

**MEETING NOTES**  
**Stevens Creek Hydroelectric Project (FERC No. 2535)**

**Dominion Energy South Carolina, Inc.**  
**Fish Passage Technical Working Committee**

**December 4, 2024**

Final JAG 3/7/25

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**MEETING ATTENDEES<sup>1</sup>:**

Taylor Allen <sup>a</sup> – Dominion Energy	Alison Jakupca – Kleinschmidt
Ray Ammarell – Dominion Energy	Bjorn Lake <sup>a</sup> – NMFS
Eric Bauer <sup>a</sup> – USFWS	Kevin Mack – NMFS
Audrey Bauhan – Dominion Energy	Paula Marcinek <sup>a,b</sup>
Jason Bettinger <sup>a</sup> – SCDNR	Elizabeth Miller – SCDNR
Bryant Bowen <sup>a</sup> – GAWRD	Jason Moak <sup>a</sup> – Kleinschmidt
Amy Bresnahan – Dominion Energy	Bill Post – SCDNR
Caleb Gaston – Dominion Energy	Will Pruitt <sup>a</sup> – Kleinschmidt
Aaron Gray <sup>a</sup> – GAWRD	Fritz Rohde – NMFS
Jenn Güt – Kleinschmidt	Andrew Rollins – Dominion Energy
Andy Herndon <sup>a</sup> – NMFS	Paul Vidonic – Dominion Energy
Fritz Hoogakker – Dominion Energy	Ellen Waldrop <sup>a</sup> – SCDNR

<sup>a</sup> attended virtually

<sup>b</sup> outside expert as outlined in the FPTWC Rules of Operation

Not in Attendance: USFS

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*These notes are a summary of the major points presented during the meeting and are not intended to be a transcript or analysis of the meeting.*

**MEETING PURPOSE:** The purpose of the meeting was to review the process and planning/siting study development of fish passage for the Stevens Creek Hydroelectric Project (Project).

Alison, Kleinschmidt, began the meeting with a welcome and led introductions of the Fish Passage Technical Working Committee (FPTWC, group, or committee). Amy, Dominion

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<sup>1</sup> Abbreviations/Acronyms: GAWRD = Georgia Wildlife Resources Department; Kleinschmidt = Kleinschmidt Associates; NMFS = National Marine Fisheries Service; SCDNR = South Carolina Department of Natural Resources; USFWS = United States Fish and Wildlife Service; USFS = United States Forest Service

Energy, provided relevant information about the meeting building to in-person attendees and led a safety moment.

### **NSBLD/ADD Update**

Kevin, NMFS, provided an update on the trial-type hearing regarding the Augusta Diversion Dam (ADD). The trial-type hearing has concluded, and the ALJ<sup>2</sup> has made the decision to dismiss the City of Augusta's hearing request. The case files were provided to FERC<sup>3</sup> on December 3, 2024, and the decision is now on the ADD docket. Bjorn, NMFS, added that the next steps are up to FERC; FERC will either issue the license for ADD or re-do their NEPA<sup>4</sup> process. It is anticipated that the City of Augusta will take FERC to circuit court to continue to challenge the ADD license.

Andy, NMFS, provided an update on the New Savannah Bluff Lock and Dam (NSBLD). On December 3, 2024, the Federal House and Senate reconciled the competing Water Resources Development Act (WRDA) amendment as it relates to the Savannah Harbor Expansion Project and fish passage at NSBLD. Significant changes were made regarding the requirements for NSBLD; there is no longer language in WRDA requiring a full-width rock-ramp arch, just a bypass around the dam. There was also revised language regarding maintaining the pool elevation and repairing the dam. The revised WRDA amendment is vastly different than what NMFS was anticipating.

### **Flows Analysis**

Kevin provided a presentation titled "Potential Impacts to Diadromous Fish Habitats in the Middle Savannah River", which included an analysis of flows at the Project. This information was filed on the Project FERC docket on October 2, 2024, by NMFS in response to Scoping Document 2.

In summary, flow duration curves for the period from 2017 to 2023 were generated using sub-daily measures of discharge recorded every 15 minutes for Stevens Creek and the Savannah River using the Upper Stevens Creek and NSBLD gages (USGS<sup>5</sup> gage nos. 021960000 and 02197000, respectively). The disparity in flows and peaking operations at J. Strom Thurmond dam (JST), which is operated by the United States Army Corps of Engineers (USACE), results in pulses of water in the Savannah River reaching the Project dam and back watering the mouth of Stevens Creek. According to NMFS, the unusual hydrology contributes to poor water quality in the Project impoundment and interrupts sediment transport in and from Stevens Creek. The flow duration curve for the Savannah River

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<sup>2</sup> ALJ = Administrative Law Judge

<sup>3</sup> FERC = Federal Energy Regulatory Commission

<sup>4</sup> NEPA = National Environmental Policy Act

<sup>5</sup> USGS = United States Geological Survey

indicates discharges from JST exceed the Project capacity of 8,300 cubic feet per second (cfs) for about 32 percent of the year. Sub-daily variations in water level greater than 1 foot occur on 46 percent of days during the period of record (2017 to 2023), and water levels vary by 2 feet or more on 18 percent of days. Sub-daily range in gage height at the Augusta Shoals was higher on days when flashboards were down at the Project compared to days when all flashboards were up. During the spawning periods for the endangered Atlantic sturgeon (ATS) and shortnose sturgeon (SNS), who are expected to use the Augusta Shoals as spawning habitat following passage implementation at NSBLD, sub-daily variations in water level greater than 1 foot occur on 44 percent of days during the period of record; water levels vary by 2 feet or more on 16 percent of days. For the purposes of data visualization, May 10, 2023, was classified as an "average day" and July 11, 2023, as a "non-average day", which is when Project flashboards were down.

Elizabeth, SCDNR, asked if NMFS's analysis considers Stevens Creek flows, which it does. Jason added that the NSBLD gage would also capture flows from Horse Creek. The data was pro-rated accordingly.

According to NMFS, the biggest concern with large water level fluctuations (greater than 2 feet) is if the fluctuation happens quickly, larvae and juveniles could be stranded. Fritz H., Dominion Energy, noted that similar case studies exist where the tidal range reaches 2 feet; Fritz H. asked if those case studies had been reviewed, which they have not been. Fritz H. stated that it appears that there are reduced changes at the Augusta Shoals, which is a direct function of reregulation at the Project.

Ray explained the typical spring and summer peaking operations at JST and reregulation at the Project. While JST is not generating, the Project reservoir is depleting as operators attempt to release the daily average flow. As the reservoir depletes, Project generation is reduced to wait for the release from JST to occur. Project operators adjust wicket gates rather than turn on and off turbines. The Project typically receives more than its capacity of 8,300 cfs from JST instantaneously. What Project operators are trying to prevent is the flashboards from tripping when the slug of water from JST is released.

Kevin clarified that he presented data in both water elevation and discharge metrics but not all gages measure discharge. Ray added that there is a time lapse between what is occurring at the Project and the NSBLD gage, which is currently unknown. Kevin further explained that NMFS established ideal water level ranges based on the variation in available data; there is not a report that NMFS has found that discusses how/what water level fluctuations affect ATS and SNS. The issue of concern is a rapid decline in water levels; for example, water in the Augusta Shoals declined 3 feet in 11 hours on the "non-average day" (July 11, 2023), which is when Project flashboards were down. Fritz H. asked the frequency of tripped flashboards during sturgeon spawning season. The answer varies, but in the case of July 11, 2023, the flashboards were down for 11 days. Ray added that the flashboards can be down

for a while in the winter and spring due to high flows. Fritz H. to investigate the frequency of flashboards down during sturgeon spawning season. Bill, SCDNR, inquired if GAWRD had any environmental data in the Augusta Shoals during July 2023 to determine if there is high temperature and/or low dissolved oxygen. Bryant, GAWRD, responded that Georgia Southern University has been handling data collection in the Augusta Shoals; GAWRD will attempt to receive the data from the university. Bryant clarified that GAWRD typically collects samples in the spring and fall. Andy added that some applicable data may be available in the ADD Biological Opinion (BiOp) issued by NMFS.

Amy pointed out that during 2020 and 2021, anchoring was being conducted at the Project. These years were wet years, and the flashboards were down a good amount, which indicate 2020 and 2021 were not “typical” years in terms of tripped flashboards.

Bill asked when ATS and SNS are present in the Augusta Shoals. Andy responded that the ADD BiOp assumed a broad range with SNS present from January through March along with some ATS. The month of June was also included based on tracking data. It is unclear whether there is a spring run of ATS but there is some evidence elsewhere to suggest the possibility. There is definitely a fall run of ATS up the Savannah River occurring from August through October. Bill added that there is evidence of spring spawning based on telemetry data; SCDNR is currently trying to verify the ATS spring spawning run with genetics.

Andy stated that NMFS is assuming there will eventually be fish passage at NSBLD, and sturgeon will be passed upstream to the Augusta Shoals. NMFS further expects that there will be requirements from the City of Augusta and/or Dominion Energy to pass a certain amount of water over the Augusta Shoals, which would not be triggered until work is completed at NSBLD.

Kevin concluded that the intent of NMFS’s comments on Scoping Document 2 was to inform FERC; however, it also provided beneficial knowledge for NMFS. Fritz H. stated that he would like to explore the biological implications of Kevin’s work in further detail. Caleb, Dominion Energy, added that comparing what is happening at the Jefferson Davis Bridge gage (USGS gage no. 02196670) is helpful for the Project, which is likely a better task for the Water Quality Adaptive Management Plan (AMP) group.

Alison spoke of the NMFS analysis being helpful for Dominion Energy in analyzing flows at the Project, leading Dominion Energy to discover more information regarding flows. Jason, Kleinschmidt, provided a presentation which discussed the additional flow analysis for the Project. Dominion Energy has at its disposal HEC-RAS<sup>6</sup> transect data through the Augusta

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<sup>6</sup> HEC-RAS = Hydrologic Engineering Center River Analysis System; HEC-RAS is simulation software used in computational fluid dynamics – specifically, to model the hydraulics of water flow through natural rivers and other channels; HEC-RAS was developed by the United States Army Corps of Engineers.

Shoals; the cross sections were provided by USACE. Jason highlighted that the last visible section of shoals on Google Earth is approximately 4.6 miles downstream from the ADD. There is an approximately 40-foot decrease in elevation between the most upstream and downstream portions of the Augusta Shoals. In reality, the shoals are step-pool in nature; the cross sections were conducted 0.5 miles apart from one another. On an “average day” (May 10, 2023), an approximately 0.2-mile stretch of the Augusta Shoals (7 hectares; 2.8 percent of total area) is affected by water level fluctuations. Andy asked how the highest water level recorded at the gage transfers to the Augusta Shoals. Jason responded that the highlighted areas are likely to experience the most effects from fluctuations. Bjorn added that from his perspective the area below the “Gauge Lo” elevation is less affected than the area upstream of the “Gauge Lo” elevation. Andy added that the percentage of shoals affected would change based on the flow fluctuations.

