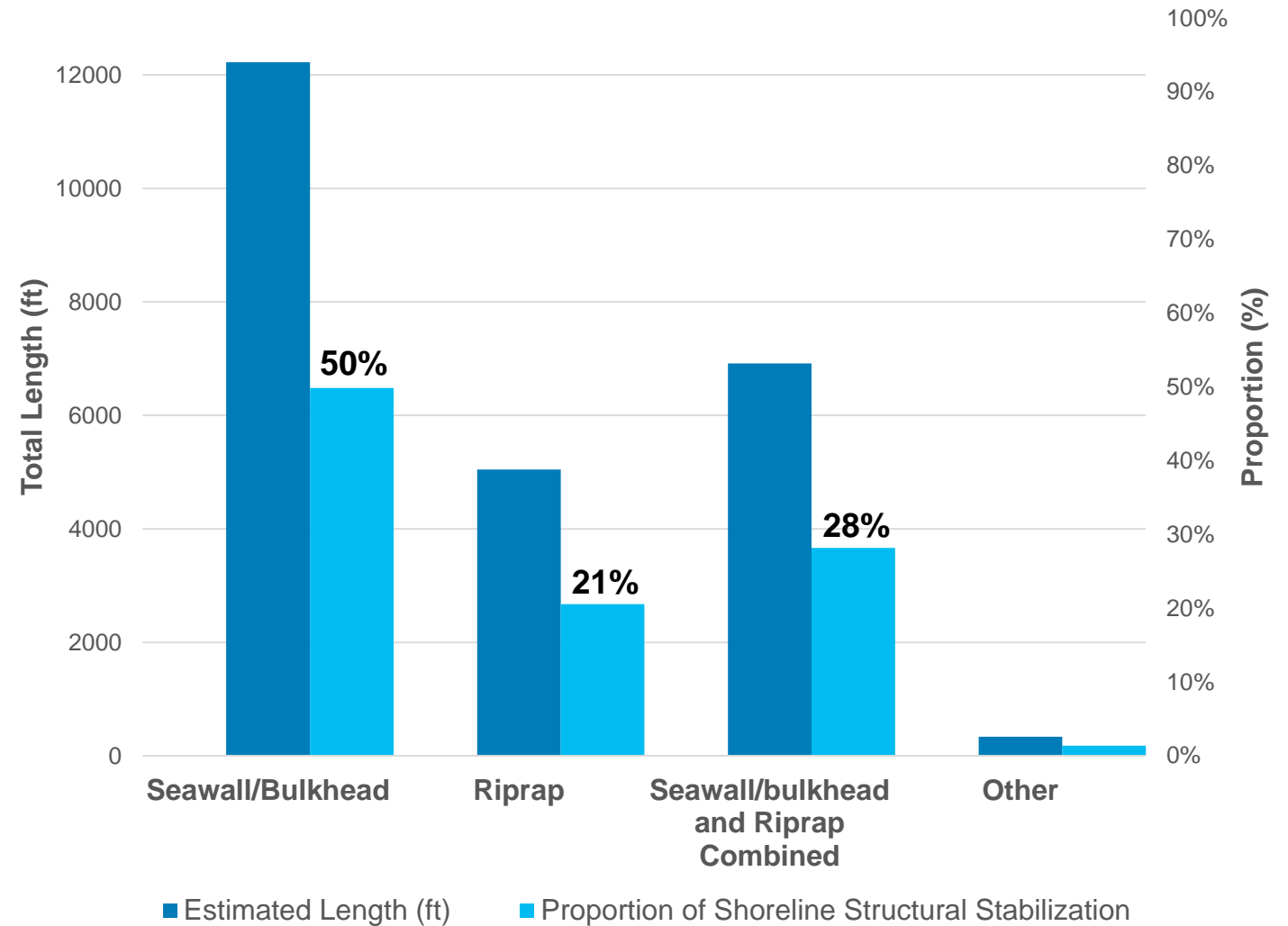


Potential Sources of Shoreline Erosion

	South River	Alcovy River	Tussehaw Creek	Mainstem Reservoir	Tailrace Area	Total
Residential landscape	5	9	20	20	--	54
Wave action from watercraft and wind	8	12	--	6	--	26
Reservoir fluctuation	--	3	1	8	--	12
Lack of buffer vegetation	3	--	3	1	--	7
Recreation access	--	--	--	3	2	5
Roads and bridges	--	--	1	3	--	4
Land disturbing activity	1	--	--	1	--	2
Stormwater runoff	1	1	--	--	--	2
Impervious surfaces	--	--	--	2	--	2
Tributary inflow	--	1	--	--	--	1

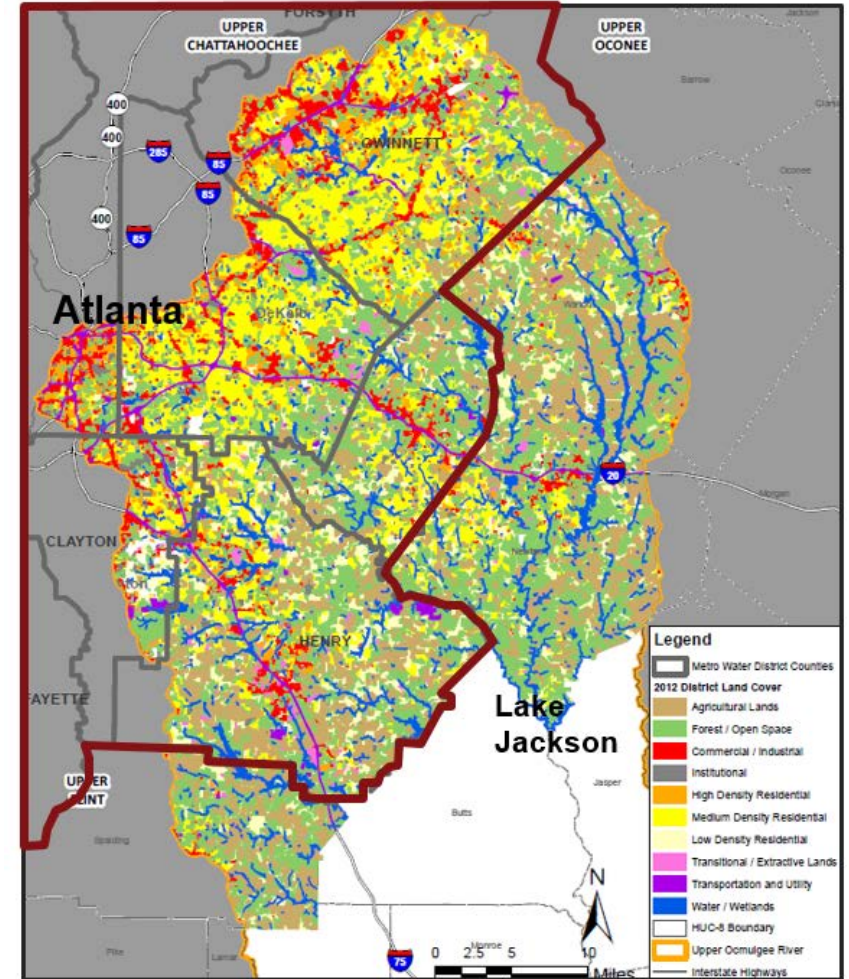
Shoreline Structural Stabilization Practices

- Stabilization structures were in place along 46% of the surveyed shoreline length
- Proportional length
 - 50% seawall only
 - 28% seawall with riprap at the base
 - 21% riprap only



Sediment Transport and Deposition Characteristics of Watershed

- Majority of upstream watershed (70%) drains eastern portions of Metro Water District
 - 80% of streams do not support designated uses
 - 29% are biota-impaired due to high sediment loads
- Sources of erosion and sedimentation identified by TMDL evaluations
 - Stormwater runoff from roads and developed areas
 - Increased imperviousness from urbanization



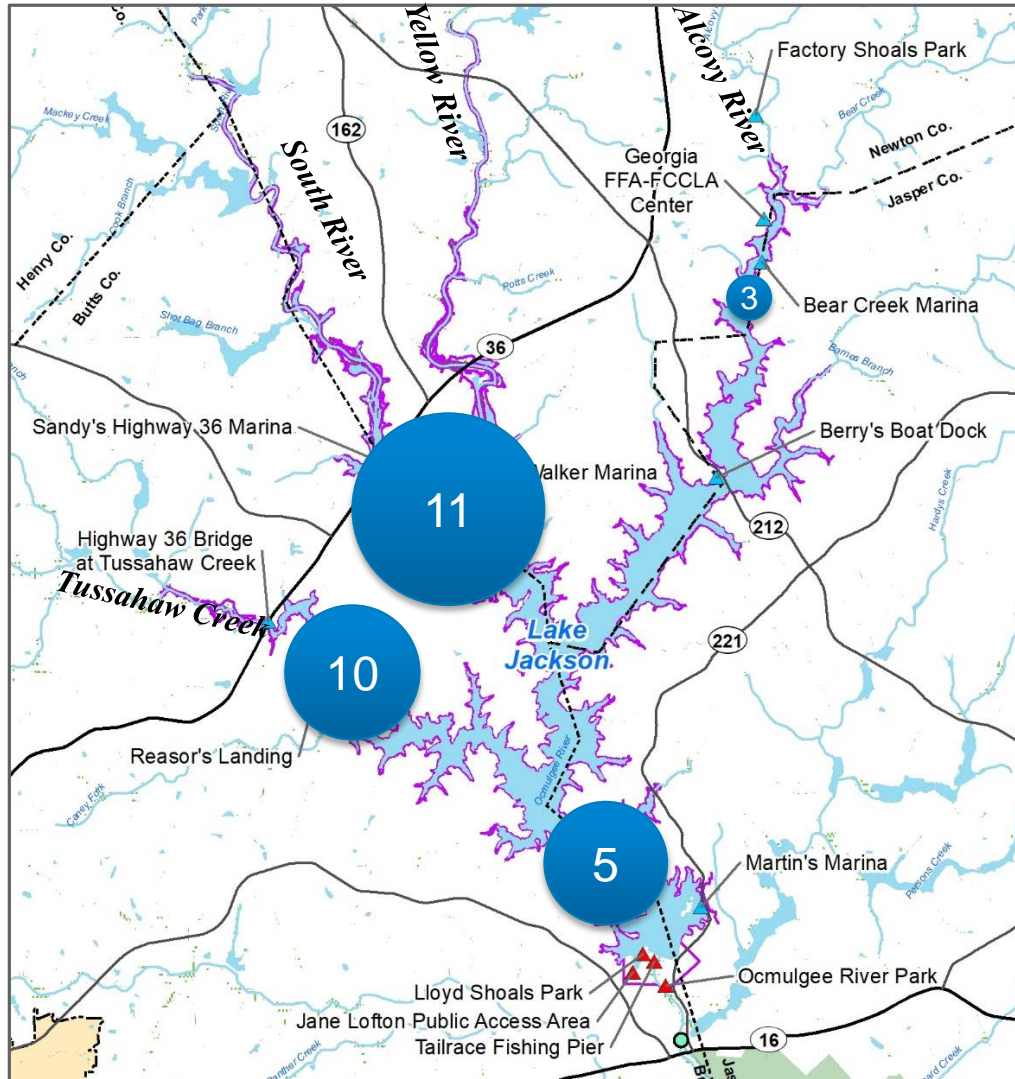
 Metro Water District

Sediment Contaminants

	Upstream Watershed	Lake Jackson
PCBs:	<ul style="list-style-type: none">• South River (51 miles) not supporting use• Source: urban runoff and combined sewer overflows• Fish consumption advisory	<ul style="list-style-type: none">• Not supporting use• Source: urban runoff and nonpoint source pollution• Declining levels – no longer a fish consumption advisory
Mercury:		<ul style="list-style-type: none">• Fish consumption advisory• Source: air deposition• Common in GA reservoirs

Small Dredging Activities in Lake Jackson

Small Dredging Permits Issued, 2006-2018

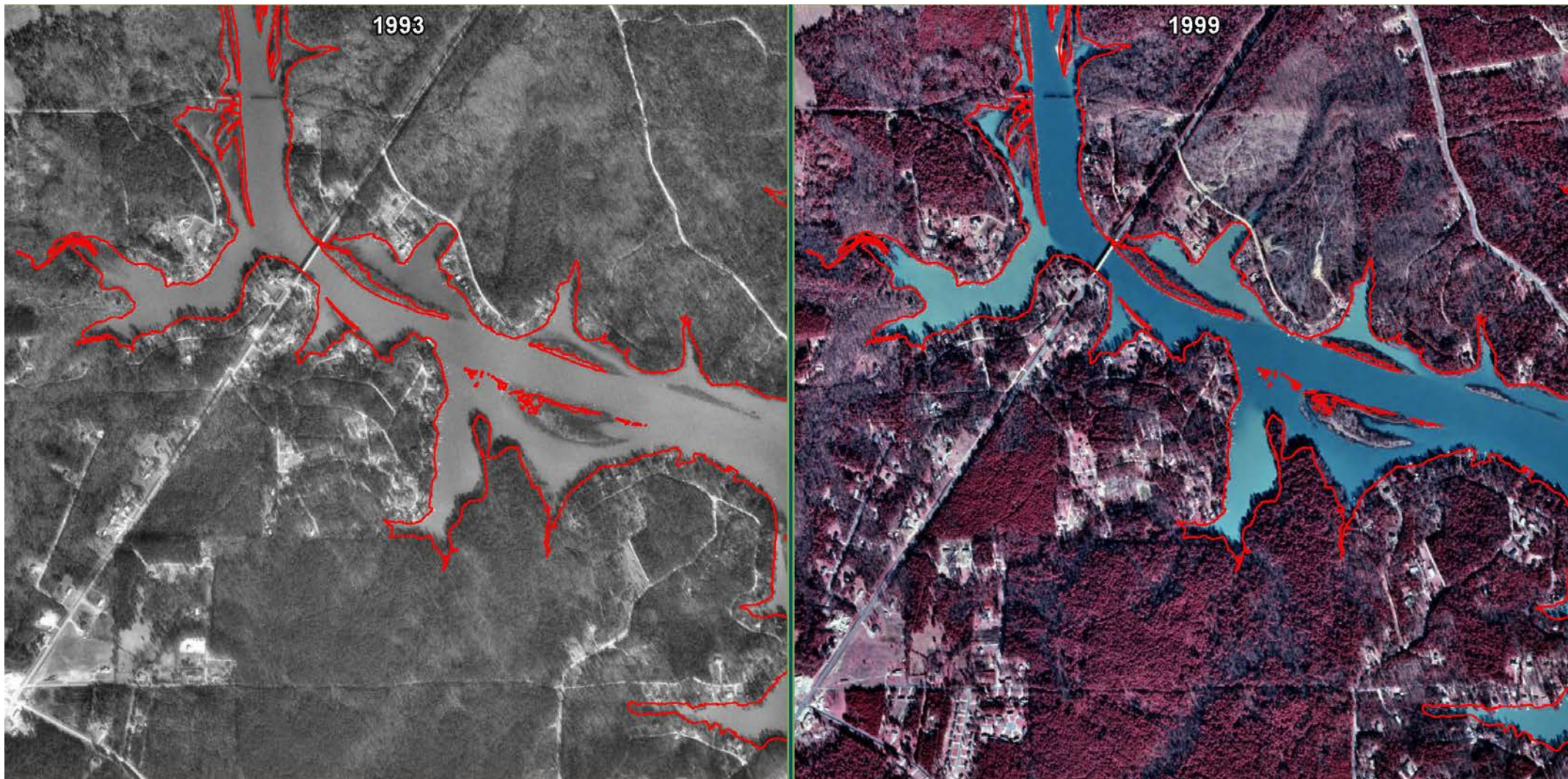


- 2006-2018 (figure):
 - 29 permits
 - Total quantity: 3,690 cubic yards (cy)
 - Average: 142 cy; range: 3.5-500 cy
- 1997-2005:
 - 20 permits
 - Total quantity: 7,113 cy
 - Average: 348 cy; range: 60-500 cy

● Number indicates number of permits by area and circle size indicates relative quantity (cy) permitted