Elizabeth inquired of the type of gage at the Jefferson Davis Bridge and how it was deployed. Jason responded that it is either a sonic or radar gage and is deployed on the bridge pointing down at the water surface. He believes the gage is relatively center on the bridge. Jason added that the width of the river in that area is approximately 600 feet; the river can reach up to approximately 1,200 feet in width within the Augusta Shoals.

On a “non-average day” (July 11, 2023), there is a bigger difference between the high and low water surface elevations which equates to 5.5 percent (13.8 hectares) of the Augusta Shoals being impacted.

Jason reviewed the results from the Augusta Shoals IFIM<sup>7</sup> study that was conducted in the early 2000s. In summary, a 1-foot increase in depth equates to an approximately 4,000 cfs increase in flow. Therefore, an increase from 1 foot to 3 feet in Augusta Shoals water levels would represent a 26,000 cfs fluctuation.

Jason then reviewed some results from the Southeastern Natural Sciences Academy (SNSA) Augusta Shoals Flow Pilot Study. In summary, over 90 percent of daily water fluctuations were less than 1 foot during the 10-month period in 2008 that SNSA continuously monitored the shoals; there were no instances of water level fluctuations over 2 feet. The highest flows may have been approximately 26,000 cfs. It was noted that 2008 was a record-breaking drought year and is likely not representative of an average year.

Jason concluded that data from the Jefferson Davis Bridge gage is indicative of only a small portion of the Augusta Shoals. In addition, 90 percent of water level fluctuations were less than 1 foot; 10 percent is a pretty small percentage to mitigate. Jason added that one thing that was not considered in the flows analysis but likely has an effect is the Augusta Canal. The canal gates usually stay at a consistent height; however, as sections are closed/re-

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<sup>7</sup> IFIM = Instream Flow Incremental Methodology

opened from work, it could look like fluctuations in the Augusta Shoals. Kevin noted that there is good news in that it appears that the Project is not having as big of an impact on the Augusta Shoals as perhaps previously believed. NMFS has been able to confirm that there is a connection between available gage data and what is happening at the Augusta Shoals. Jason believes that the gage data and flows analysis can help determine the biological relevance of water level fluctuations in the Augusta Shoals.

Fritz H. inquired about the availability of imagery in the Project area that might help answer questions about water level. Jason replied that while there have been advances in AI<sup>8</sup> in aerial imagery to estimate river flows, the methodology requires calibration data, which does not currently exist for the Project area.

### **American Eel Passage**

Caleb provided an overview of the Spring 2025 Eel Study Plan. The study plan was developed in consultation with Kevin M. and Fritz R. from NMFS. Dominion Energy staff executed preliminary surveys for upstream-migrating eels at the Project dam in April and August of 2024. Dominion Energy will continue to investigate American eel population in the vicinity of the Project in March through May 2025. In summary, sampling efforts will include boat electrofishing below the dam, deployment of eel pots above and below the dam, and a temporary eel ramp installed below the powerhouse. All eels captured below the Project dam will be marked with coded wire tags and those captured above the dam would be fin clipped; all eels will be released at the site of capture.

Dominion Energy will conduct electrofishing of seven transects once in each two-week period from March through May 2025 and will attempt to target sampling during the new moon phase. Dominion Energy will place three eel/elver pots, one per site, in the Stevens Creek mouth. The remaining two pots will be placed along the Georgia shoreline. The FPTWC discussed bait options for the elver pots. Blue crab was very successful at Roanoke Rapids, but it was agreed that crab may be difficult to obtain and that the bait used should be something more readily available; herring was selected, which was amenable with NMFS. The pots will be deployed for one night in each two-week period from March through May.

The temporary eel ramp will be installed along the exposed shoreline on the Georgia side of the Savannah River, with hopeful anchoring. Attraction flow will be provided from the collection tank and from the tailrace. Caleb asked the group if the source of the attraction flow was important to them. Kevin responded that using flow from the collection tank is best because eels can smell other eels. Bill added that attraction flow from collection will be essential for a permanent structure but recognizes that it may not be feasible for the

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<sup>8</sup> AI = Artificial Intelligence

temporary eel ladder. Bjorn agreed with Bill that Dominion Energy should try to cycle the collection trap water as much as possible.

Taylor, Dominion Energy, explained that the temporary eel trap is made of metal (never wood) and consists of 30-foot sections that fall into a trashcan. Bjorn is favorable of using material that will last and potentially re-using it for a permanent structure. Bjorn suggested that Dominion Energy should consider some anti-predation measures for the ramp and ensure the trap reservoir is tightly contained so eels do not escape. Bill added that a channel of Enkamat should also be deployed on the temporary eel ramp to assist the navigation of smaller eels. NMFS stated their interest in reviewing proposed eel ramp designs.

Elizabeth asked what the elevation fluctuation is where the ramp is proposed to be deployed. Ray will investigate and inform the committee.

Dominion Energy will need to be permitted through the USDA<sup>9</sup> to use AQUI-S, a solution for anesthetizing eels. Dominion Energy will begin the permitting process soon. Bill noted that Dominion Energy will need a collection permit from both South Carolina and Georgia to conduct the study.

Elizabeth suggested monitoring the water temperature of the collection basin to ensure it does not get too warm. The committee discussed that the collection basin will have circulating flow. A cooler could also be used instead of a trashcan to reduce temperatures. Dominion Energy will deploy a temperature logger in the vicinity of the tailrace during the monitoring period. It was confirmed that the target angle for the temporary eel ladder is 45 degrees.

The group discussed that the next FPTWC meeting could be held during the eel study plan season and be a Project site visit.

Alison asked NMFS if the Spring 2025 Eel Study Plan will collect data that is informative for NMFS to develop the Project fish passage prescription (Rx). Kevin replied that, yes, the study could help with developing targets. Pace, NMFS, added that NMFS will have another chance to modify the Rx to tie it to FERC's Environmental Assessment, which would be after the Ready for Environmental Assessment (REA) notice. Alison commented that the FPTWC could continue to add to and edit the Fish Passage AMP, which could discuss the eel study plan; Alison added that the AMP will be the most helpful for FERC to reference.

Kevin is comfortable with the proposed Spring 2025 Eel Study Plan but noted that the FPTWC previously discussed some alternative methods to the temporary eel ramp such as trying to locate eels on the face of the Project dam. Caleb replied that some considerations were

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<sup>9</sup> USDA = United States Department of Agriculture



eliminated for various reasons. For example, Dominion Energy opted to do daytime sampling due to safety concerns and staff availability.

Elizabeth asked if backpack electrofishing could be conducted at the Project. Caleb responded that the topography of the Project area does not lend itself to backpack electrofishing.

Caleb will make minor edits to the Spring 2025 Eel Study Plan and distribute it to the FPTWC.<sup>10</sup> Alison asked if/when the committee felt comfortable including the study plan in the Fish Passage AMP. Kevin responded that including it could be useful for the group, but NMFS believes that it is pre-mature to file the Fish Passage AMP with FERC.

### **Alosine Passage**

Fritz H. provided a presentation to the FPTWC about a Stevens Creek Habitat Suitability Study. In summary, Hightower et al. 2012<sup>11</sup> updated American shad HSI<sup>12</sup>, and that model is currently considered the most accurate. Dominion Energy proposes to apply the Hightower et al. 2012 methodology to the Stevens Creek watershed through measuring habitat values, such as substrate, mean depth, and mean current velocity. Temperature was removed in Hightower et al. 2012's application because of high Spring variability; Dominion Energy is proposing to collect temperature for the for the study but not use it for the HSI model. Dominion Energy proposes a dissolved oxygen cut-off of 5.0 milligrams per liter. Other parameters recorded would include wetted width, pH, conductivity, types of cover present, and turbidity. Dominion Energy proposes to sample 30 stations located on Stevens Creek and Turkey Creek; 9 stations were identified in the 2005 Diadromous Fish Restoration Plan and the remaining 21 stations will be assigned for every 2.5 river kilometers of Stevens Creek. However, Dominion Energy noted that they are still working through access of Stevens Creek and Turkey Creek sampling stations, and as such they may not be able to sample the upper approximately 5 miles of Turkey Creek or Price's Mill in Stevens Creek. Fritz H. anticipates two to three days of field work for the study and proposes to conduct it on representative days during the American shad spawning period.

Fritz H. commented that this data collection could also be useful for investigating robust redhorse potential habitat in the future should the FPTWC desire. Bill to send Fritz H. a paper regarding robust redhorse spawning analysis.

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<sup>10</sup> The final Spring 2025 Eel Study Plan was distributed to the FPTWC via email by Caleb on December 17, 2024.

<sup>11</sup> Hightower, J.E., J.E. Harris, J.K. Raabe, P. Brownell, and C.A. Drew. 2012. A Bayesian spawning habitat suitability model for American shad in southeastern United States rivers. *Journal of Fish and Wildlife Management* 3(2):184-198. doi: <https://doi.org/10.3996/082011-JFWM-047>.

<sup>12</sup> HSI = Habitat Suitability Index



Kevin asked for further details on what work would occur at a sampling station. Fritz H. responded that they would sample transects to obtain mean depth. They may also attempt to calculate mean velocity but may choose to present maximum velocity. Fritz H. proposes to sample quadrats across the wetted width to record sediment but may conduct a sediment grab depending on water depth. The committee discussed the possibility of using side-scan sonar, but the topography is likely not conducive for the methodology. It was noted that during the 2023 Water Quality Study for the Project, scientists were able to travel up Stevens Creek past the confluence with Horn Creek but not as far as the confluence with Lloyd Creek.

Paul, Dominion Energy, inquired of the group if changes are anticipated in the future since Stevens Creek is a flashy system, and thus, would the study need to be repeated. Fritz H. explained that 30 sampling stations will allow them to collect from variable areas. Fritz H. believes that they may record sediment differences spatially but not temporally.

Bjorn asked for more detail on what Dominion Energy considers a representative day during the American shad spawning period. Bjorn explained that depth and velocity is dictated by flow. Fritz H. responded that Dominion Energy is seeking guidance on such considerations. They would ideally aim for flows that were on the high end but safe enough to still conduct the study.

Elizabeth inquired if there was a plan to account for flows coming from JST. Caleb replied that they will track the time of measurements and look at JST flows during that time accordingly. Fritz H. added that no matter what JST is doing, the velocity will be extremely low to the point where the variation is likely less than the error. Either way, he does not believe the mouth of Stevens Creek will be suitable spawning habitat.

Dominion Energy is aiming to conduct the Stevens Creek Habitat Suitability Study in Spring 2025. Paul added that it will be ideal to obtain GPS<sup>13</sup> coordinates of the sampling stations. Fritz H. discussed that they may use a canoe for sampling as some online guidance states Stevens Creek is accessible that far upstream on small, floating vessels.

Alison commented that USFS may have ideas for put-in locations. She also noted to Fritz H. that Jason may have some contact information for landowners in Stevens Creek.

Both NMFS and USFWS agree that the Stevens Creek Habitat Suitability Study could provide useful information for the FPTWC. Fritz H. concluded that he would draft a study plan for distribution and added that Dominion Energy would like to use the results from the study to inform high-level conversations about opening up Stevens Creek to shad and other, potentially invasive, species.

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<sup>13</sup> GPS = Global Positioning System

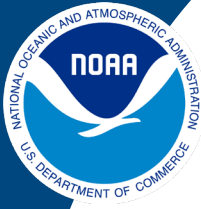
Alison asked the FPTWC if the flow discussions that took place during the first part of the meeting was an evolving topic. Kevin responded that as a member of the Water Quality AMP, NMFS wants to respond to FERC's Additional Information Request as completely as possible, but they recognize that FERC and the committee will likely require some additional analysis. The FPTWC will continue to remain informed on flows in the Project area.

The next meeting was scheduled for Thursday, March 20, 2025, at the Project.

The meeting was adjourned.

**ACTION ITEMS:**

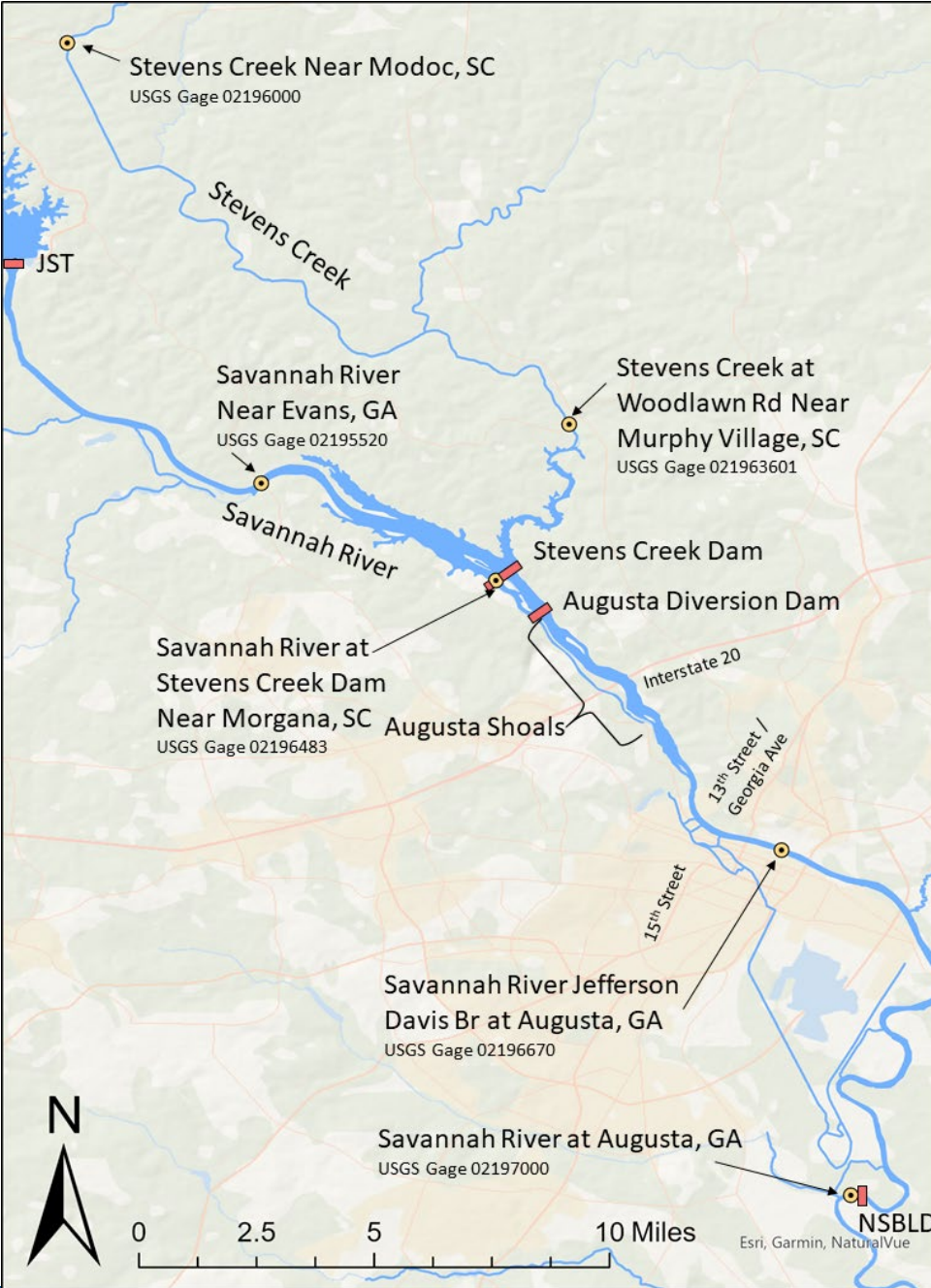
- Dominion Energy/Kleinschmidt to investigate the lag time between measured inflow and outflow for the Project.
- GAWRD to request Augusta Shoals data from Georgia Southern University.
- Dominion Energy to investigate elevation fluctuations in the area where the temporary eel ladder is proposed to be installed.
- SCDNR to provide Dominion Energy with science paper/article that discusses robust redhorse spawning analysis in the Savannah River.



**NOAA  
FISHERIES**

# Potential Impacts to Diadromous Fish Habitats in the Middle Savannah River

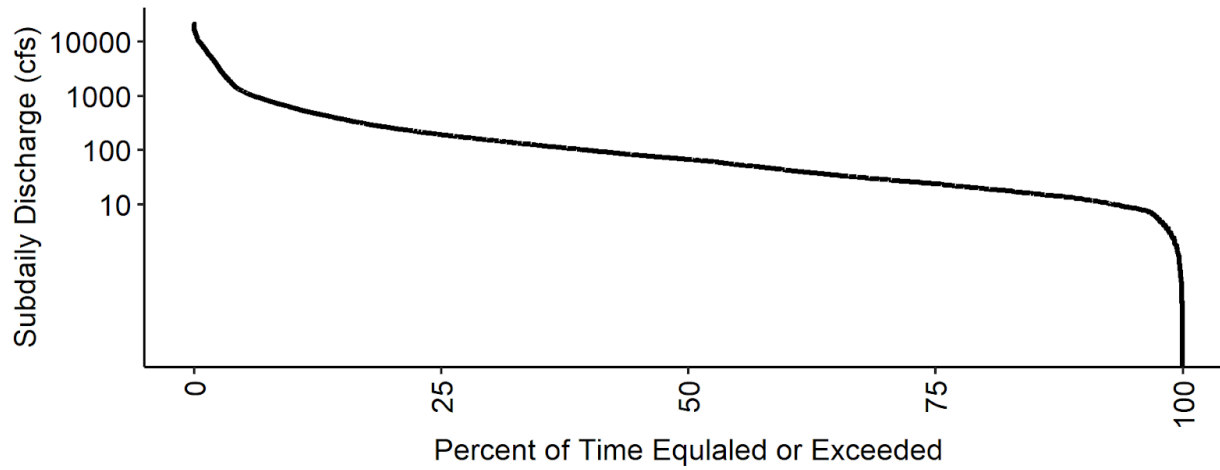
Stevens Creek Fish Passage TWC Meeting  
December 4, 2024



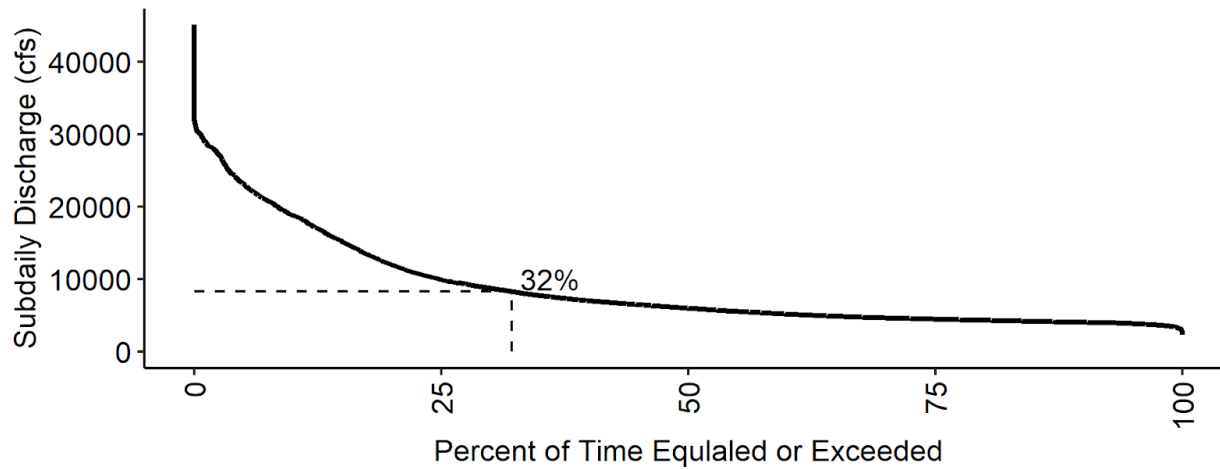
River	Name	Location	Gage Number	Discharge	Gage Height	Surface Elevation NAVD 1988	Surface Elevation above datum
Stevens Creek	Upper Stevens Creek	Near Modoc, SC	02196000	1986	2007	2021	N/A
	Lower Stevens Creek	Woodlawn Rd Near Murphy Village, SC	021963601	N/A	2019	2021	N/A
Savannah River	Below JST	Near Evans, GA	02195520	N/A	2007	N/A*	N/A
	Stevens Creek Dam	Near Morgana, SC	02196483	N/A	N/A	2021	2007
	Augusta Shoals	Jefferson Davis Bridge at Augusta, GA	02196670	2016	2016	2021	N/A
	NSBLD	Augusta, GA	02197000	1986	2007	2021	N/A