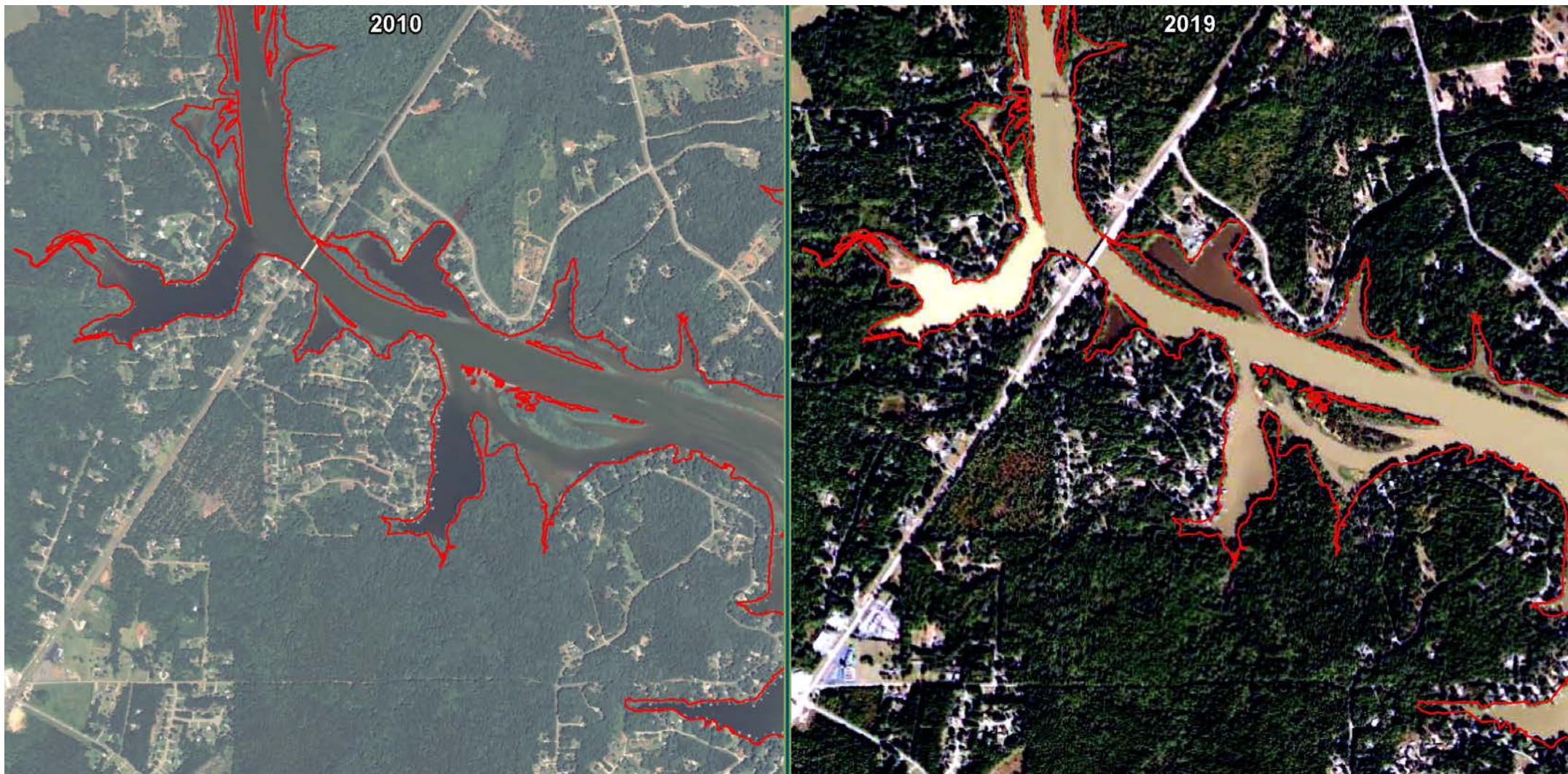
Shoreline Temporal Change Analysis

South River Embayment – 1993 and 1999



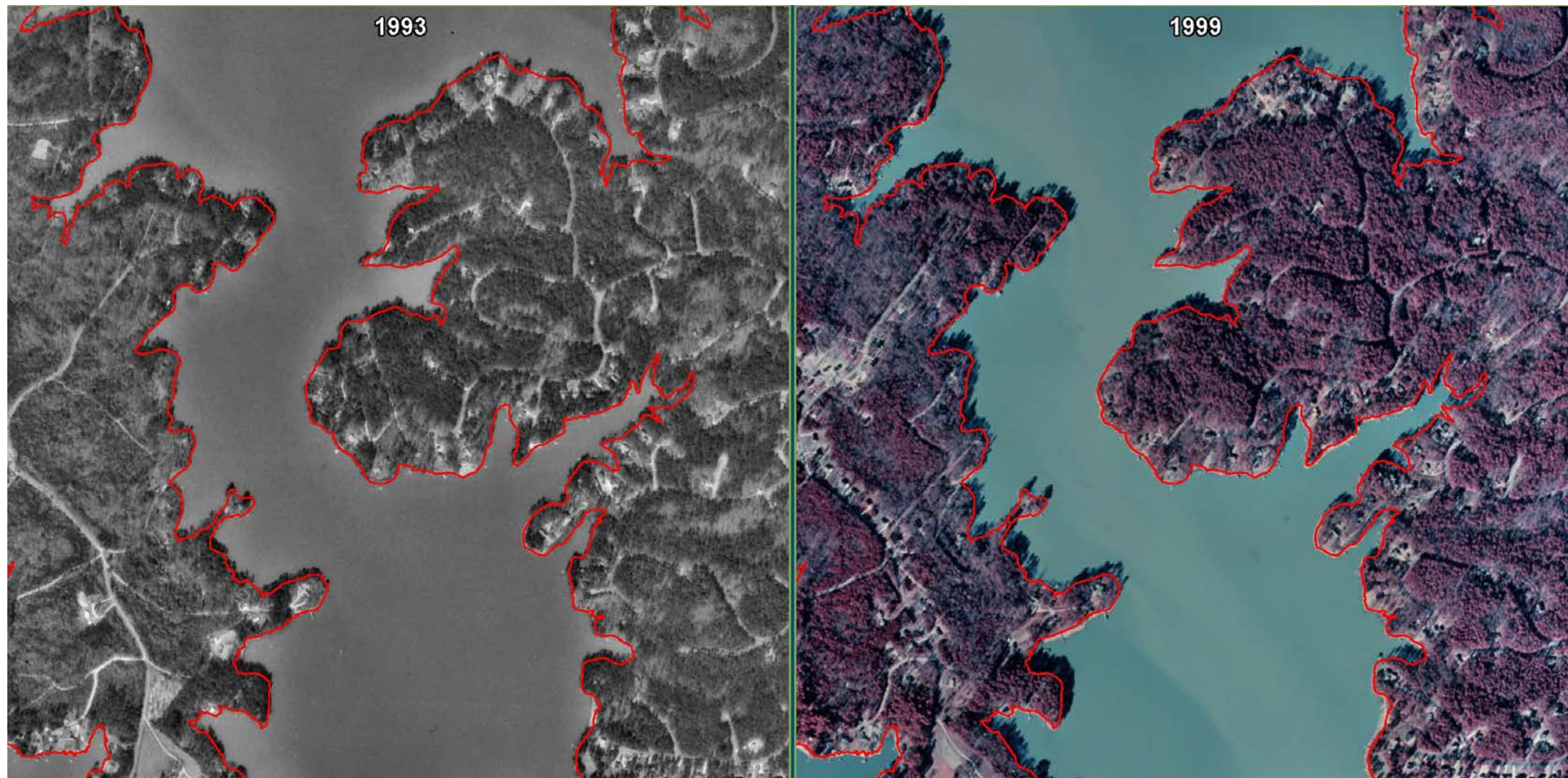
Shoreline Temporal Change Analysis

South River Embayment – 2010 and 2019



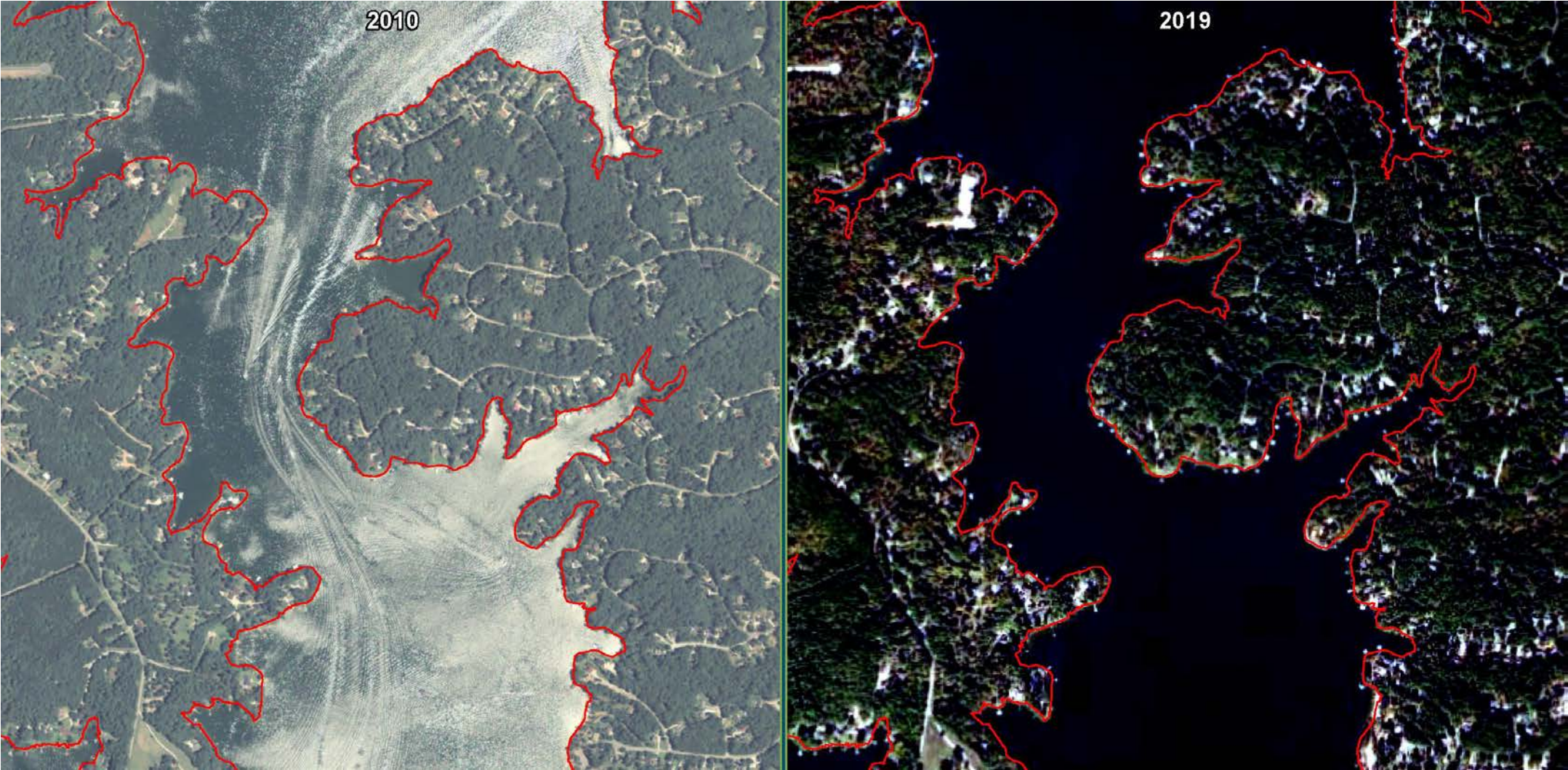
Shoreline Temporal Change Analysis

Mainstem Reservoir, Middle – 1993 and 1999



Shoreline Temporal Change Analysis

Mainstem Reservoir, Middle – 1993 and 1999

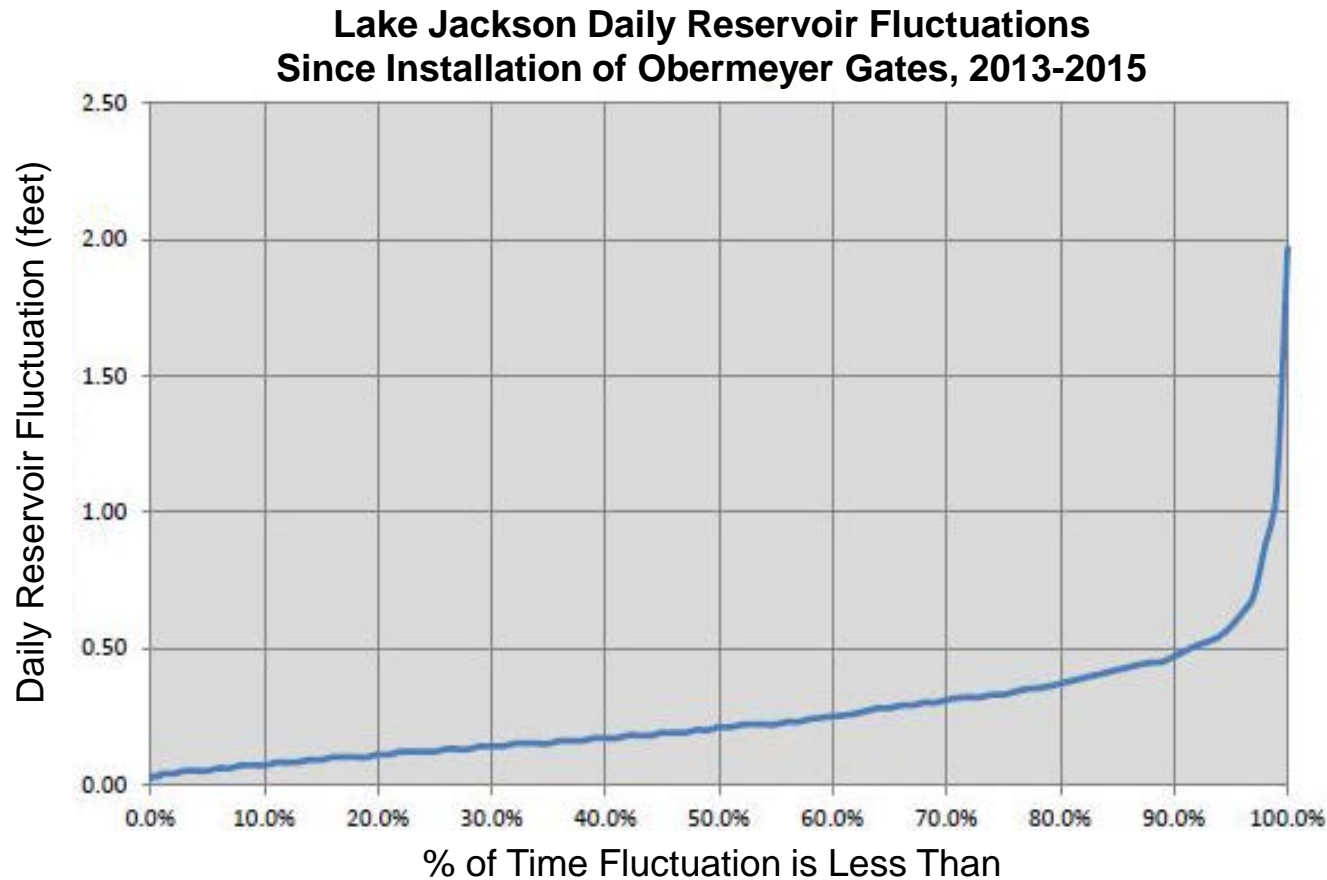


Shoreline Temporal Change – Trends

- Land use changes minimal and related mainly to new residential construction
- Shoreline change most common in natural upper reaches of tributaries
 - South River, Tussahaw Creek, and Alcovy River embayments
 - Areas transitioning from riverine to lacustrine conditions
- Sediment deposition most apparent in South River due to sediment transport from highly developed upstream watershed
- Shoreline change less common along residential shorelines due to widespread use of structural stabilization practices (seawalls, riprap)

Project Operations – Daily Reservoir Fluctuations

- 1997-2016: <1.5 feet 98-percent of the time, <1.0 foot 95-percent of the time
- Since installation of Obermeyer gates, fluctuations have decreased

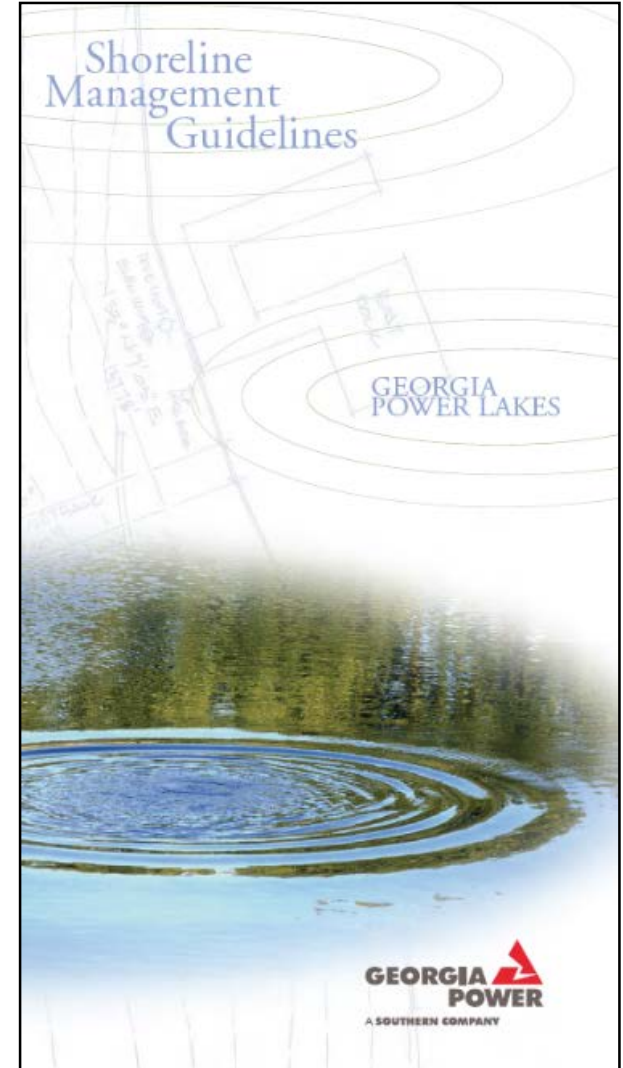


Shoreline Structural Stabilization and Fish Habitat

- Greater habitat complexity of riprap provides for higher species richness, diversity, and abundance of littoral-zone fish assemblages
- When erosion control is necessary, the use of riprap, either alone or in front of seawalls, provides better habitat than seawalls alone
- Factors improving habitat complexity of seawalls without riprap include other structural or non-structural practices (docks, boathouses, vegetation, etc.)