Stevens Creek Flow Duration Curve  
USGS No 02196000



Savannah River Flow Duration Curve  
USGS No 02197000, Prorated for SCP



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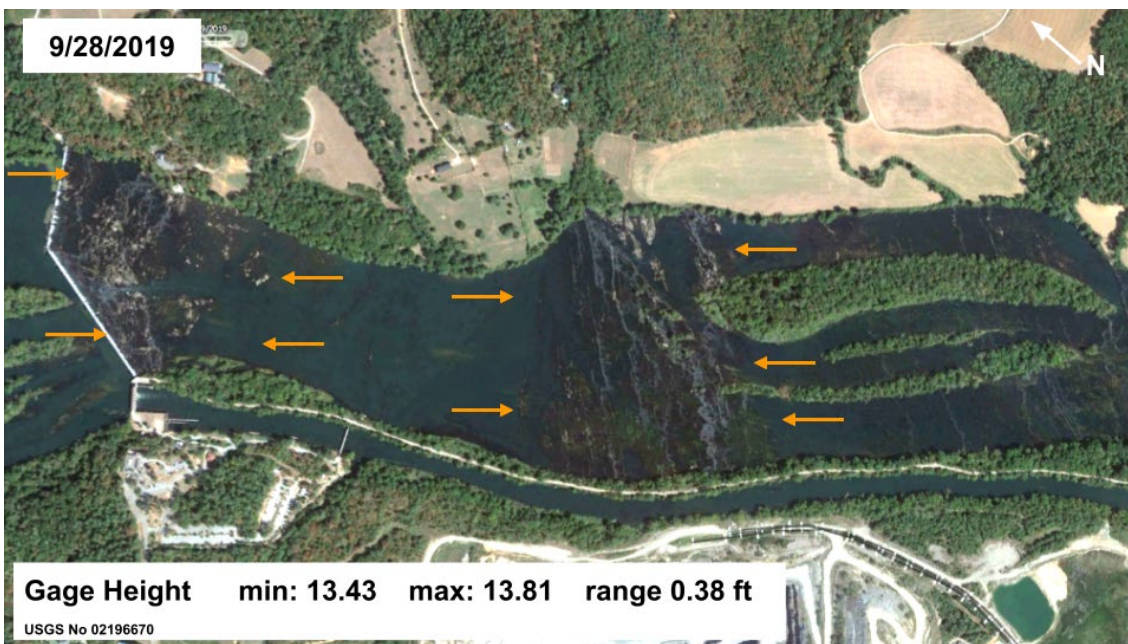


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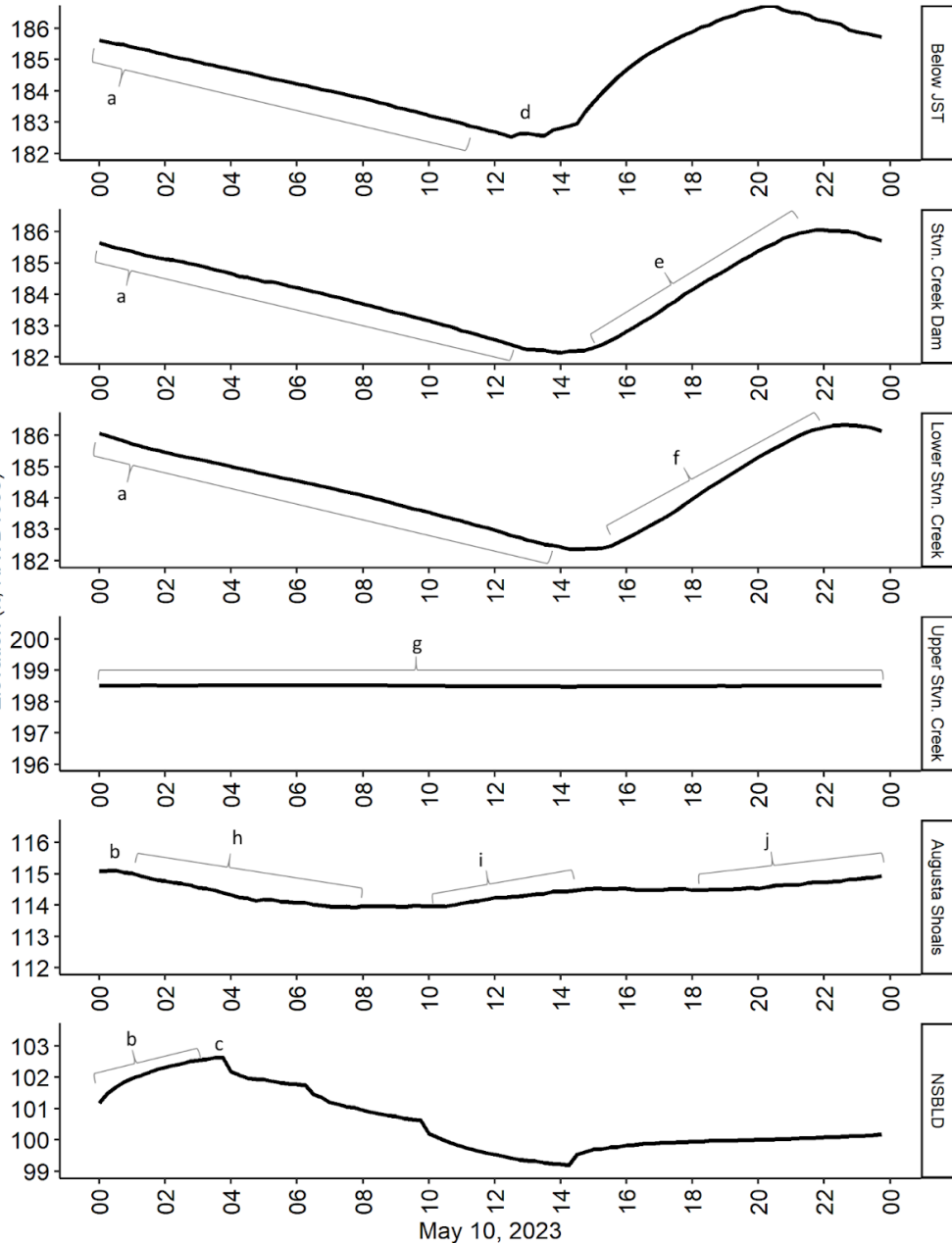
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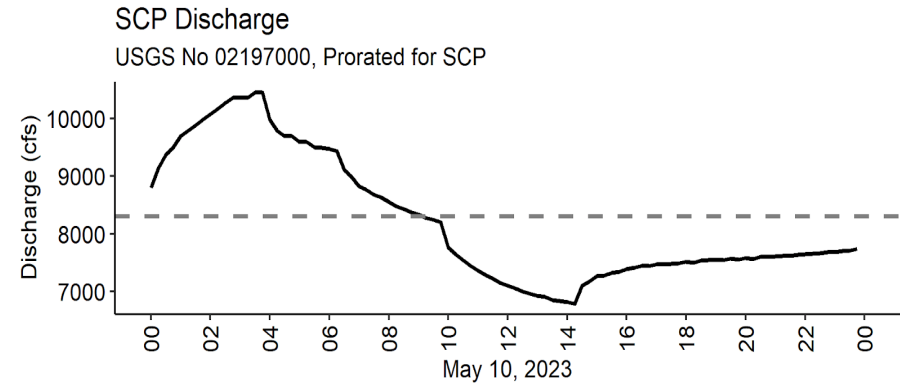


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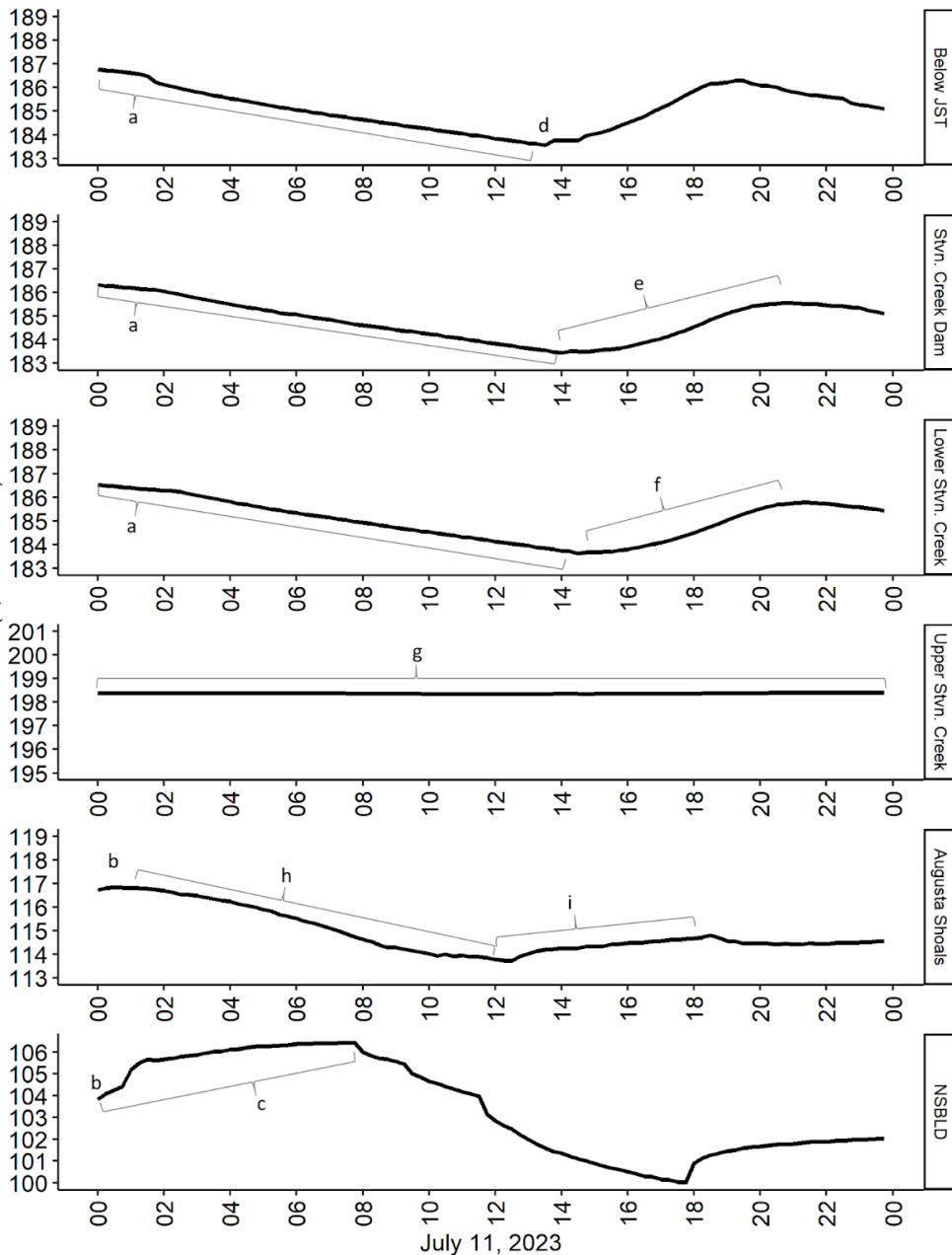
# JST Flows through System



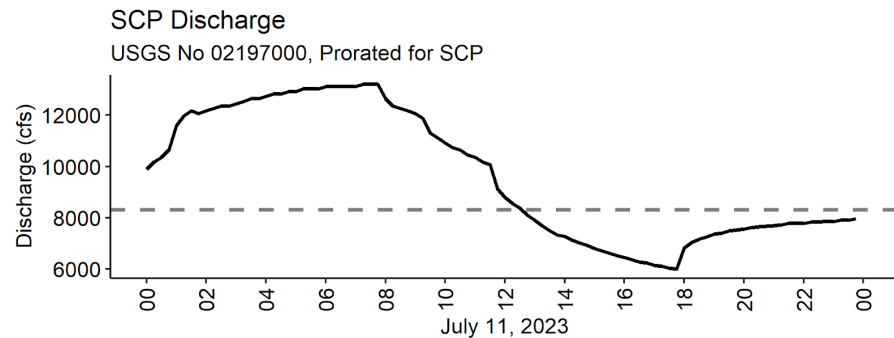
- Water levels declined throughout the morning at the gages upstream of SCP.
- At Augusta Shoals and NSBLD, the previous day's discharges were still moving downstream at midnight.
- At NSBLD, water level peaked a little before 4 am, then began to fall.
- Around 12:30 pm, water levels below JST stabilized, then started to rise as JST began to generate to meet energy demand.
- Water levels begin to rise at SCP around 3 pm and increase by 3.91 feet over about 7 hours. As JST discharges interact with SCP, they are diverted up Stevens Creek, slowing and reversing flow.
- At the Lower Stevens Creek gage water levels began to rise after 3 pm and increase by 3.97 feet over the next 8 hours.
- The Upper Stevens Creek gage experienced very little variation in water level, fluctuating by less than 0.1 feet.
- At the Augusta Shoals, water levels declined by 1.8 feet over a period of about 7 hours from 1 am to 8 am.
- Water levels began to rise a little after 10 am.
- Water levels rose again at the shoals in the evening as JST discharges entered the system from 6 pm to midnight.



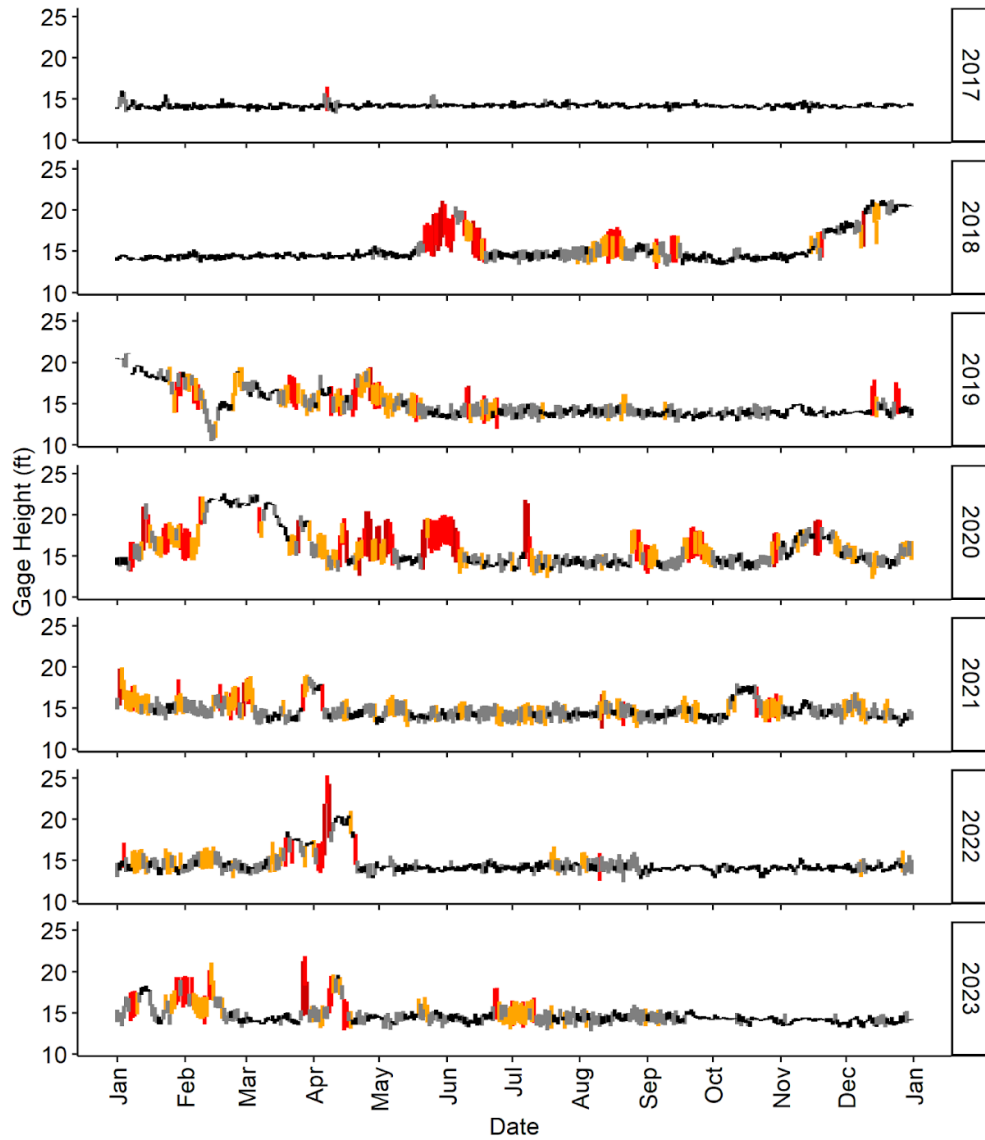
## JST Flows through System



- Water levels declined throughout the morning at the gages upstream of SCP.
- At Augusta Shoals and NSBLD, the previous day's discharges were still moving downstream at midnight.
- At NSBLD, water level continued to rise until about 8 am.
- Around 1:30 pm, water levels below JST started to rise as JST began to generate.
- JST discharges reached SCP around 2 pm and water levels increased by 2.21 feet over about 7 hours.
- At Lower Stevens Creek gage water levels began to rise after 3 pm and increased by 2.15 feet over the next 7 hours.
- The Upper Stevens Creek gage recorded stable water levels throughout the day.
- At the Augusta Shoals, water levels declined by 3.13 feet over a period of about 11 hours from 1 am to 12 pm.
- Then, water levels began to rise from about 12:30 pm to 6 pm.