Georgia Power's Shoreline Management Guidelines

- Specific requirements and restrictions for constructing seawalls, docks, wharves, boatslips, outbuildings, and gazebos/picnic shelters/decks, and ramps on Lake Jackson
- Placement of riprap required along base of all new sea walls
- Limits on tree removal and mechanical clearing to protect 25-ft vegetative buffer surrounding the lake



Overall Summary

- The majority of shorelines are stable or moderately stable and exhibit low potential for future erosion problems
- Stormwater runoff from roads and developed areas are major sources of erosion and sedimentation upstream of the Project, especially on the South River
- Shoreline change has been minimal but is most common in natural upper reaches
- Project operations have minor effects on shoreline erosion
- Riprap provides better fish habitat than seawalls alone
- About 49 percent of structural stabilization practices currently use riprap
- Georgia Power's Shoreline Management Guidelines provide for continued shoreline protection and maintenance



Georgia
Power



Recreation and Land Use

Presented by: Joey Charles and Dawson Ingram

Study Results Meeting
Lloyd Shoals Project
July 29, 2020

Study Objectives

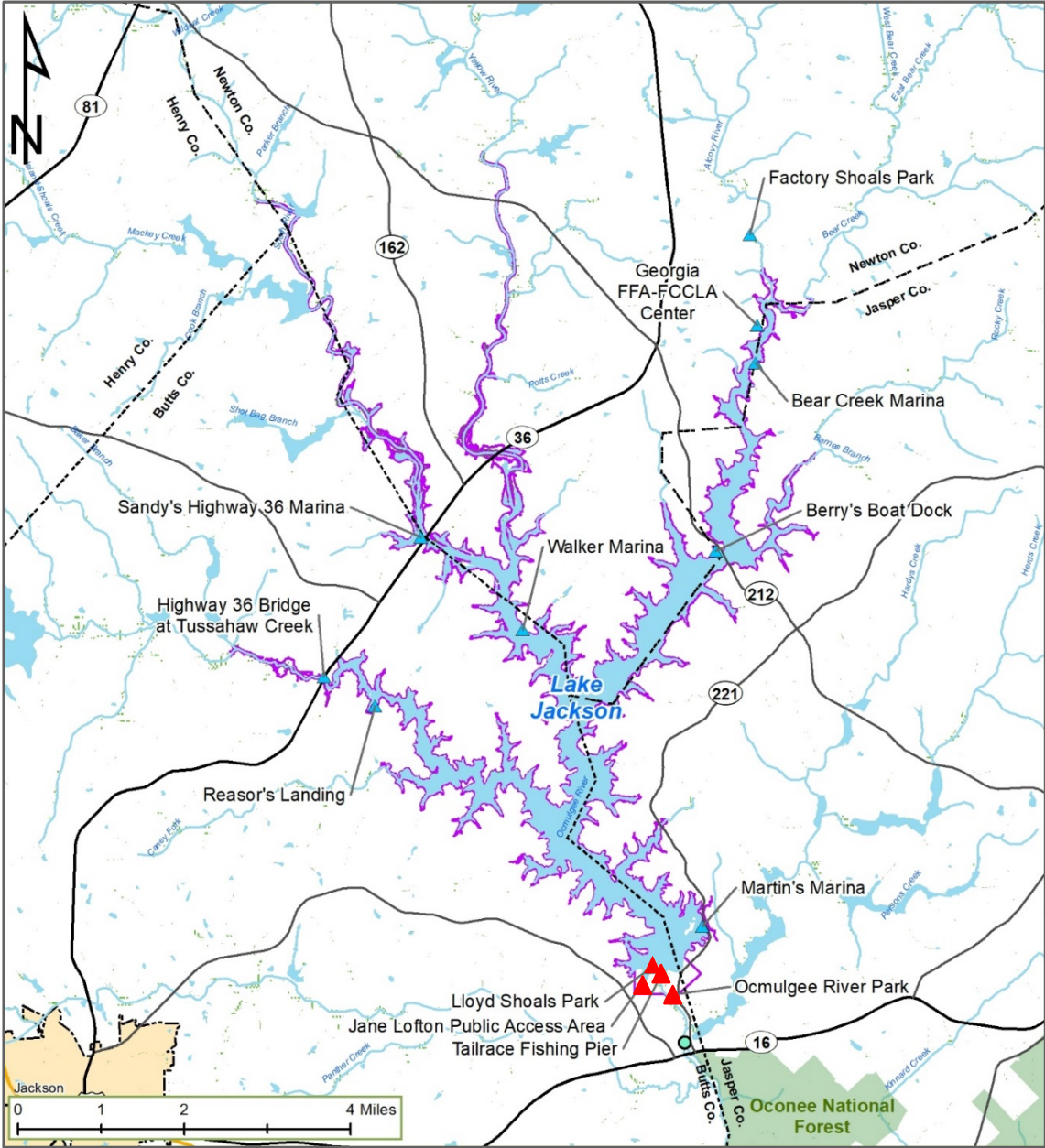
- Review existing information to describe existing recreation and land use
- Characterize the effects of continued project operation on recreational opportunities
- Characterize existing recreational capacity and usage on Lake Jackson and Lloyd Shoals tailrace
- Evaluate the adequacy of existing recreational facilities to meet current and future recreational demand
- Evaluate the adequacy of the existing Shoreline Management Program to address land use practices, including erosion, and protect environmental resources



Study Area

- FERC Project boundary around Lake Jackson and the Lloyd Shoals tailrace area, including four project recreation facilities
- Four counties adjacent to the Project and 20-county region

- Project Boundary
- ▲ Project Recreation Facilities



Study Methods

Methods – Recreational Use Assessment

- Characterize existing recreation facilities and opportunities at the Project and in the region
- Conduct recreation surveys in 2019 to assess user trends and satisfaction
- Estimate current recreational use based on:
 - 2015 FERC Form 80 and supporting data
 - Article 405 Recreation Report (2015)
 - Attendance records
 - Data from 2019 field surveys
 - Estimated population change from 2014 to 2019



Methods – Recreation Field Surveys

- Conducted surveys at four project recreation facilities on 3 days in 2019
 - Lloyd Shoals Park
 - Ocmulgee River Park
 - Tailrace Fishing Pier
 - Jane Lofton Public Access Area
- Surveys also conducted at informal bank fishing area at Hwy 36 bridge at Tussahaw Creek
- Surveys planned for 2 days in March-April 2020 cancelled due to Covid-19

Georgia Power Company Lloyd Shoals Project Recreation Use Survey		Georgia Power Company is conducting this survey to learn about recreational use at Lake Jackson, user satisfaction with existing recreation facilities, and whether facility improvements may be needed. Please take a few minutes to answer some questions about your visit today. Thank you for your participation.	
Location: _____		Site Info	
Weather: _____ Clear _____ Partly Cloudy _____	_____		Time: _____
Investigator: _____			
1. What is your county and state of residence? County: _____ State: _____			
2. How many people (including you) are in your group today? _____ people			
3. What is your age group? _____ 18-24 _____ 25-34 _____ 35-44 _____ 45-54 _____ 55+			
4. If you are with others, what are their age groups? (check all that apply)			
_____ Youth (13-17) _____ Adults (18-55) _____ Senior Adults (over 55)			
5. How many hours have you spent here today? _____ hours			
6. How many times (including today) have you visited Lake Jackson or its parks in the last 30 days? _____ times			
7. How many times do you visit Lake Jackson annually? _____ times			
8. Do you use the reservoir at night? _____ Yes _____ No If "yes", how many times per year? _____ times			
9. Are the parks at this reservoir your primary destination for outdoor recreation activities? _____ Yes _____ No			
10. What other parks and lakes in the area do you frequent for recreation? (list below)			
11. What is the primary reason for your visit today? (check all that apply)			
_____ Boat fishing	_____ Picnicking/kayaking	_____ Hiking/walking	
_____ Bank fishing	_____ Surfing	_____ Shoreline relaxation	
_____ Tournament fishing	_____ Water skiing	_____ Other (list below): _____	
_____ Pleasure boating	_____ Jet skiing	_____ Swimming/wading	
12. If you came to fish today, what were you fishing for? (check all that apply)			
_____ Largemouth bass	_____ Striped bass	_____ Channel catfish (list below): _____	
_____ Crappie	_____ Hybrid bass	_____ Blue catfish	
_____ Sunfish/bream	_____ White bass	_____ Flathead catfish	
13. Please rate the quality of the existing facilities at this access area. (choose one description for each)			
Parking: _____ Good _____ Fair _____ Poor	Restrooms: _____ Good _____ Fair _____ Poor		
Boat ramp: _____ Good _____ Fair _____ Poor	Cleanliness: _____ Good _____ Fair _____ Poor		
Dock: _____ Good _____ Fair _____ Poor	Bank fishing access: _____ Good _____ Fair _____ Poor		
14. List any specific improvements you would like to see at this access area, and any other comments or suggestions.			
Desired Improvements			

Methods

- **Future Recreational Use**

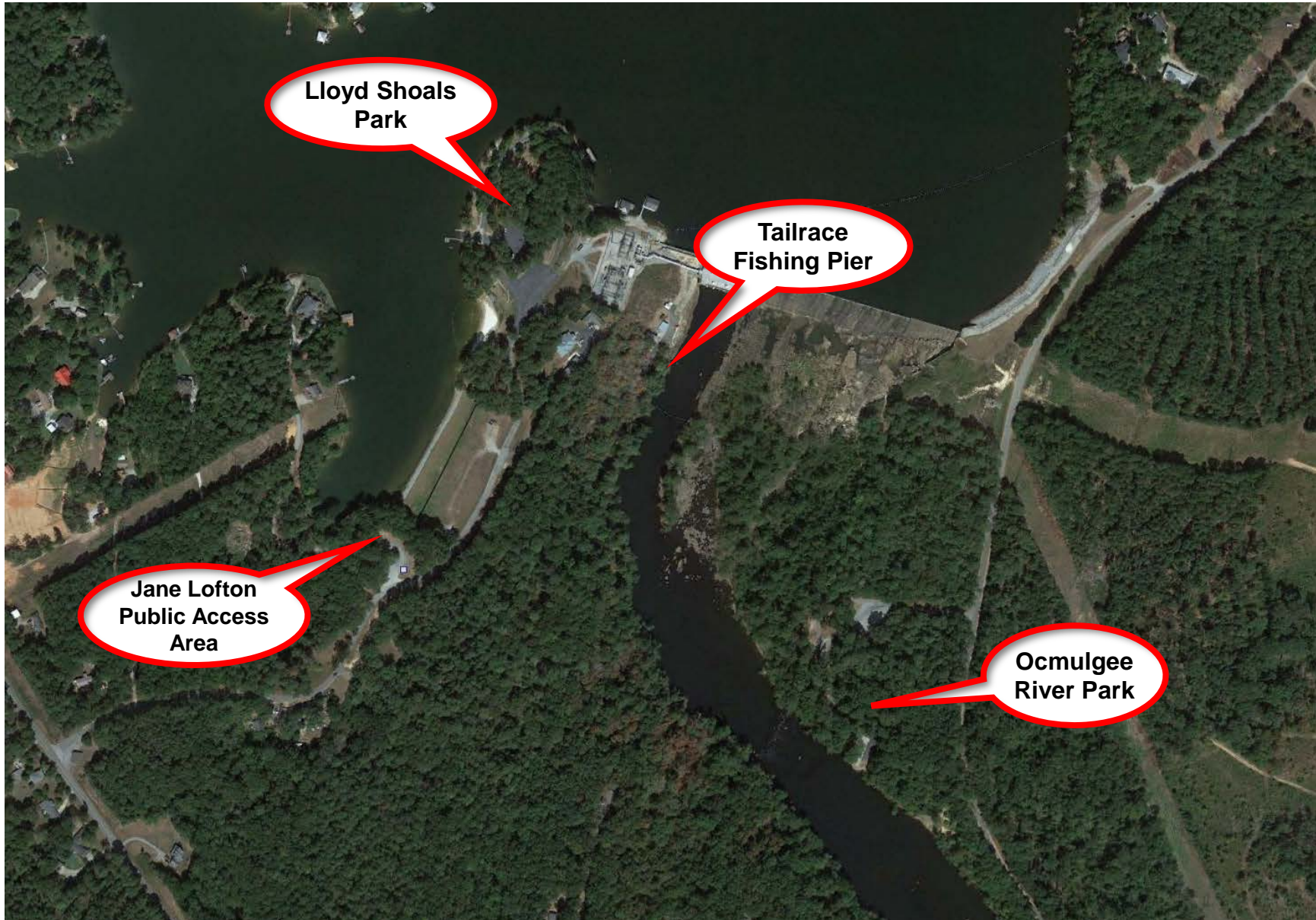
- Forecast future recreational demands based on projected population change
- Compare future demand to the estimated carrying capacity of project recreation facilities

- **Land Use**

- Map land use within project boundary and 2,000-ft zone around Project
- Map Georgia Power-owned lands within project boundary
- Review Georgia Power's shoreline management program

Existing Recreation Facilities

Project Recreation Facilities



Project Recreation Facilities

Recreation Site	County	Location	Acreage	Amenities
Lloyd Shoals Park	Butts	Lake Jackson	5 acres	50 parking spaces (with trailer slots), picnic/day use area, swimming beach, playground, pavilion, barrier-free fishing pier, restrooms, 2-lane barrier-free boat ramp, courtesy dock, shoreline fishing
Lloyd Shoals Tailrace Fishing Pier	Butts	Tailrace Area	0.6 acre	10 parking spaces, barrier-free boardwalk path to fishing pier with seats for fishing as well as a secluded seated area for viewing
Ocmulgee River Park	Jasper	Tailrace Area	4 acres	15 parking spaces, 1-lane boat ramp, picnic/day use area, bank fishing, trail to eastern tailrace
Jane Lofton Public Access Area	Butts	Lake Jackson	0.7 acre	Bank fishing, gravel parking area