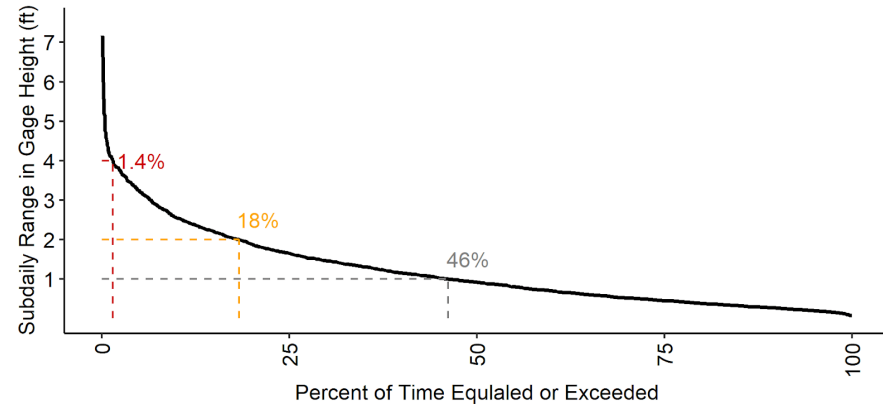


Augusta Shoals  
USGS No 02196670

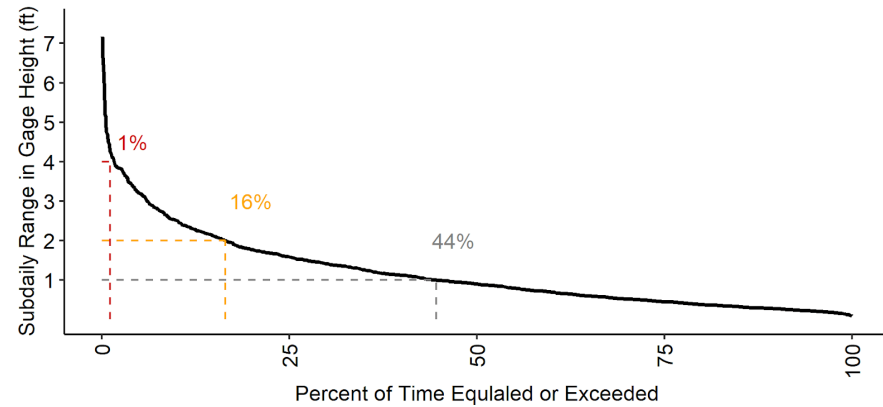


Subdaily Range (ft) | < 1 | > 1 | > 2 | > 3 | > 4

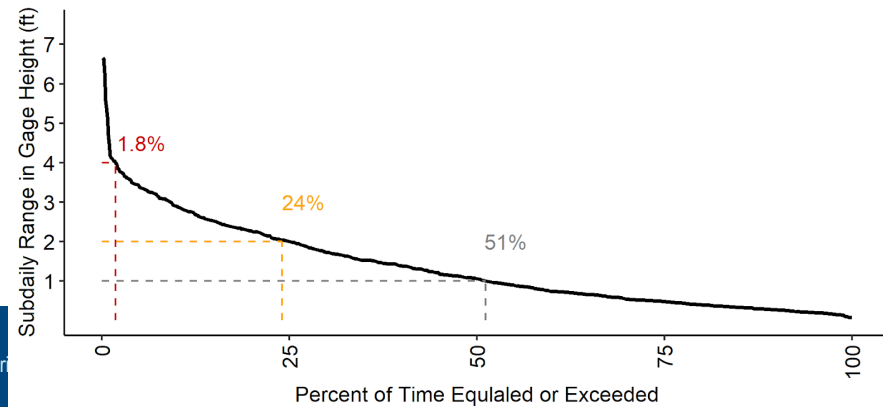
Augusta Shoals  
USGS No 02196670



Augusta Shoals: ATS Present  
USGS No 02196670



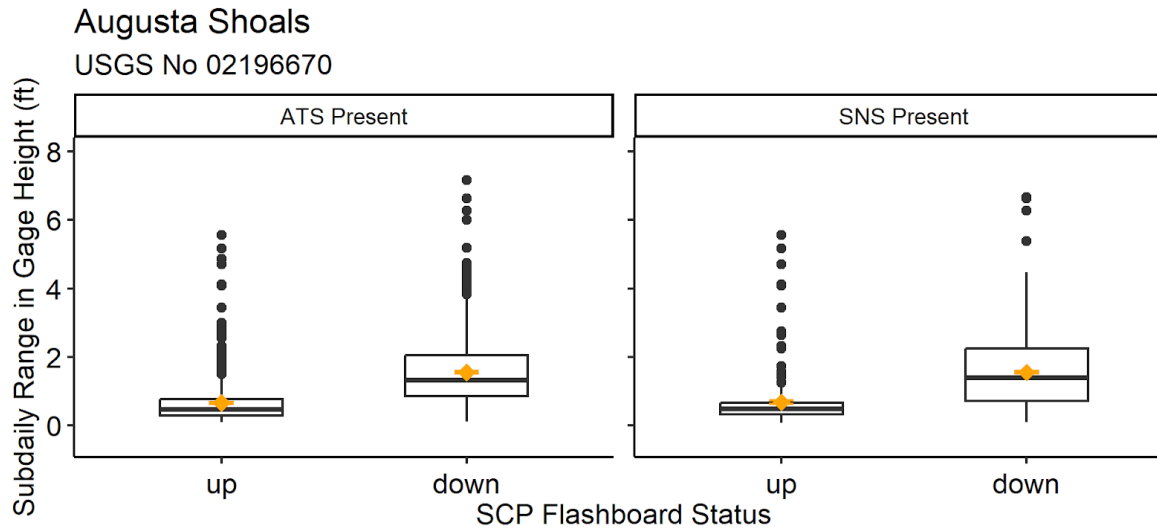
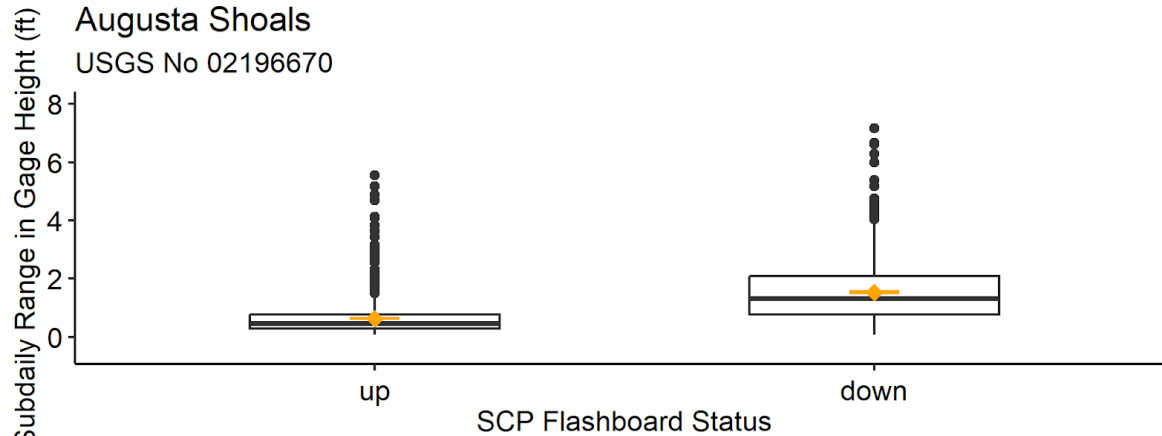
Augusta Shoals: SNS Present  
USGS No 02196670



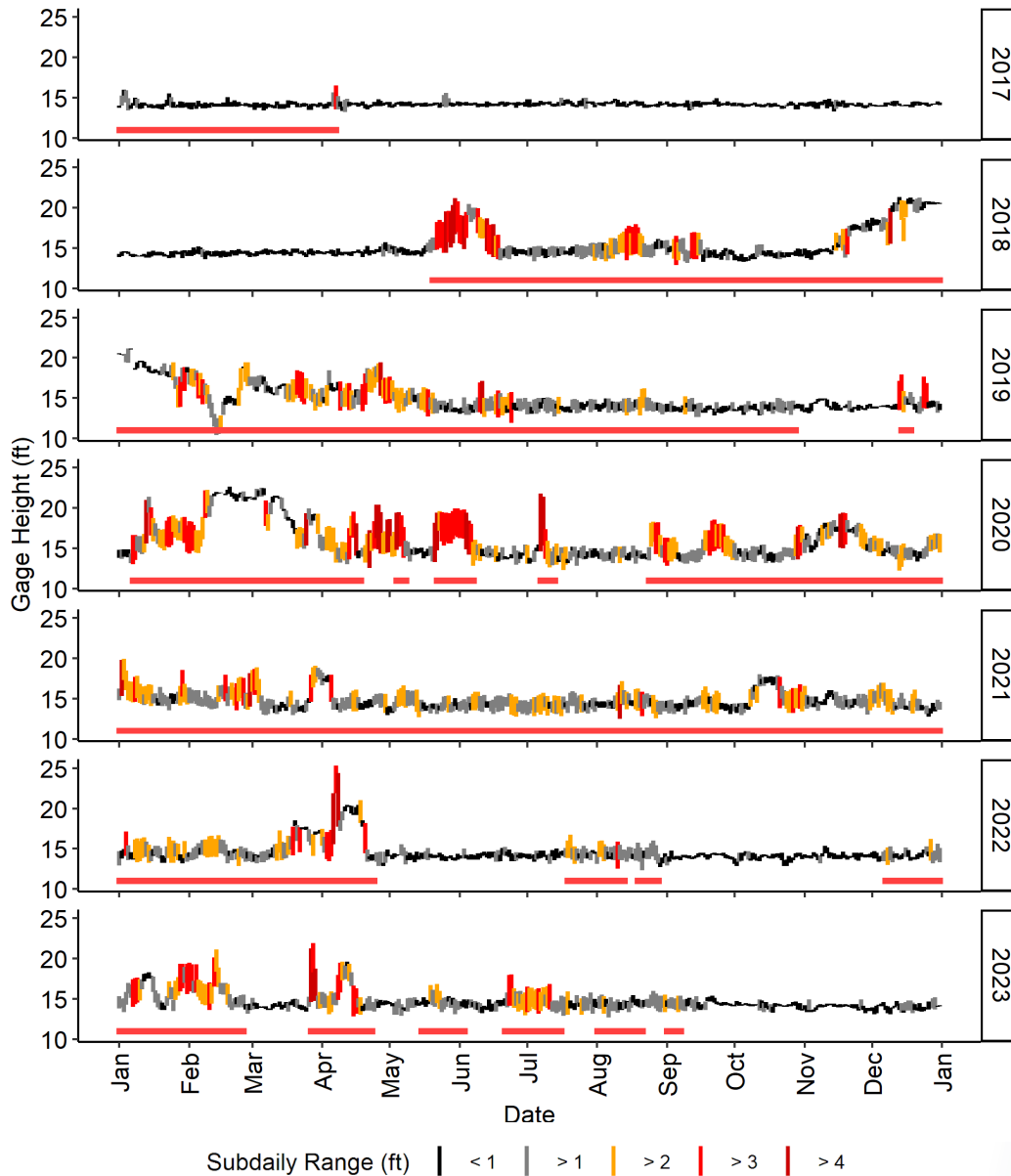


**Table 2.** Days the flashboards were up and down at SCP during 2017 to 2023.

	2017	2018	2019	2020	2021	2022	2023
Up	266	139	55	96	0	184	195
Down	99	226	308	269	365	181	170



Augusta Shoals  
USGS No 02196670



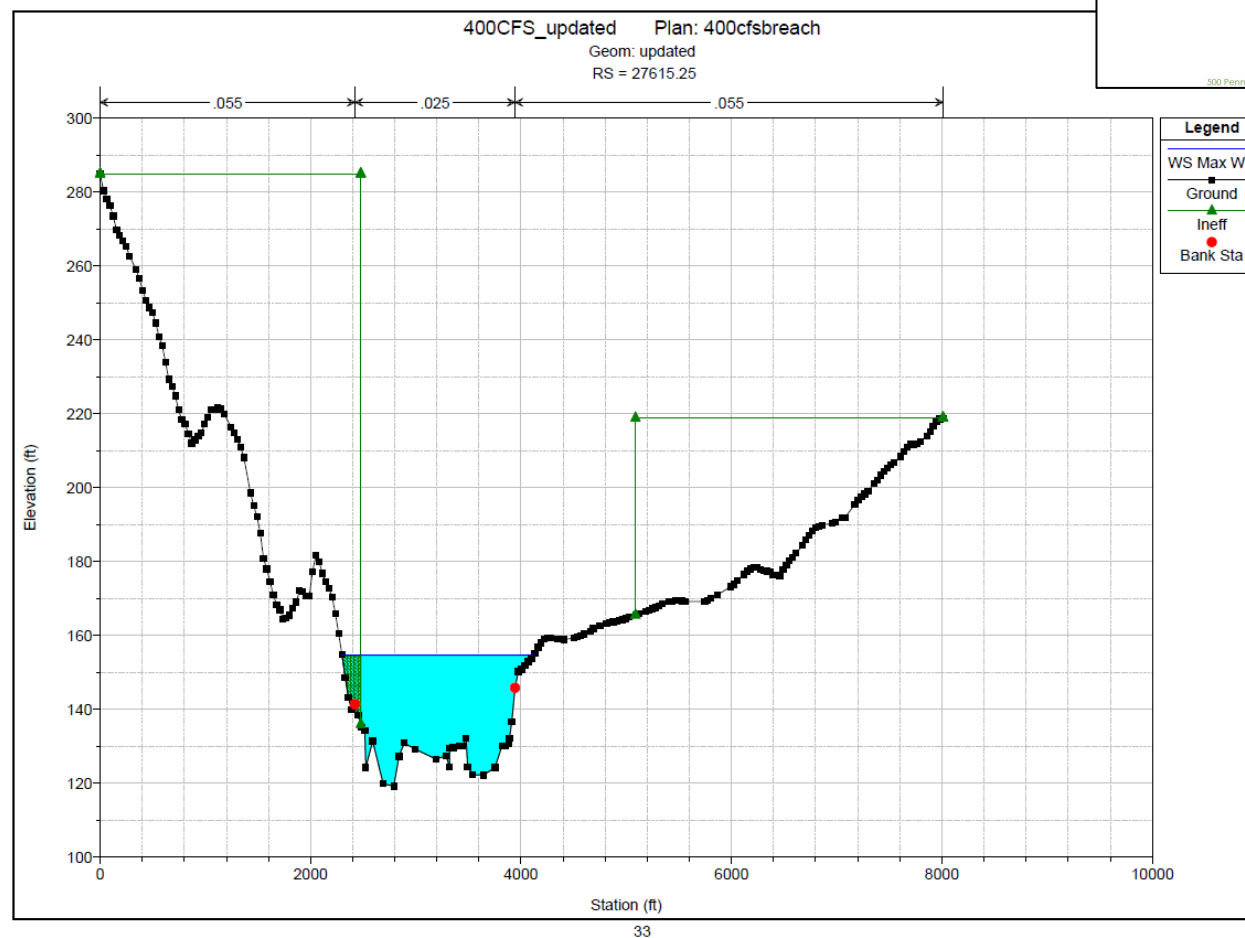
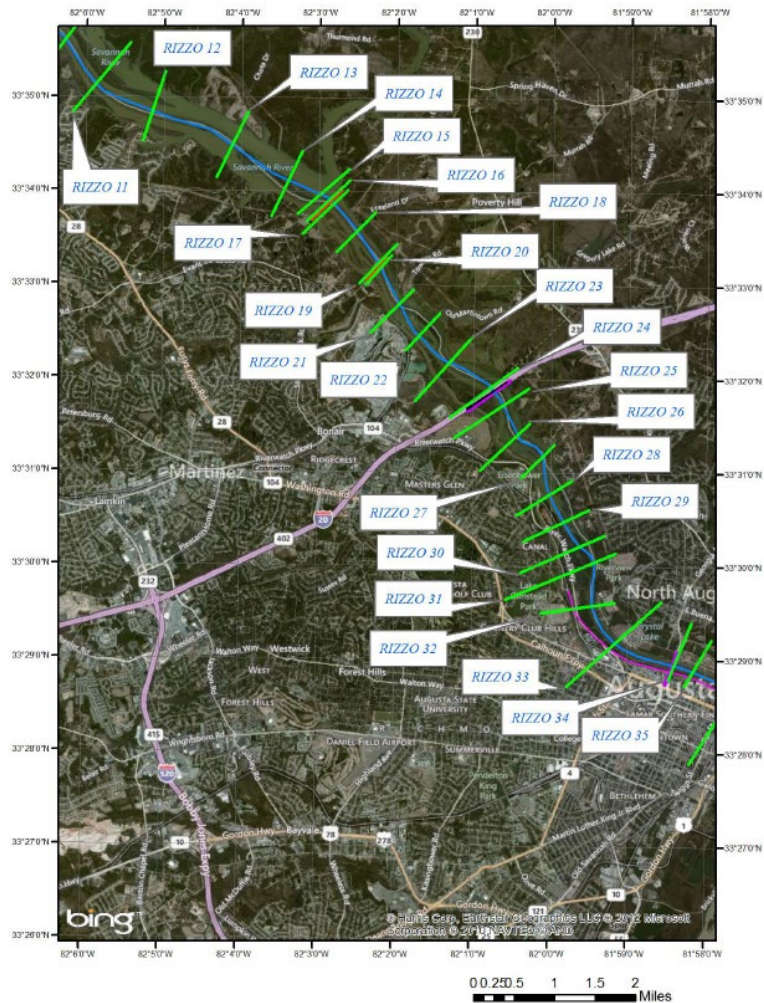
**NOAA**  
FISHERIES



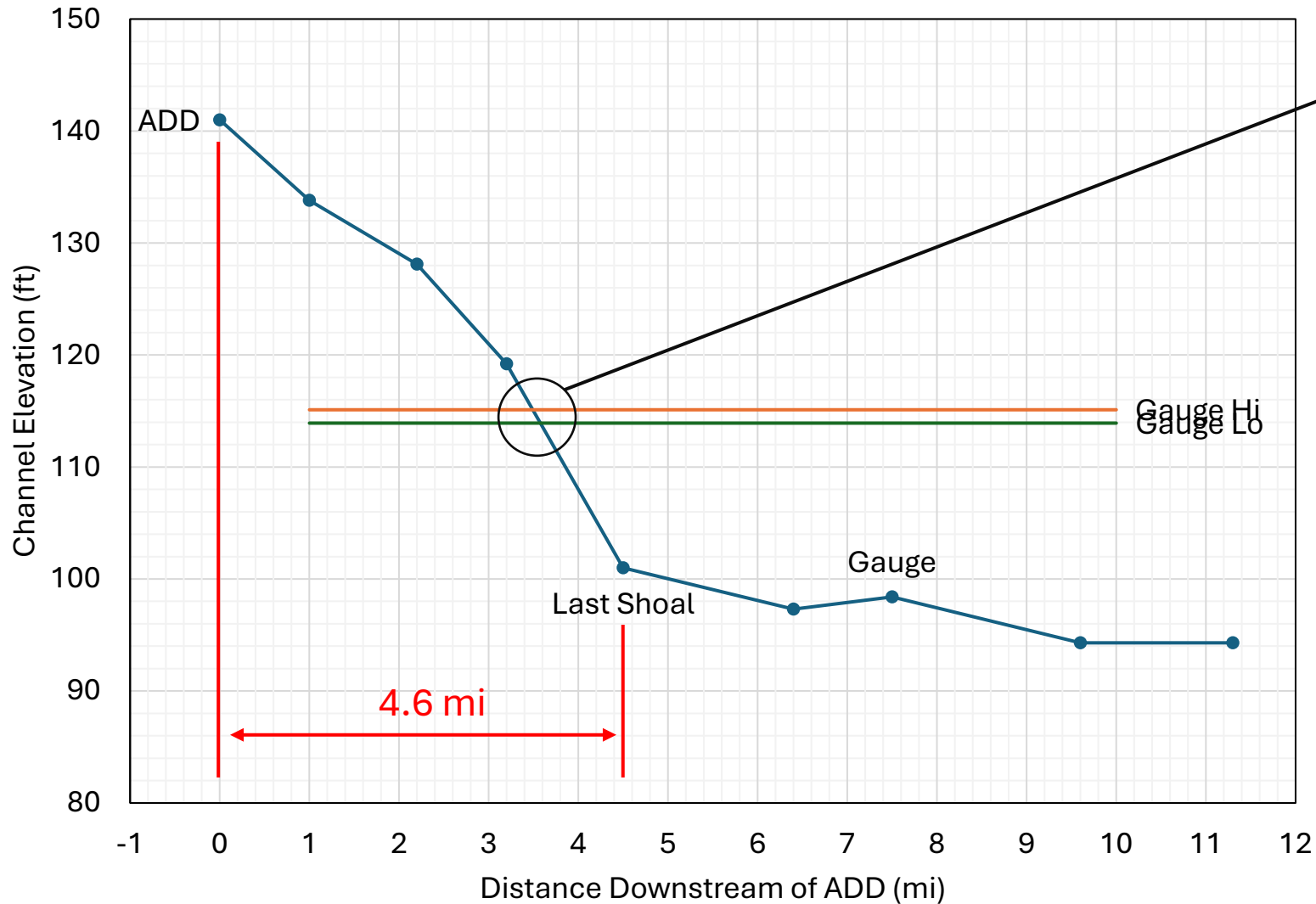
# Additional Flows Analysis

Prepared by: Kleinschmidt Associates

# HEC-RAS Transect Data



# May 10, 2023: Normal Day

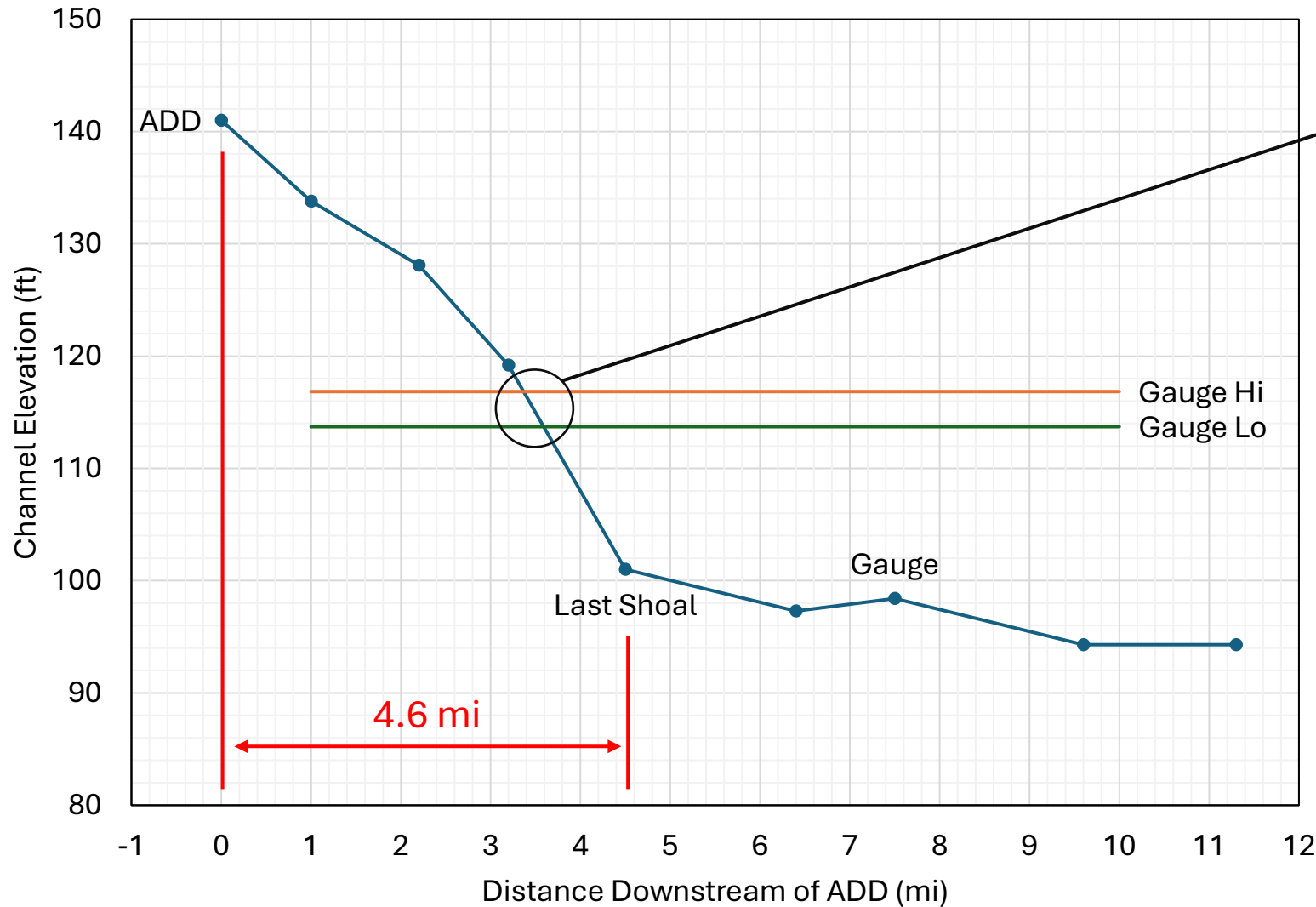


Affected Reach Length = 0.2 mi  
Affected Area = 7 ha (2.8% of Total Shoals Area)