Project Recreation Facilities

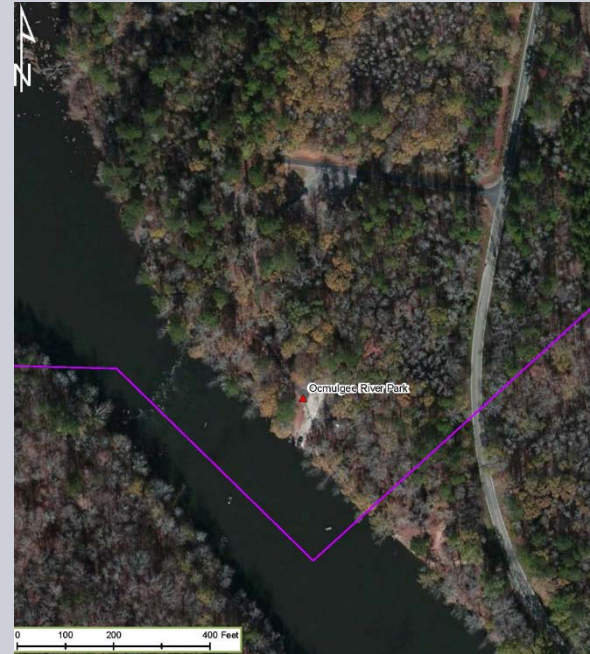
Lloyd Shoals Park



Tailrace Fishing Pier



Ocmulgee River Park






Jane Lofton Public Access Area

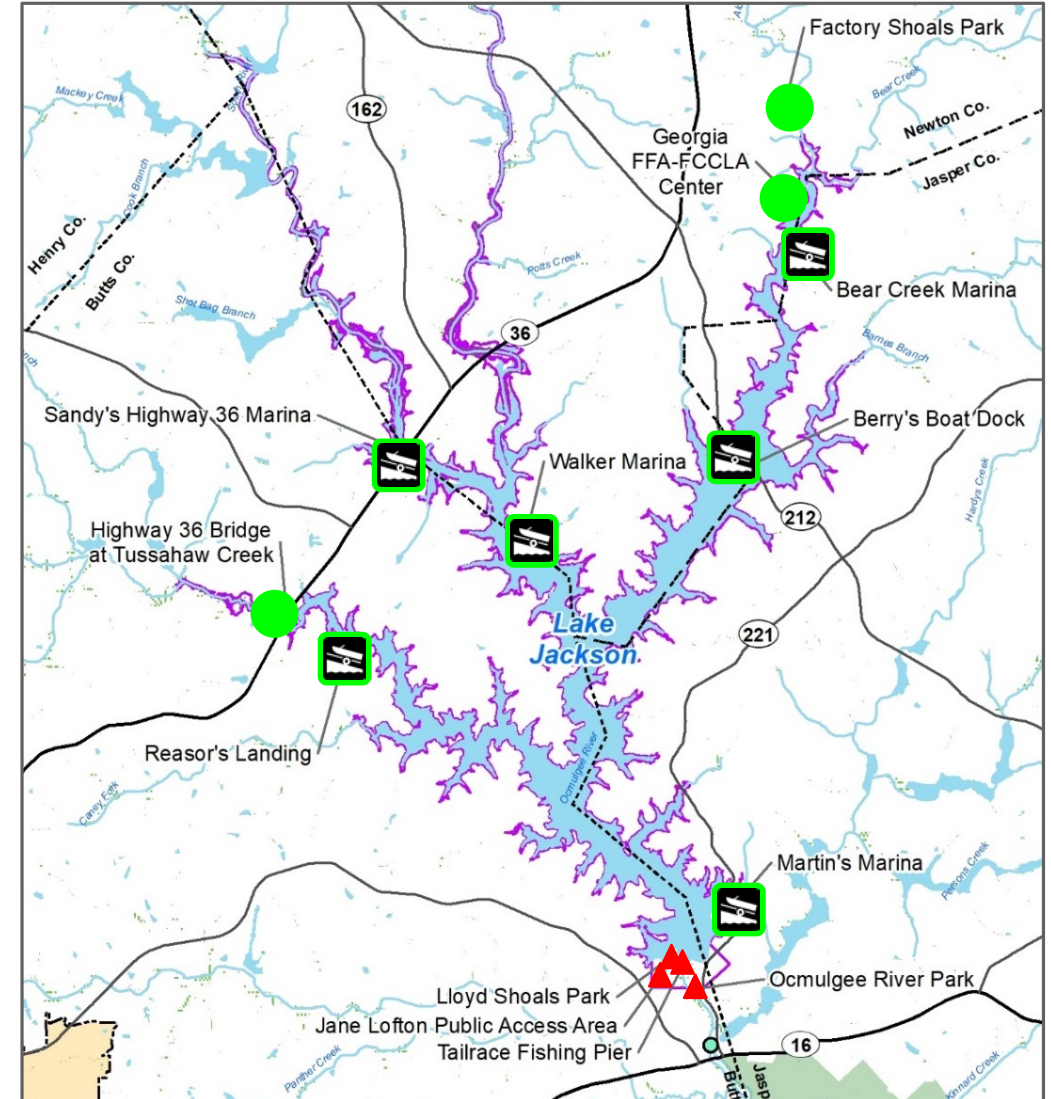


Other Publicly or Privately Owned and Operated Facilities

- Nine facilities and access areas:
 - 6 private marinas with boat ramps
 - Factory Shoals Park (Newton County)
 - Georgia FFA-FCCLA Center (State)
 - Informal bank fishing (Georgia Power)

Non-project Recreation Facilities:

-  Marinas/boat ramps
-  Other facilities/access
-  Project Recreation Facilities



Regional Recreation Opportunities

- Georgia Power reservoirs
 - Lake Sinclair (15,330 acres)
 - Lake Oconee (19,050 acres)
 - Lake Juliette (3,600 acres)
- Oconee National Forest
- State Parks (4)
- GDNR Wildlife Management Areas (5)
- Piedmont National Wildlife Refuge
- Ocmulgee Mounds National Historic Park
- Jarrell Plantation State Historic Site



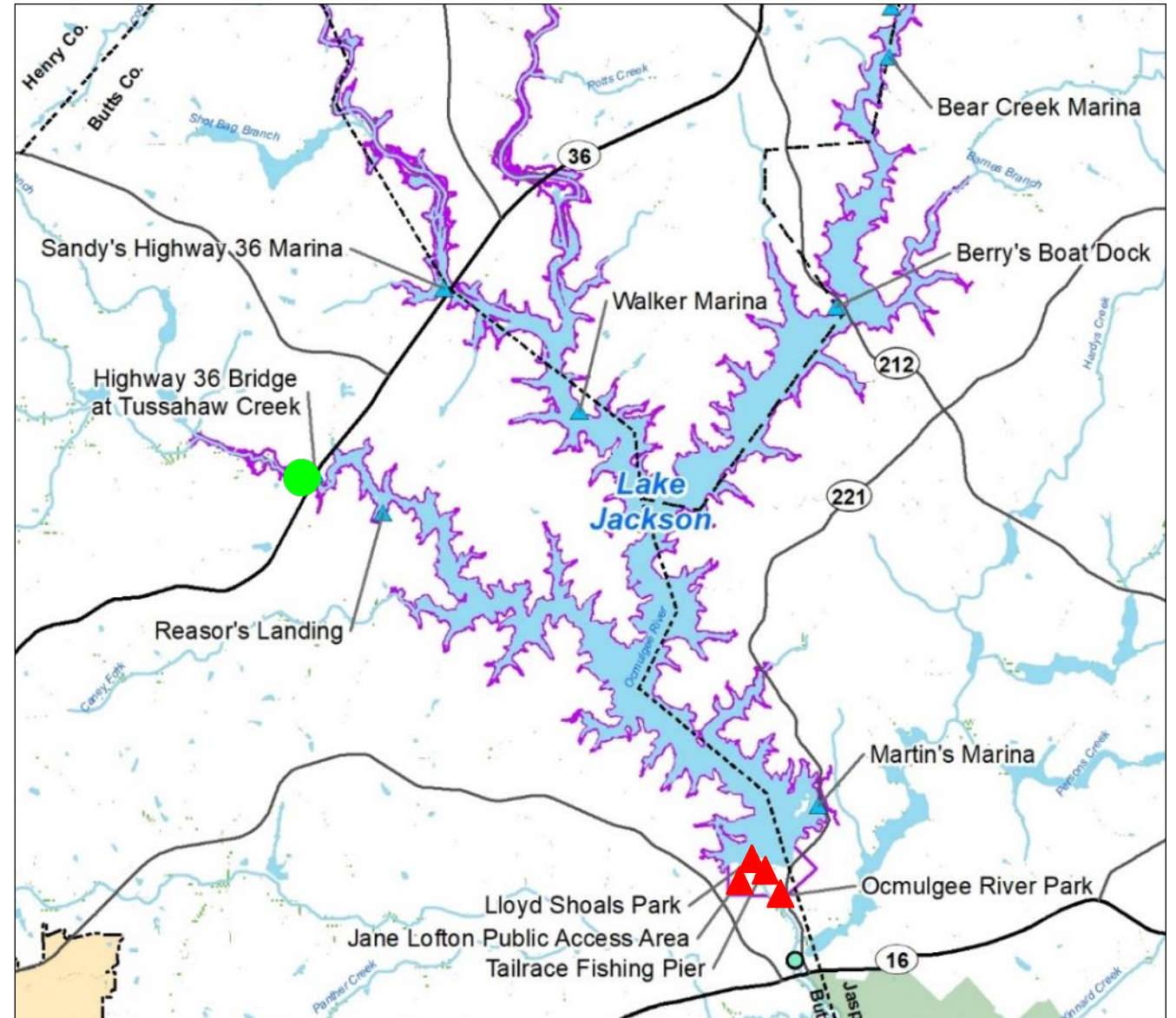
High Falls SP - Photo from GDNR State Parks & Historic Sites



Lake Oconee – Photo by S. Layman

Recreation Survey Locations

- ▲ Project recreation facilities
 - Lloyd Shoals Park
 - Tailrace Fishing Pier
 - Ocmulgee River Park
 - Jane Lofton Public Access Area
- Informal bank fishing area at Hwy 36 bridge at Tussahaw Creek

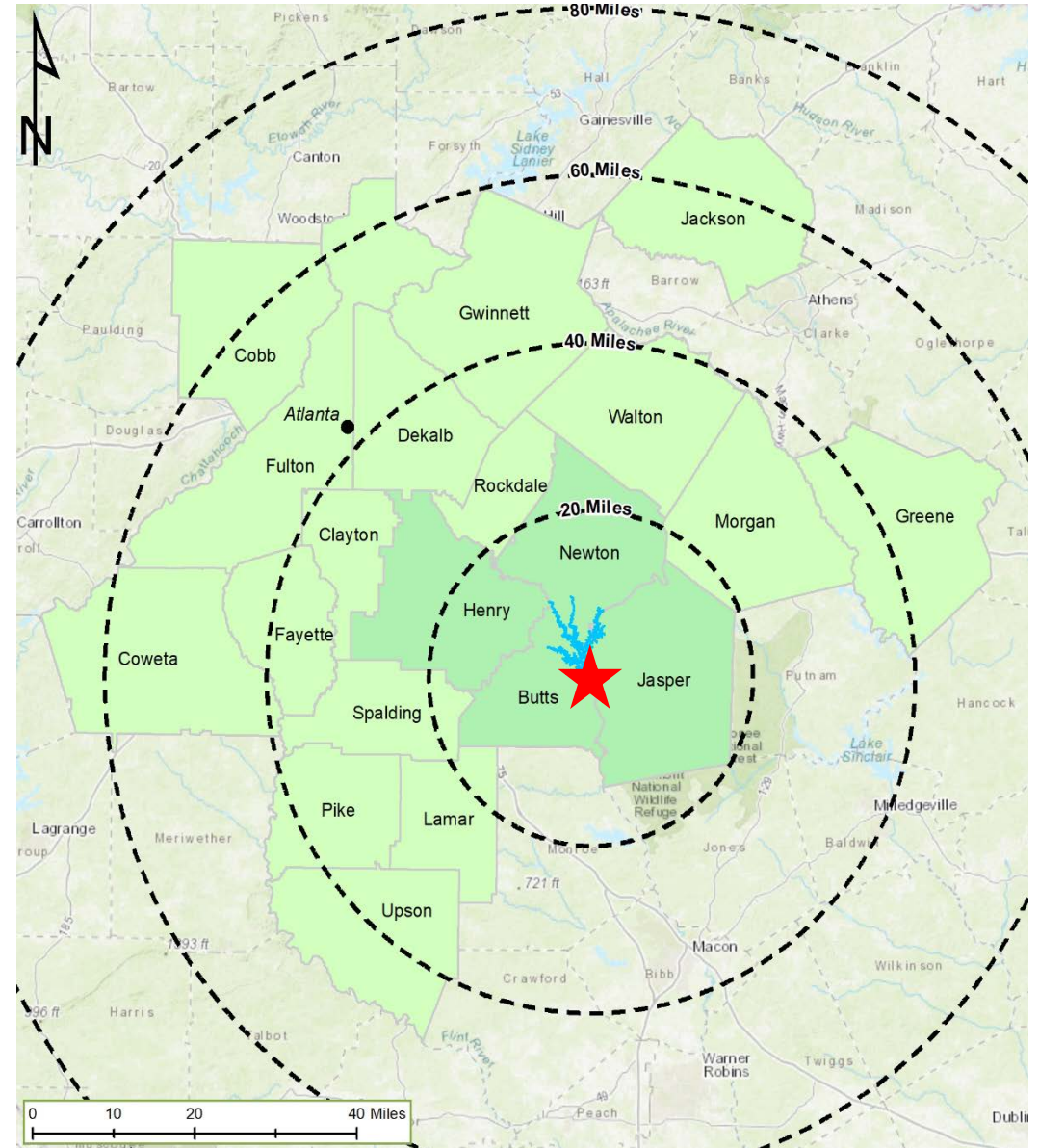


Number of Recreation Surveys Administered

Location	June 27, 2019 (Weekday)	July 7, 2019 (Holiday)	August 4, 2019 (Weekend)	Access Point Total
Lloyd Shoals Park	15	36	13	64
Tailrace Fishing Pier	3	4	7	14
Ocmulgee River Park	9	14	14	37
Jane Lofton Public Access Area	0	0	0	0
Hwy 36 at Tussahaw Creek	0	0	2	2
Total	27	54	36	117

Origin of Users Surveyed at Project

- Users came from 32 Georgia counties and other states
- 20 counties totaled 89 percent of users surveyed and included metro Atlanta
- Top 5 counties (68 percent):
 - Henry
 - Spalding
 - Butts
 - Newton
 - Jasper



Primary Reasons for Visits

Percent of Responses:

Activity	Lloyd Shoals Park	Tailrace Fishing Pier	Ocmulgee River Park	Hwy 36 at Tussahaw Creek	Total
Bank Fishing	<u>11.1</u>	<u>78.6</u>	<u>39.6</u>	<u>100</u>	<u>25.6</u>
Swimming/wading	<u>27.8</u>	7.1	2.1	--	<u>18.6</u>
Picnicking/playing	<u>19.4</u>	--	2.1	--	<u>12.8</u>
Shoreline relaxation	<u>13.0</u>	7.1	<u>10.4</u>	--	<u>11.6</u>
Boat Fishing	<u>12.0</u>	--	<u>12.5</u>	--	<u>11.0</u>
Pleasure Boating	7.4	--	4.2	--	5.8
Canoeing/kayaking	0.9	--	<u>16.7</u>	--	5.2
Water Skiing	2.8	--	--	--	1.7
Jet Skiing	2.8	--	--	--	1.7
Hiking/walking	--	--	4.2	--	1.2
Other	2.8	7.1	8.3	--	4.7

Note: Top reasons indicated by bold underline

User Ratings of Georgia Power Facilities

- Boat ramps, parking, cleanliness, and bank fishing were rated good by vast majority of users
- Facilities rated fair by larger proportions of users: Lloyd Shoals Park restroom and parking; Tailrace Fishing Pier dock and bank fishing access

Percent of Respondents:

Park	Rating	Parking	Boat Ramp	Dock	Restroom	Cleanliness	Bank Fishing Access
Lloyd Shoals Park	Good	<u>73</u>	<u>95</u>	<u>89</u>	<u>65</u>	<u>82</u>	<u>96</u>
	Fair	24	5	8	32	13	--
	Poor	3	--	3	4	5	4
Tailrace Fishing Pier	Good	<u>82</u>	NA	<u>75</u>	NA	<u>82</u>	<u>72</u>
	Fair	18	NA	25	NA	9	28
	Poor	--	NA	--	NA	9	--
Ocmulgee River Park	Good	<u>92</u>	<u>94</u>	NA	NA	<u>87</u>	<u>80</u>
	Fair	9	6	NA	NA	13	16
	Poor	--		NA	NA	--	4

Improvements Desired at Georgia Power Parks

Proportion of Total User Comments:

Lloyd Shoals Park

- Parking (23%)
- Restrooms (18%)
- Trailer parking (9%)

Tailrace Fishing Pier

- Trash cans (21%)
- Cleaning (14%)
- Shoreline access (14%)

Ocmulgee River Park

- Restrooms (34%)
- Trash cans (22%)
- Shoreline access (19%)



Current and Projected Future Recreational Use

- 2019 annual recreation use estimate:
 - 78,262 visits, including 76,696 day-use visits and 1,565 night-use visits
- Future recreation use based on forecasted population change in 4-county area

Facilities	2019	2030	2040	2050
Lloyd Shoals Park	42,544	50,202	56,728	62,968
Ocmulgee River Park	5,350	6,313	7,134	7,918
Tailrace Fishing Pier	1,076	1,270	1,435	1,593
Georgia Power Project Recreation Use	48,970	57,785	65,297	72,479
Non-Georgia Power Recreation Use	29,292	34,565	39,058	43,354
Total Recreation Use	78,262	92,349	104,355	115,834
		2020-2030	2030-2040	2040-2050
4-County Forecasted Growth Rates	--	18%	13%	11%

Carrying Capacity and Future Demand

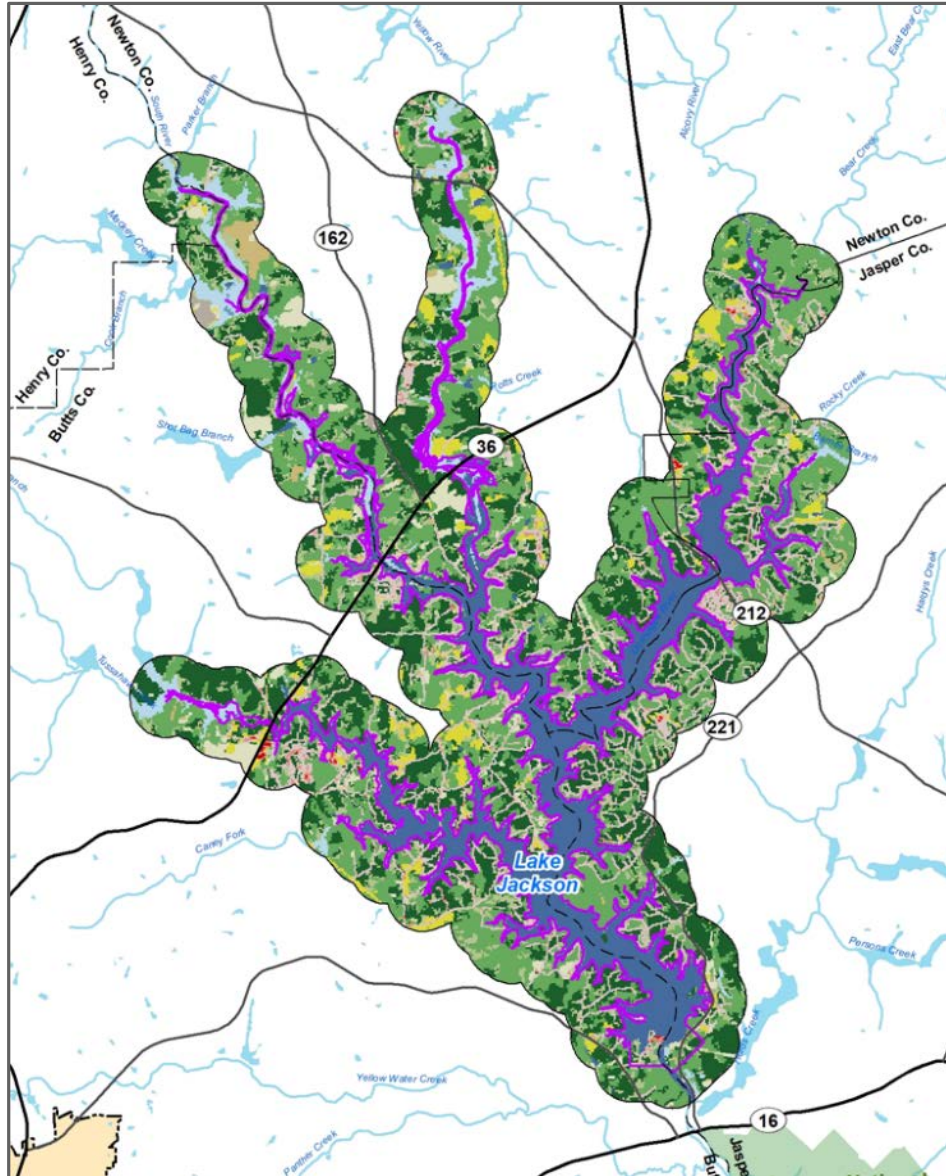
- Carrying capacity at all Georgia Power facilities is adequate to accommodate projected average spring and summer use into the near future
- Peak use during holiday weekends exceeds capacity at Lloyd Shoals Park



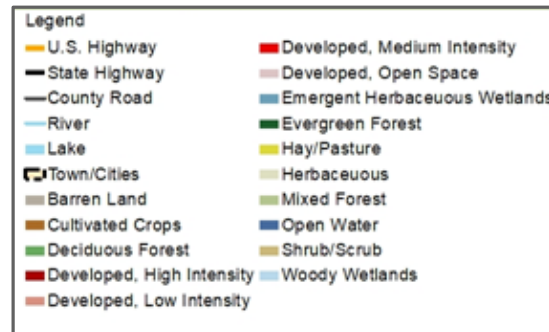
	Total Parking Capacity	Average Observed Spring/Summer Use in 2019	Peak Observed Use in 2019	Projected Average Spring/Summer Use in:		
				2030	2040	2050
Lloyd Shoals Park	50	20	78	24	27	30
Tailrace Fishing Pier	10	1	4	1	1	1
Ocmulgee River Park	15	7	10	8	9	10

Project Land Use

Land Uses within the Project Area

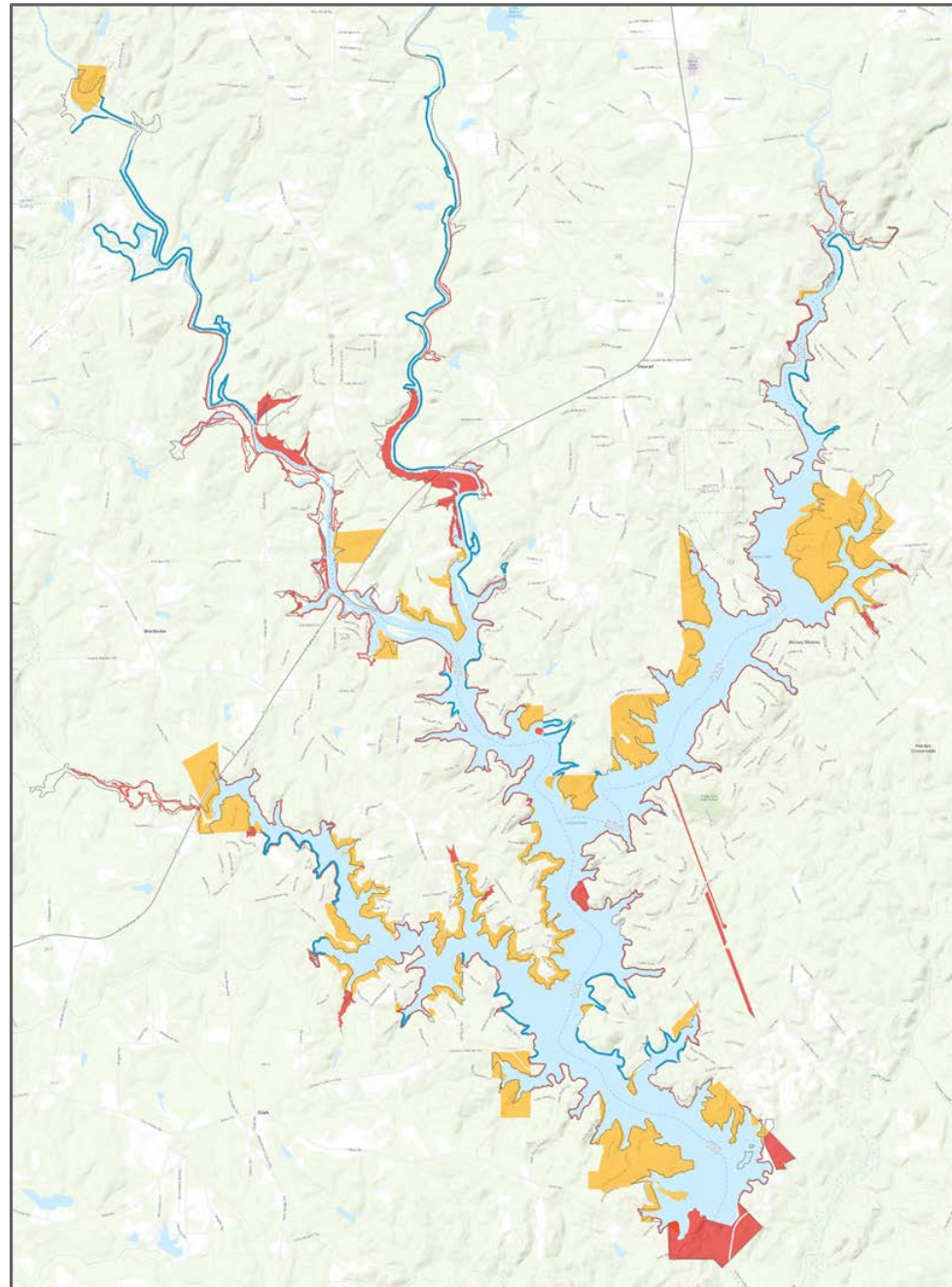


- Predominant land uses (81 percent)
 - Deciduous forest
 - Evergreen forest
 - Developed open space
 - Mixed forest
 - Woody wetlands
 - Herbaceous
 - Hay/pasture
- Developed areas (10 percent)



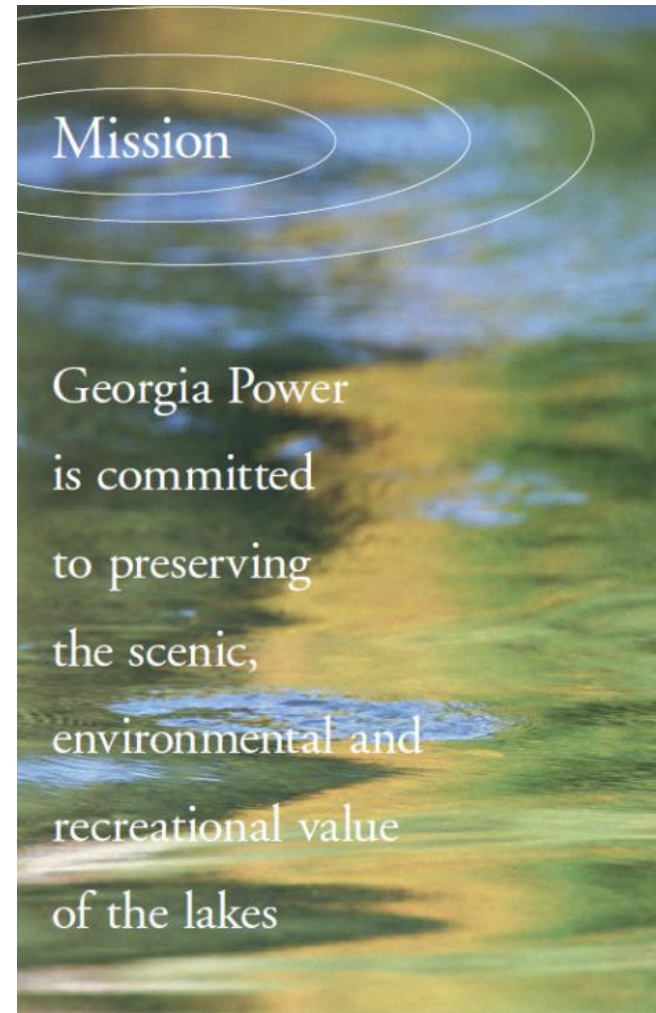
Source: National Land Cover Database 2016
(Multi-Resolution Land Characteristics Consortium)

Georgia Power-owned Lands within the Project Boundary



Shoreline Management Program

- Landowner agreement types
 - Residential lease lots
 - Access lease agreement
 - License agreement
- Permit Program for all construction, renovation, tree removal, grading, and dredging
- Shoreline Management Guidelines for structure size, setbacks, docks, seawalls, boat houses, gazebos, etc.



Shoreline Management Web Access



Shoreline Guidelines & Permit Applications

Please choose the applicable permit form(s) below. You may select a form(s) to submit online, or select each applicable PDF to print, fill out, then mail or fax to your Land Management Office. Before starting any of the activities listed below, a valid Georgia Power permit must be obtained by every homeowner for any activity on Georgia Power land. This permit requirement applies to Georgia Power leases and deeded properties.

<http://georgiapowerlakes.com/lakejackson/shoreline-management/>

Seawall



- ▶ VIEW DETAILS
- ▶ SUBMIT ONLINE FORM
- ▶ DOWNLOAD PDF

Docks



- ▶ VIEW DETAILS
- ▶ SUBMIT ONLINE FORM
- ▶ DOWNLOAD PDF

Boathouses



- ▶ VIEW DETAILS
- ▶ SUBMIT ONLINE FORM
- ▶ DOWNLOAD PDF

Dredging



- ▶ VIEW DETAILS
- ▶ SUBMIT ONLINE FORM
- ▶ DOWNLOAD PDF

Tree Removal and Landscaping



- ▶ VIEW DETAILS
- ▶ SUBMIT ONLINE FORM
- ▶ DOWNLOAD PDF

Residential Dwelling



- ▶ VIEW DETAILS
- ▶ SUBMIT ONLINE FORM
- ▶ DOWNLOAD PDF

Boatlifts and PWC Lift



- ▶ VIEW DETAILS
- ▶ SUBMIT ONLINE FORM
- ▶ DOWNLOAD PDF

Outbuilding Construction



- ▶ VIEW DETAILS
- ▶ SUBMIT ONLINE FORM
- ▶ DOWNLOAD PDF

Marinas



- ▶ VIEW DETAILS

Recreation and Land Use Summary

- Substantial existing information on recreational use was supplemented with user surveys at Georgia Power-owned recreation facilities
- Recreational opportunities within the region are numerous and diverse
- Usage estimates and projections indicate there is sufficient capacity to meet current and near-future recreation demands
- Recreation users are generally pleased with existing amenities
- Improvements desired by users include more parking, restroom, trash receptacles, and improved shoreline access for bank fishing
- Georgia Power's Shoreline Management Program is comprehensive and successful at preserving the scenic, environmental, and recreational values of Lake Jackson



Georgia
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Terrestrial, Wetland, and Riparian Resources

Presented by: Jim Ozier

Study Results Meeting
Lloyd Shoals Project
July 29, 2020

Study Objectives

- Describe terrestrial and botanical resources occurring in the Lloyd Shoals project area, including plant and animal species that use representative habitats
- Characterize the floodplain, wetlands and riparian habitats occurring in the project area
- Identify invasive species within the Lloyd Shoals project area
- Identify potentially suitable habitats for terrestrial rare, threatened, and endangered (RTE) species

Study Area

- FERC project boundary around Lake Jackson and tailrace area downstream, including project recreation facilities
- Zone extending 2000 feet beyond the project boundary for characterizing existing vegetative communities adjacent to the Project

- FERC Project Boundary
- 2000-foot Project Buffer



Study Methods

Methods – Review of Existing Information & GIS Mapping

Vegetative and Wildlife Communities

- The Natural Communities of Georgia
- State Wildlife Action Plan (GDNR)
- Terrestrial Ecological Classification (NatureServe)

Plant and Animal Species Distributions

- Amphibians and Reptiles of Georgia
- North American Breeding Bird Dataset
- Field Guide to Rare Plants of Georgia

GIS Mapping

- Aerial imagery from National Agriculture Imagery Program
- USFWS National Wetland Inventory
- Georgia Land Use Trends
- USGS topographic maps

Methods – Terrestrial Field Surveys

- Field reconnaissance surveys conducted in August 2019, February 2020, and April 2020
 - Vegetative communities and dominant plant species
 - Visual and auditory observations of birds
 - Visual observations of wildlife and wildlife signs
 - Invasive plant species
- Pedestrian- and boat-based surveys
- Particular attention to potentially suitable habitat for RTE terrestrial species

Community Evaluation Form

Community Evaluation Form – Lloyd Shoals Project (FERC No. 2336)

Community ID#: B2:1

Date: 21 August 2019

General Community Description: Deciduous/ mesic forest

Latitude: 33.4188

Longitude: -83.9081

Plant Species:

Common name	Scientific Name	Canopy %	Sub Canopy %	Ground Cover %
Black cherry	<i>Prunus serotina</i>		20	
Christmas fern	<i>Polystichum acrostichoides</i>			10
Virginia creeper	<i>Parthenocissus quinquefolia</i>			5
Shortleaf pine	<i>Pinus echinata</i>	2		
American beech	<i>Fagus grandifolia</i>	15	10	
Elliot's blueberry	<i>Vaccinium elliotii</i>		5	
Box elder	<i>Acer negundo</i>	10	5	
red buckeye	<i>Aesculus pavia</i>			
American basswood	<i>Tilia americana</i>	10		
Red maple	<i>Acer rubrum</i>			
Water oak	<i>Quercus nigra</i>	20		
Flowering dogwood	<i>Cornus florida</i>		5	
hawthorn	<i>Crataegus spp.</i>		2	

IPP Species Observations:

Common Name	Scientific Name	Canopy %	Sub Canopy %	Ground Cover %
Chinese privet	<i>Ligustrum sinense</i>		5	
Nepal grass	<i>Microstigium vimineum</i>			5

Wildlife Observations:

Green anole Carolina chickadee

Box turtle

Coyote

Skink spp

Study Results

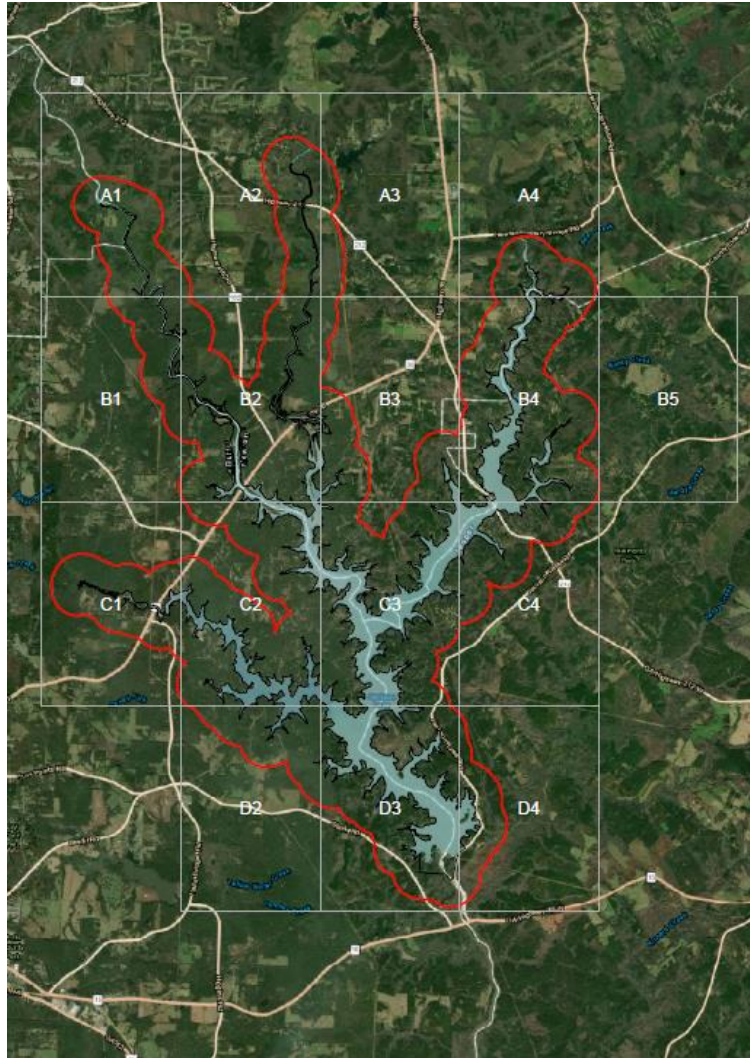
Vegetative Community Types in the Study Area

- Twelve vegetative community types were observed (top five in bold underline)

Vegetative Community Type	Acreage within Project Boundary	Percentage within Project Boundary	Acreage within 2,000-ft Buffer	Percentage within 2,000-ft Buffer
Mixed Pine/Hardwood Forest	173.7	4.1	10,6540.4	<u>43.9</u>
Floodplain and Riparian Forest	58.0	1.4	166.4	0.7
Deciduous/Mesic Slope Forest	138.2	3.2	1,777.6	<u>7.3</u>
Pine Forest/Pine Plantation	7.9	0.2	1,837.3	<u>7.6</u>
Dry Oak/Pine Forest	0.3	<0.1	3.9	<0.1
Utility Easement	2.9	0.1	160.0	0.7
Agriculture/Row Crop	0.1	<0.1	621.7	2.6
Forested Wetland	33.2	0.8	63.5	0.3
Scrub-shrub Wetland	10.2	0.2	17.6	0.1
Emergent/Herbaceous Wetland	35.2	0.8	52.5	0.2
Anthropogenic Disturbances	194.1	4.5	4,361.6	<u>18.0</u>
Clearcut/Sparse	--	--	795.3	<u>3.3</u>
Open Water (outside of Lake Jackson)	47.7	1.1	139.4	0.6
Lake Jackson	3,585.5	83.6	3,633.9	15.0
Total Acreage	4,286.9		24,281.1	

Vegetative Community Maps

Map Index – 16 grids



B2 – South River/Yellow River



C3 – South River/Alcovy River



Representative Habitats

- Agriculture/Row Crop

- 2.6% of study area; <0.1% of area within project boundary
- Hay fields, pasture, fallow fields
- 31 plant species observed



- Anthropogenic Disturbance

- 18.0% of land within study area; 4.5% of area within project boundary
- Residential areas, parks, landscaped areas
- 85 plant species observed



Representative Habitats

- Clearcut/Sparse
 - 3.3% of study area
 - Early successional maples, sweetgum, dogwood, sedges, dogfennel, blackberry
 - 36 plant species observed
- Dry Oak/Pine Forest
 - 0.01% of area within project boundary
 - Post oak, scarlet oak, hawthorn, sparkleberry, yucca
 - 17 plant species observed
- Deciduous/Mesic Forest
 - 7.3% of study area; 3.2% of area within project boundary
 - American beech, southern magnolia, northern red oak, blackgum, sugar maple, sourwood, American holly
 - 92 plant species observed



Representative Habitats

- Utility Easement

- 0.7% of study area; 0.07% of area within project boundary
- Maintained rights-of-way: various grasses, goldenrod, saltbush, softrush
- 51 plant species observed



- Emergent/Herbaceous Wetland

- 0.2% of study area; 0.8% of area within project boundary
- Knotweed, rice cutgrass, lizard's tail, false nettle, softrush
- 29 plant species observed



Representative Habitats

- Floodplain/Riparian Forest

- 0.7% of study area; 1.4% of area within project boundary
- American sycamore, sweetgum, black willow, ironwood, cherrybark oak, Christmas fern, false nettle, butterweed
- 67 plant species observed



- Forested Wetland

- 0.3% of study area; 0.8% of area within project boundary
- American sycamore, tupelo, green ash, box elder, button bush, black willow, silky dogwood, sensitive fern, cardinal flower
- 45 plant species observed



Representative Habitats

- Lake Jackson

- 15.0% of study area; 83.6% of area within project boundary



- Mixed Pine-Hardwood Forest

- 43.9% of study area; 4.1% of area within project boundary
- Loblolly pine, water oak, mockernut hickory, tuliptree, flowering dogwood, maples, eastern redbud, American holly, black cherry, Christmas fern, partridge berry, trumpet creeper
- 109 plant species observed



Representative Habitats

- Open Water

- 0.6% of study area; 1.1% of area within project boundary
- Lakes and ponds near Lake Jackson



- Pine Forest/Planted Pine

- 7.6% of study area; 0.2% of area within project boundary
- Loblolly pine, shortleaf pine, slash pine, various oaks and hickories, wax myrtle, maples, sweetgum, blackberry, muscadine, virginia creeper
- 41 plant species observed



Representative Habitats

- Scrub-Shrub Wetland
 - 0.1% of study area; 0.2% of area within project boundary
 - Buttonbush, silky dogwood, black willow, swamp knotweed, softrush, marsh pepperweed
 - 18 plant species observed



Wetland Community Types

- Wetland areas within the project boundary total 79 acres
- Most occur along upstream reaches of tributary embayments

Wetland Type ^a	Number of Features	Acreage within Project Boundary	Acreage with 2,000-ft Buffer
Forested	17	33.2	30.3
Scrub-Shrub	6	10.2	7.4
Emergent/Herbaceous	28	35.2	17.3
Total	51	78.7	55.0
Cumulative Acreage			133.6

^a Classification follows Cowardin et al. (1979)

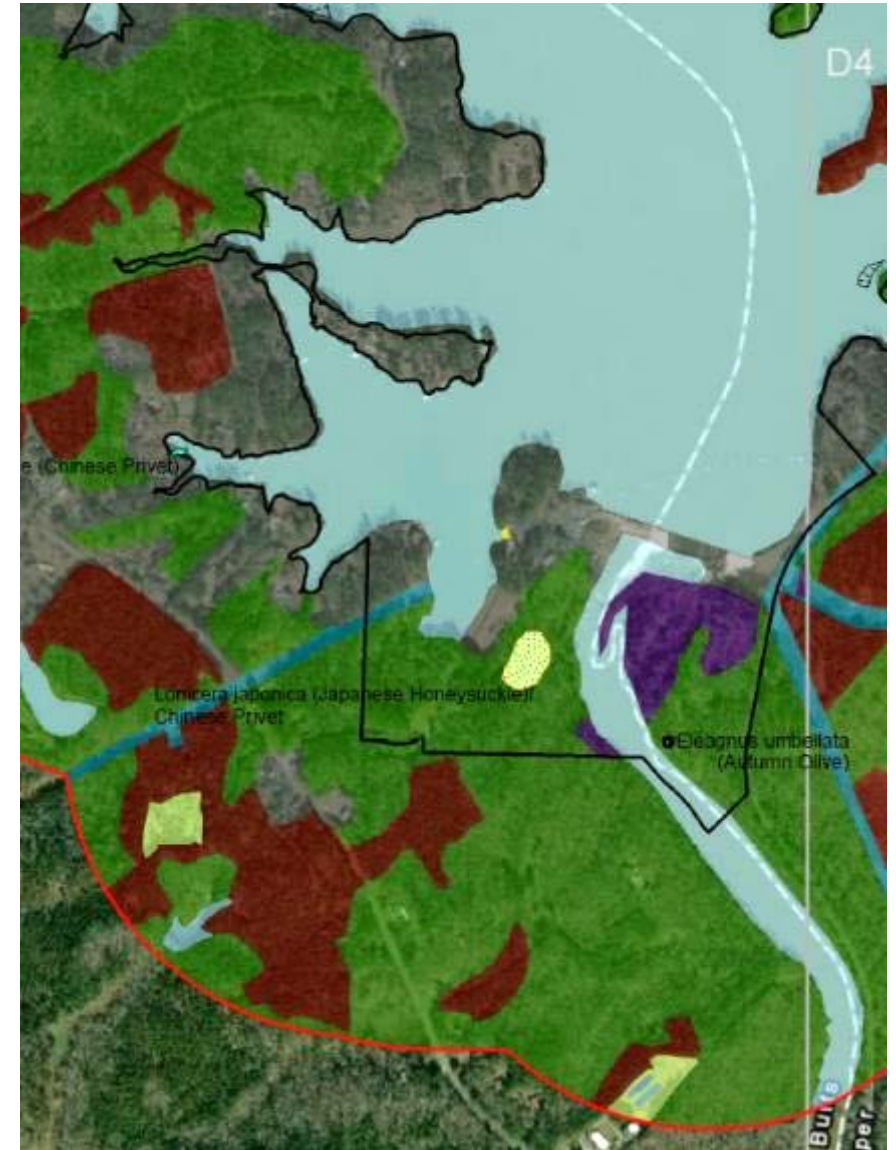
Floral and Faunal Species Observed

- Over 190 species of plants were identified
- No RTE plant species were observed during field efforts
- Eight mammal species observed
- 70 bird species observed
 - One bald eagle observed in the Alcovy River embayment of Lake Jackson
 - One active bald eagle nest is located in proximity to the project boundary
- Eight amphibian species observed
- Six reptile species observed



Invasive Plant Species

- Eleven invasive plant species identified within project boundary
- Species observed that exceeded 10% of coverage within certain natural areas
 - Autumn olive
 - Chinese privet
 - Japanese honeysuckle
 - Giant reed
 - Golden bamboo
 - Nepal grass
 - Mimosa



Aquatic Vegetation Management

- Georgia Power periodically coordinates herbicide treatments to help control nuisance aquatic vegetation in Lake Jackson
 - Small-scale and targeted to problem areas
 - Most treatments since 2012 have occurred in the South River embayment
- Georgia Power administers a residential shoreline aquatic vegetation management program for Lake Jackson
 - <http://georgiapowerlakes.com/lakejackson/aquatic-vegetation-management/>
 - Permit application required
 - Licensed aquatic herbicide applicator must be used
 - Area treated can be no larger than 0.5 acre

Summary

- Dominant vegetative communities include mixed pine-hardwood forest, anthropogenic disturbances, pine forest, deciduous forest, and floodplain forest
- Vegetative communities provide habitat for numerous wildlife species
- Wetlands are associated primarily with rivers and creeks in upstream reaches
- Littoral habitats in upstream reaches include limited standing timber, emergent wetlands, and sediment islands/flats
- Overall habitat conditions in the study area are unsuitable for RTE plant species
- Bald eagle occurs at the Project and nests just outside of the project boundary
- Invasive plant species occur in small areas, often in residential landscaping
- Continued project operation would not adversely affect terrestrial, wetland, or riparian resources within the project boundary



Georgia
Power



Rare, Threatened, and Endangered (RTE) Species

Presented by: Jim Ozier

Study Results Meeting
Lloyd Shoals Project
July 29, 2020

Study Objectives

- List federal and state RTE plant and animal species, and species currently under federal status review, with known records of occurrence near the Project
- Identify the habitat requirements of these species
- Describe distributions and habitat use of RTE species presently occurring near the Project



Photo by James Hanula, USFS



Photo by Pete Pattavina, USFWS

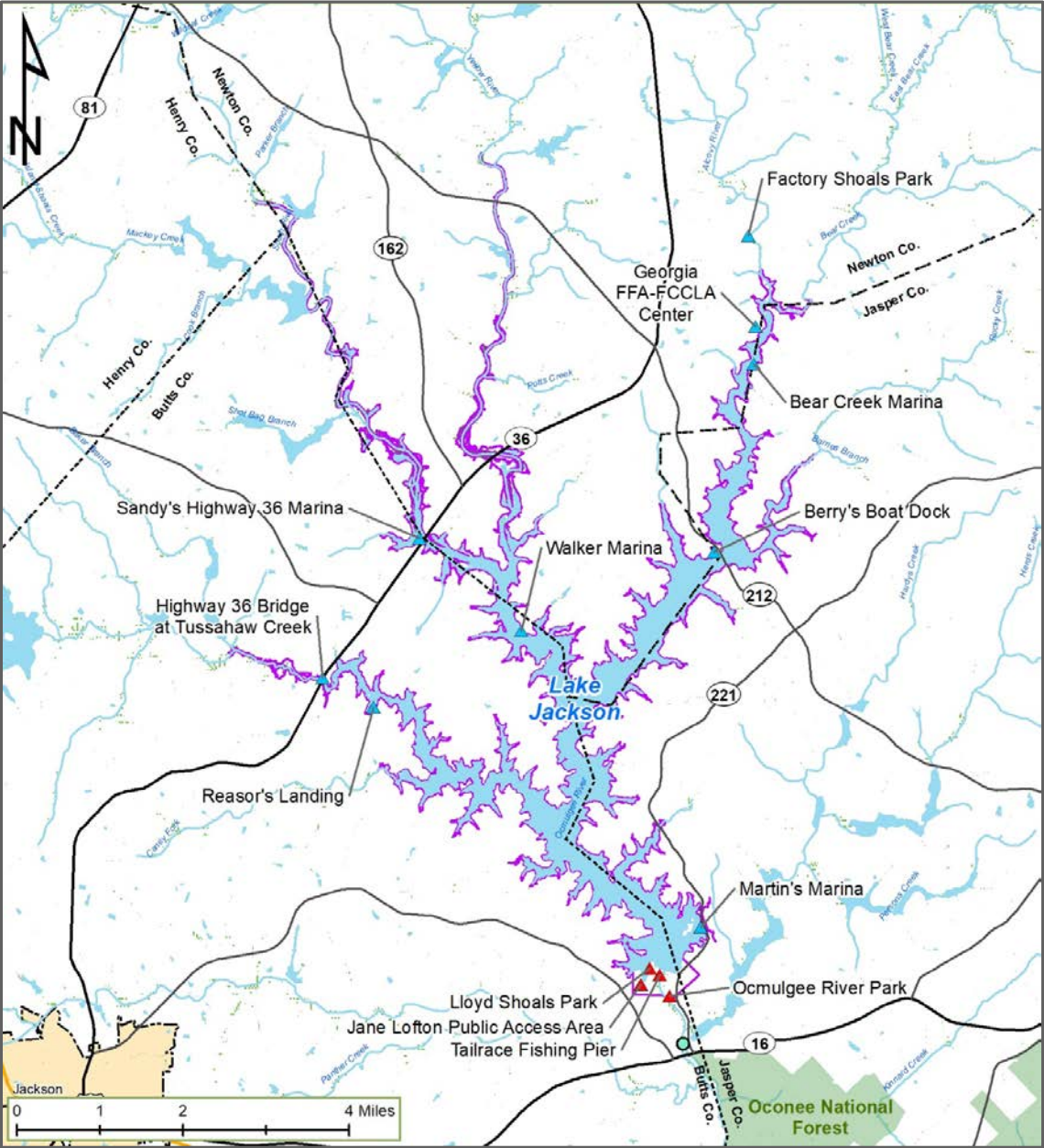


Photo by Dick Biggins, USFWS

Study Area

- FERC project boundary around Lake Jackson and tailrace area downstream, including the project recreation facilities

- Project Boundary
- ▲ Project Recreation Facilities



Study Methods

Methods – Review of Existing Information

GDNR Wildlife Resources Division

- Online Georgia Biodiversity Portal
- State Wildlife Action Plan

U.S. Fish and Wildlife Service (FWS)

- Environmental Conservation Online System
- IPaC project planning tool

Fishes of Georgia Website

- Distributional atlas with collection data from UGA's Georgia Museum of Natural History

Scientific Literature and Technical Reports

- Regional field guides and research publications
- NatureServe Explorer

Methods – RTE Terrestrial Surveys



Forested Wetland

Photo by Corblu Ecology Group

- Field reconnaissance surveys conducted in August 2019, February 2020, and April 2020
- Concurrent with field surveys for Terrestrial, Wetlands, and Riparian Resources Study
- Pedestrian- and boat-based surveys
- Particular attention to potentially suitable habitat for RTE species

Methods – Freshwater Mussel Survey

- Surveys conducted by GDNR Wildlife Resource Division in Sep-Nov 2019
 - Lake Jackson – 22 survey sites
 - Tailrace area – 20 survey sites in 3-mile reach
 - Tailrace area to Juliette Dam – 7 survey sites in 16-mile reach



Photos by GDNR WRD

Study Results

Federally Listed Species

- Five species from Butts, Henry, Newton, and Jasper Counties
- None presently known to occur within project boundary



Scientific Name	Common Name	Federal Status	Habitat	Suitable Habitat Present?
PLANTS:				
<i>Gratiola amphiantha</i>	Little Amphianthus	T	Granite-outcrop vernal pools	No
<i>Isoetes melanospora</i>	Black-spored Quillwort	E	Granite-outcrop vernal pools	No
<i>Rhus michauxii</i>	Michaux's Sumac	E	Sandy or rocky open woods	No
<i>Trillium reliquum</i>	Relict Trillium	E	Mature mesic hardwood forest	No
WILDLIFE:				
<i>Picoides borealis</i>	Red-cockaded Woodpecker	E	Mature open pine forest	No

Species Under Review for Federal Listing



Robust Redhorse – Photo by Valerie Renee, via Flickr, CC

- Four species known from project vicinity
- One species (Robust Redhorse) known to occur within project boundary

Scientific Name	Common Name	GA Status	Findings
<i>Moxostoma robustum</i>	Robust Redhorse	E	Refugial population in Ocmulgee River downstream of Project; Georgia Power working with partners to renew Candidate Conservation Agreement with Assurances
<i>Somatogyrus alcoviensis</i>	Reverse Pebblesnail	--	Inhabits shoals with rapidly flowing water; not found in Lake Jackson or Ocmulgee River; WRD to conduct survey in Alcovy River in 2020
<i>Perimyotis subflavus</i>	Tricolored Bat	--	Widespread but significantly declining; roosts in caves, rock shelters, trees, and man-made structures; potentially occurs in project area but no hibernacula observed during field surveys
<i>Eriocaulon koernickianum</i>	Small-headed Pipewort	E	Granite-outcrop habitat not found

State Protected Species



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- Eleven species known from project vicinity (plants, aquatic species, snake, bird)
- Four state threatened species known to occur within project boundary

Scientific Name	Common Name	Findings
<i>Haliaeetus leucocephalus</i>	Bald Eagle ^a	One known nesting territory on Lake Jackson; 2020 nest site just outside of project boundary
<i>Alasmidonta arcula</i>	Altamaha Arcmussel	One relict shell found in Lake Jackson in 2019; live specimens reported in previous surveys
<i>Toxolasma pullus</i>	Savannah Lilliput	One live mussel found in Lake Jackson in 2019, extends known range 235 miles upstream
<i>Cyprinella xaenura</i>	Altamaha Shiner	Inhabits Ocmulgee River downstream, including tailrace area
^a Also federally protected under the Bald and Golden Eagle Protection Act.		

Other Species of Concern

- 28 other plant and wildlife species of conservation concern in project vicinity
- Two aquatic species known to occur within project boundary

Scientific Name	Common Name	Findings
<i>Pyganodon gibbosa</i>	Inflated Floater	Found in Lake Jackson and Ocmulgee River downstream in 2019
<i>Micropterus cataractae</i>	Shoal Bass	Popular riverine sport fish introduced to Ocmulgee River downstream of Lloyd Shoals Dam



Inflated Floater – Photo by GDNR WRD



Shoal Bass – Photo by Drew Morgan, CC

Summary

- No federally listed species presently occur within the project boundary
- Seven RTE species are known to occur within the project boundary
 - Robust Redhorse – under review
 - Bald Eagle – state threatened
 - Altamaha Arcmussel – state threatened
 - Savannah Lilliput – state threatened
 - Altamaha Shiner – state threatened
 - Inflated Floater – conservation concern
 - Shoal Bass – conservation concern



Bald Eagle – Photo by Saffron Blaze



Altamaha Arcmussel – Photo by Brett Albanese



Robust Redhorse – Photo from Georgia Power



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Cultural and Tribal Resources

Presented by: Joey Charles

Study Results Meeting
Lloyd Shoals Project
July 29, 2020

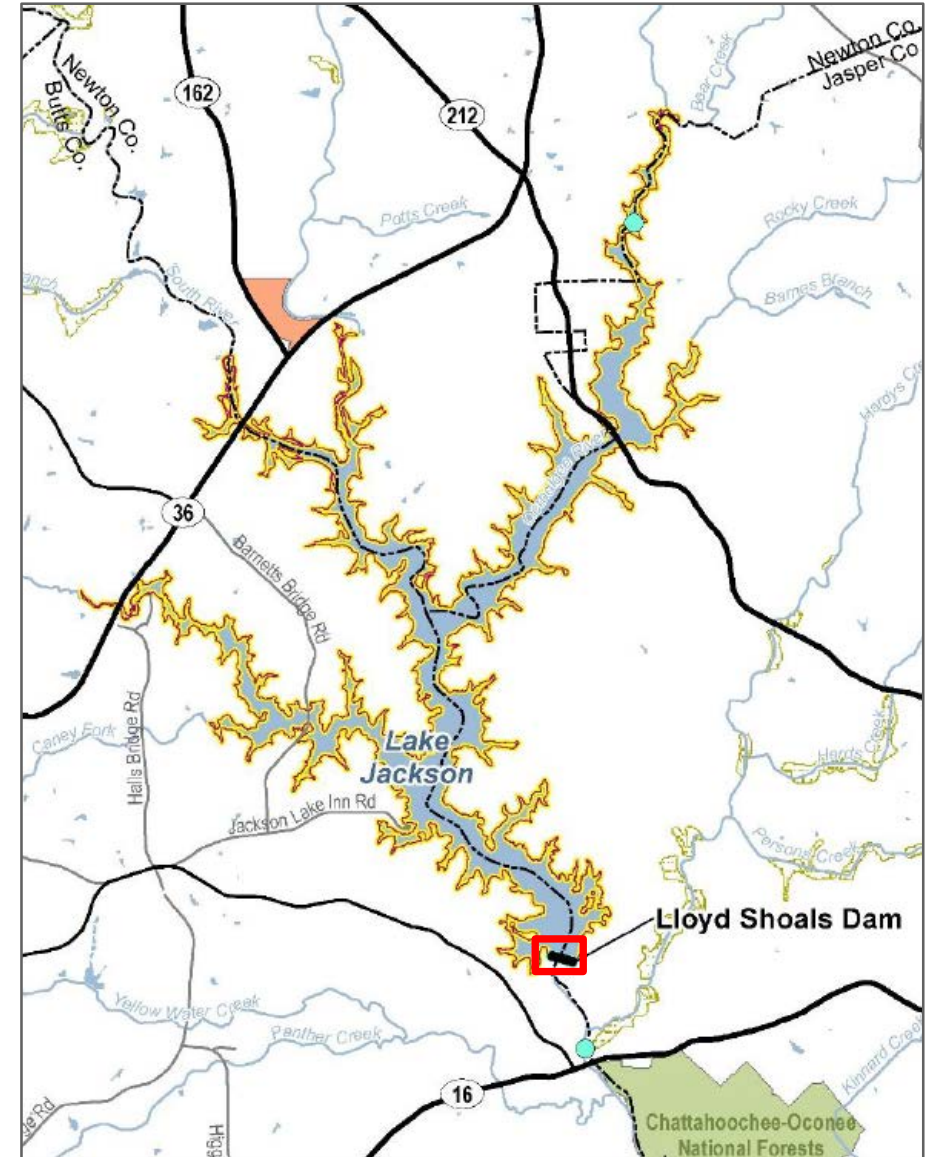
Study Objectives

- Identify and delineate area of potential effects (APE)
- Identify known historic resources through literature and site file review
- Determine if any historic properties are eligible for listing on the National Register of Historic Places (NRHP)
- Evaluate the potential for effects upon historic resources by the operation and maintenance of the Project or by activities conducted along the shoreline of the project reservoir



Study Area

- Area of Potential Effects (APE)
 - **Archaeological assessment** – the area between the Lake Jackson normal low pool elevation of 527 feet plant datum and the project boundary
 - **Historic hydro-engineering assessment** – area immediately around the dam, powerhouse, and operations areas (project works) within the project boundary



Tribal Consultation



Tribal Consultation

- FERC contacted eight tribes to initiate government-to-government consultation
- Georgia Power involved as non-federal designee
- The Muscogee (Creek) Nation expressed interest in participating
 - Tribal consultation meeting held via teleconference
 - Comments filed on Proposed Study Plan

Tribes
Alabama-Quassarte Tribal Town
Alabama-Coushatta Tribe of Texas
Cherokee Nation
Coushatta Tribe of Louisiana
Kialegee Tribal Town
Muscogee (Creek) Nation
Poarch Band of Creek Indians
Thlopthlocco Tribal Town

Archaeological Assessment



**Phase II
Archaeological
Assessment of Six
Sites at the Lloyd
Shoals Hydroelectric
Project (FERC No.
2336), Butts, Henry,
Jasper and Newton
Counties, Georgia**

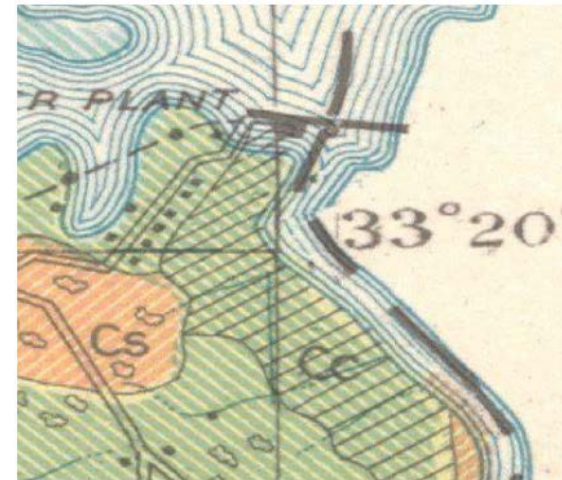
April 2020

Prepared For:

Georgia Power
Under Contract to Kleinschmidt

Prepared By:

TRC



Methods

Review available information
on six previously recorded
archaeological sites

Conduct field testing/site
evaluation of four of the sites

Provide recommendations
regarding NRHP eligibility



Previously Recommended NRHP-Eligible Sites

- Georgia Power annually monitors six sites
- Four sites tested; two sites inundated were not investigated

Site	Area	Description	1989 condition
9BS17	Lloyd Shoals Construction and Operator's Village	African American housing area	Disturbed, foundations may be present
9BS18	Lloyd Shoals Construction and Operator's Village	Construction village, numerous features	Disturbed, foundations may be present
9BS19	Lloyd Shoals Construction and Operator's Village	Landscape feature, construction staging pad	Disturbed to subsurface
9BS20	Lloyd Shoals Construction and Operator's Village	Plant supervisor's home site	Disturbed, foundations may be present
9BS23	Hendrick's Mill	Circa 1830-1910 grist mill	Partially submerged
9JA223	Dempsey Ferry	Circa 1859 river ferry	Submerged

Methods – Phase II Testing/Site Evaluation

- Shovel testing and test unit excavation
- Artifact sorting, identification, and analysis
- NRHP eligibility criteria applied

Criteria

- A – Event
- B – Person
- C – Design/Constr.
- D – Info Potential

Integrity

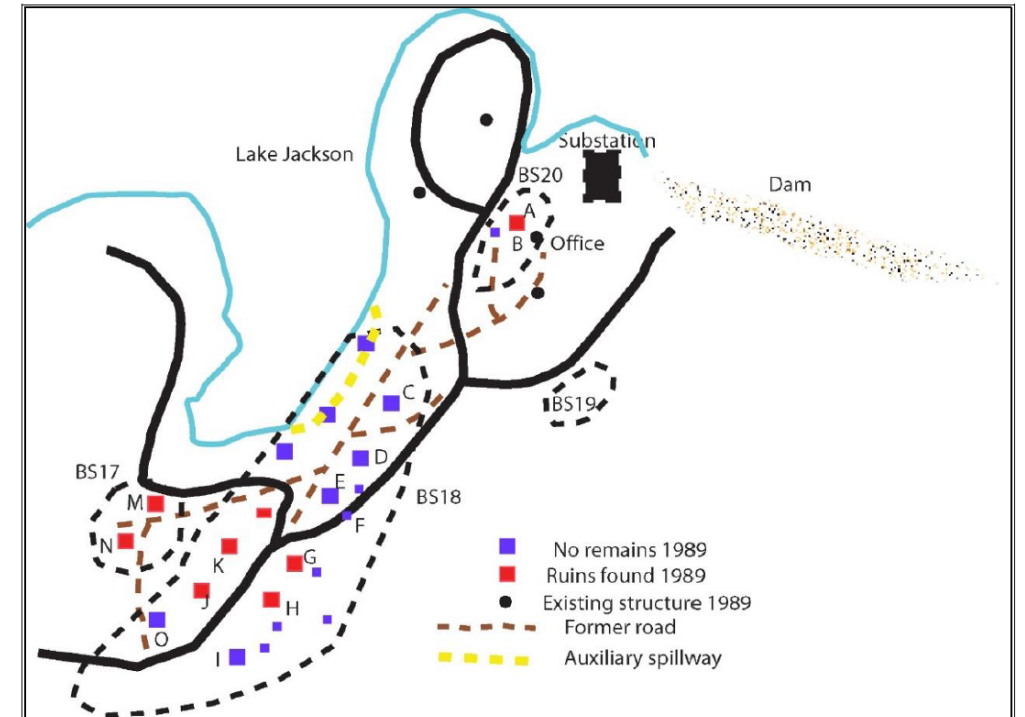
- Location
- Design
- Setting
- Materials
- Workmanship
- Feeling
- Association



Results – Background Research

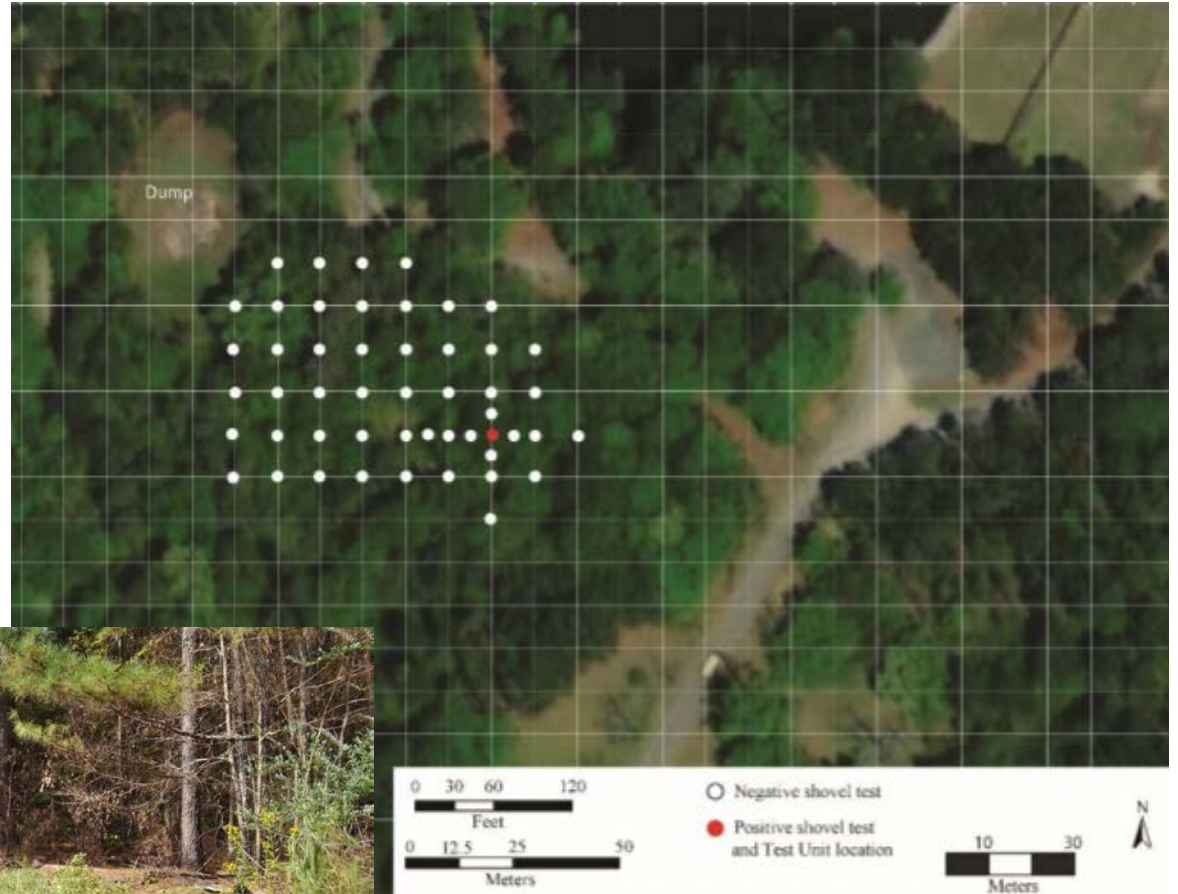
- Dempsey Ferry (Site 9BS23) and Hendrick’s Mill (Site 9JA223) first recorded in 1989
 - Inundated in fall-winter 2019
 - Both sites “potentially eligible”
- Lloyd Shoals Village documented in 1982 (Site GP-BT-01)
 - Reassessed in 1989 and split into four sites (9BS17, 9BS18, 9BS19, 9BS20)
 - All recommended as “eligible” in 1989

1989 Map of Lloyd Shoals Village



Results – Site 9BS17

- 1989: described as “extremely disturbed”, “possibly bulldozed,” and used as a dump
- Revisited in 2019
 - Little change in conditions from 1989
 - Recommended for continued monitoring



Results – Site 9BS18

- 1989: described as having “readily observed remains”: curbing, stone foundations, ornamental plants, concrete steps and slabs
- Revisited in 2019
 - No new impacts to structural remains
 - Variety of artifacts collected
 - Recommended for continued monitoring



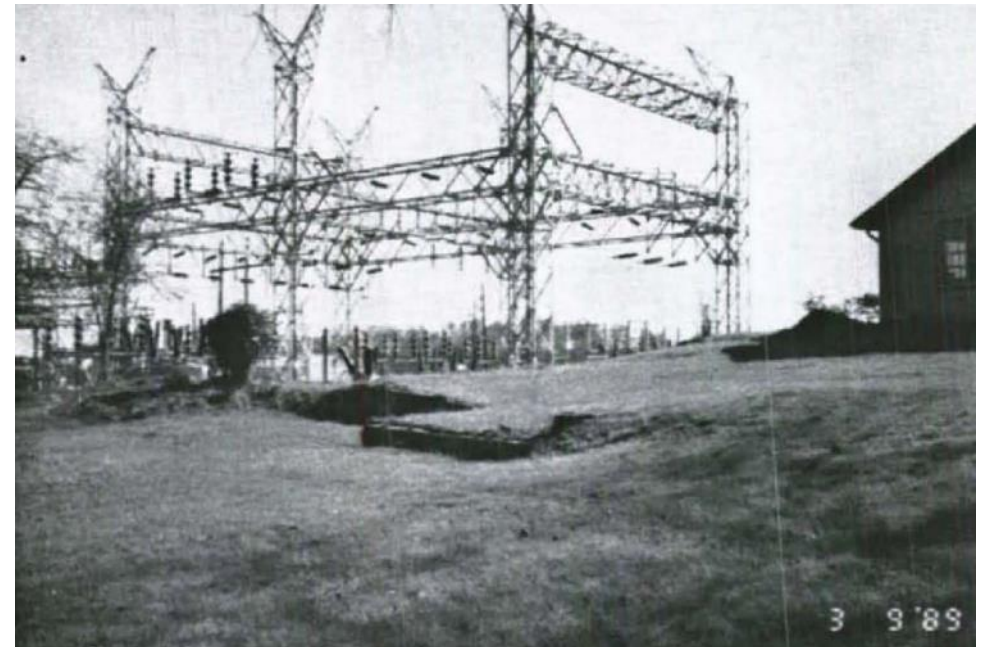
Results – Site 9BS19



- 1989: described as being on “artificially leveled terrace”
 - Thought to have been staging area during dam construction
 - Currently paved
- 2019 examination shows same conditions as 1989
 - No artifacts or structural remains
 - Not recommended for continued monitoring

Results – Site 9BS20

- Location of plant supervisors' house, 1911-1967
- By 1989, site was office complex (field office, shop buildings, parking)
 - Foundations visible near field office
- 2019 assessment found little change to site conditions since 1989
 - Recommended for continued monitoring



Recommendations

- In 1989, six sites on Lake Jackson were recommended eligible/potentially eligible
 - Avoided by construction/development activities since that time; monitored annually
- Four sites comprising Lloyd Shoals Village were tested/reevaluated in 2019

Site	Area	NRHP Recommendation
9BS17	Lloyd Shoals Village	Eligible
9BS18	Lloyd Shoals Village	Eligible
9BS19	Lloyd Shoals Village	Not eligible
9BS20	Lloyd Shoals Village	Eligible
9BS23	Hendrick's Mill	Eligible
9JA223	Dempsey Ferry	Eligible

Historic Hydro- Engineering Assessment



Historic Hydro- Engineering Assessment of the Lloyd Shoals Hydroelectric Project (FERC No. 2336), Butts and Jasper Counties, Georgia

Prepared For:

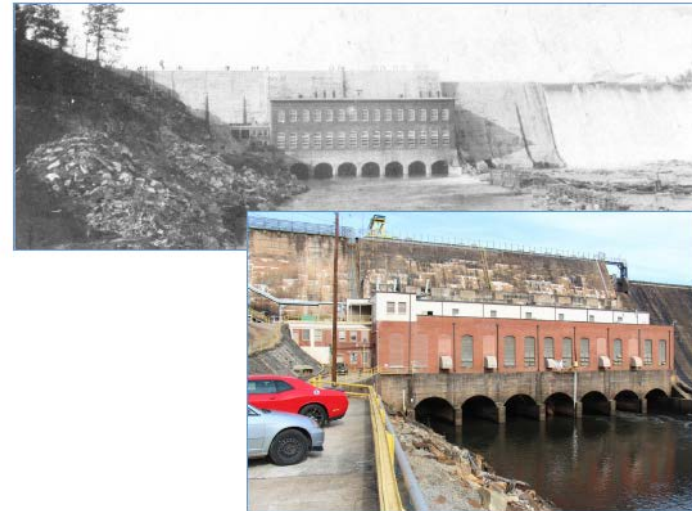
Georgia Power
241 Ralph McGill Blvd., NE
Atlanta, Georgia 30308

Prepared By:

TRC
1865 Air Lane Drive, Suite 9
Nashville, Tennessee 37210

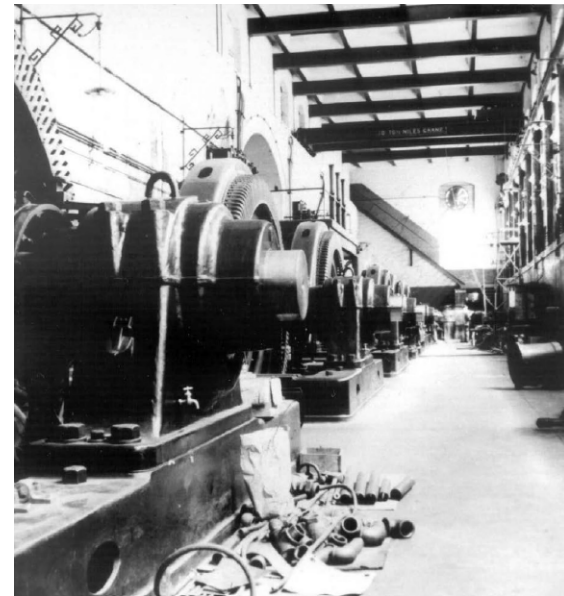
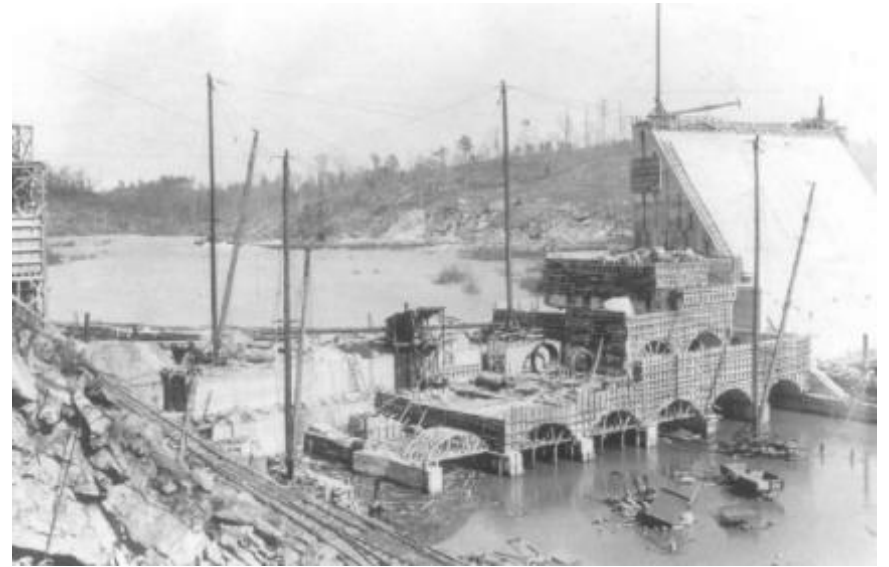
Under Contract to
Kleinschmidt

April 2020



Methods

- Background research and field work in December 2019
- Developed historical context of hydropower development in US and in Georgia
- Documented design, construction, and operational history of Lloyd Shoals Project
- Documented current conditions of Lloyd Shoals dam and powerhouse
- NRHP evaluation and assessment of effects of continued operation on project works



Results – Background Research

- Lloyd Shoals Project is well documented in the historic record
- Inventoried in 1975 for the Historic American Engineering Record
 - Nominated for NRHP listing
- Surveyed again in 1990 for FERC relicensing
 - Recommended eligible under Criteria A and C; no concurrence record with SHPO
 - Project is not in Georgia's Natural, Archaeological and Historic Resources GIS (GNAHRGIS)



Results – Background Research

1983 Fire
damage



Results – Project Description

- Project Dam
 - Max height: 105 feet
 - Length: 1,599 feet



Results – Project Description



- Powerhouse
 - 1910 two-story building with brick curtain walls on a steel frame
 - Ground floor is original, second floor rebuilt after 1983 fire
 - Ground floor divided into 15 bays with windows, 6 have been modified/bricked over
 - On west end of powerhouse is original two-story brick wing that serves as administration and office area
 - Six original turbine-generator units

Recommendations and Conclusion

- Project long recognized as significant historic resource but never formally listed in NRHP
- In 1990, Project was recommended as eligible for listing under:
 - Criterion A – significant association with the history of hydroelectric development in Georgia
 - Criterion C – distinctive example of an early-twentieth century hydroelectric dam
- 2019 assessment recommends the Project remain eligible for listing under Criteria A and C
- No effect to historic properties as result of continued operation





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Next Steps

Presented by: Courtenay O'Mara, P.E.

Study Results Meeting
Lloyd Shoals Project
July 29, 2020

Next Steps in Schedule

First Season Studies		May 2019 – April 2020	New Date	Original Date
Study Report filed	Georgia Power	To be filed no later than 1 year after FERC approval of Study Plan 18 CFR § 5.15	19-May-20	19-May-20
Study Results Meeting	Georgia Power	Within 15 days of Study Reports 18 CFR § 5.15	29-Jul-20	3-Jun-20
File Study Results Meeting Summary	Georgia Power	Within 15 days of Study Results Meeting 18 CFR § 5.15	13-Aug-20	18-Jun-20
File Study Results Meeting Summary Disagreements and/or Modified or New Study Requests	Stakeholders	Within 30 days of Study Results Meeting Summary filing 18 CFR § 5.15	14-Sep-20	20-Jul-20
File Response to Study Results Meeting Summary Disagreements and/or Modified or New Study Requests	Georgia Power	Within 30 days of stakeholder deadline for Study Results Meeting Summary Disagreements and/or Modified or New Study Requests 18 CFR § 5.15	14-Oct-20	19-Aug-20
FERC resolves disagreements (and modifies Study Plan if necessary)	FERC	Within 30 days of filing response to Study Results Meeting Summary Disagreements and/or Modified or New Study Requests 18 CFR § 5.15	13-Nov-20	18-Sep-20
Second Season Studies (If necessary)		May 2020 – April 2021		



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