# July 11, 2023: Flashboards Down

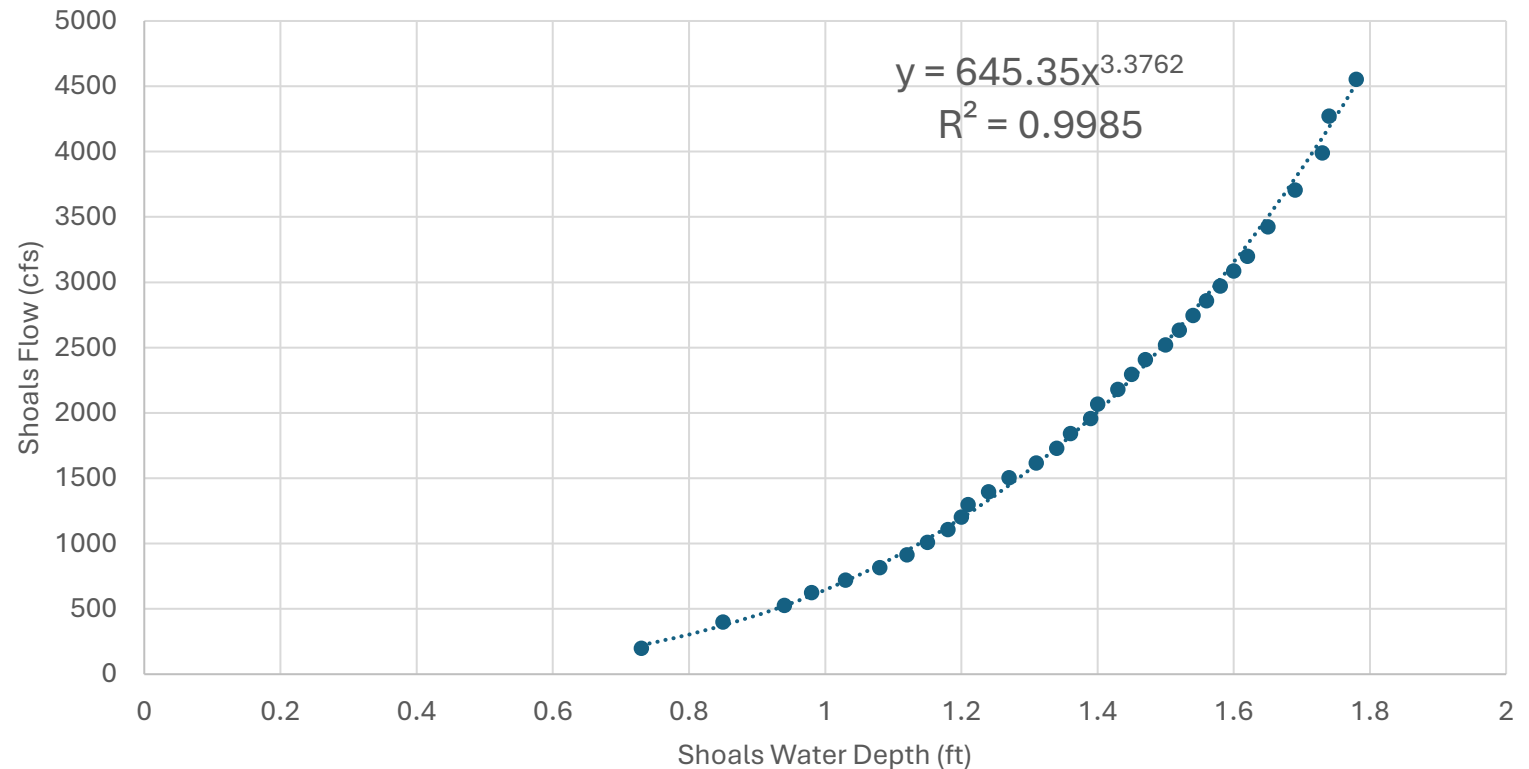


Affected Reach Length = 0.4 mi  
Affected Area = 13.8 ha (5.5% of total Shoals Area)



# Augusta Shoals IFIM Data

Shoals Flow (cfs)	Depth (ft)
200	0.73
400	0.85
528	0.94
625	0.98
721	1.03
817	1.08
914	1.12
1010	1.15
1107	1.18
1203	1.2
1299	1.21
1396	1.24
1505	1.27
1618	1.31
1731	1.34
1844	1.36
1957	1.39
2069	1.4
2182	1.43
2295	1.45
2408	1.47
2521	1.5
2634	1.52
2747	1.54
2860	1.56
2973	1.58
3086	1.6
3199	1.62
3425	1.65
3707	1.69
3990	1.73
4272	1.74
4554	1.78

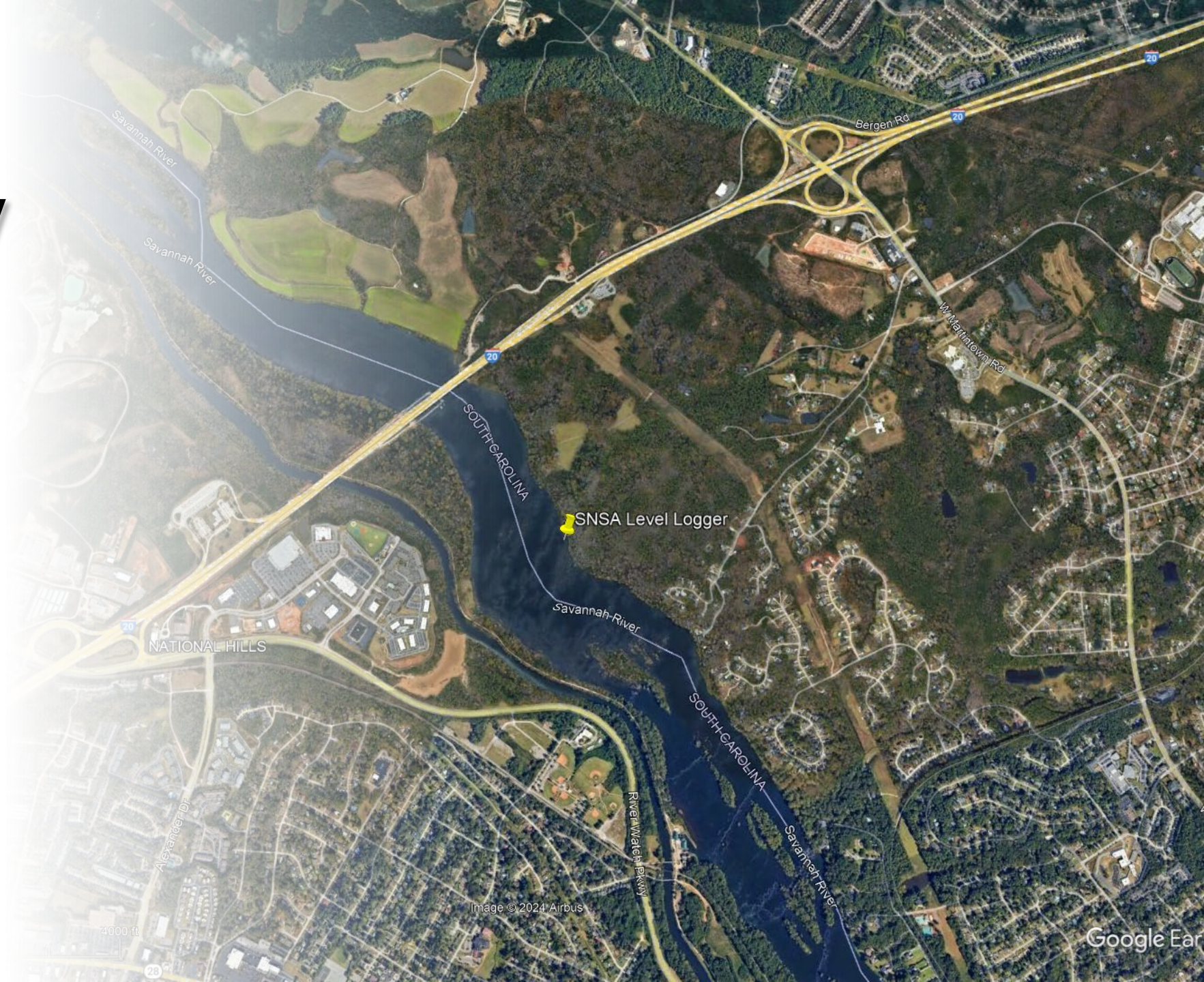


- 1 ft increase in depth = ~ 4,000 cfs increase in flow
- An increase from 1 ft to 3 ft in Shoals water levels (2 ft change) would represent a 26,000 cfs fluctuation



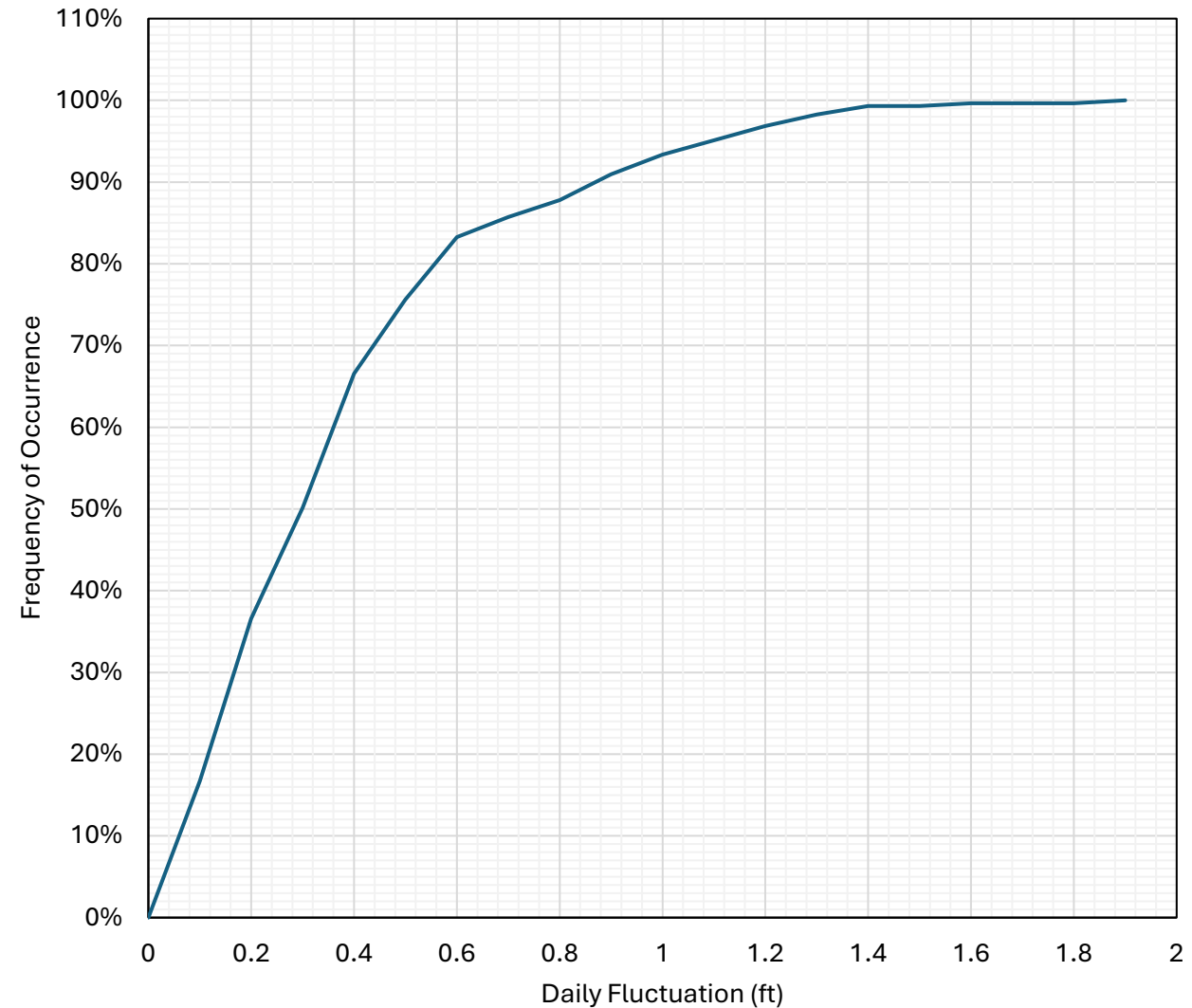
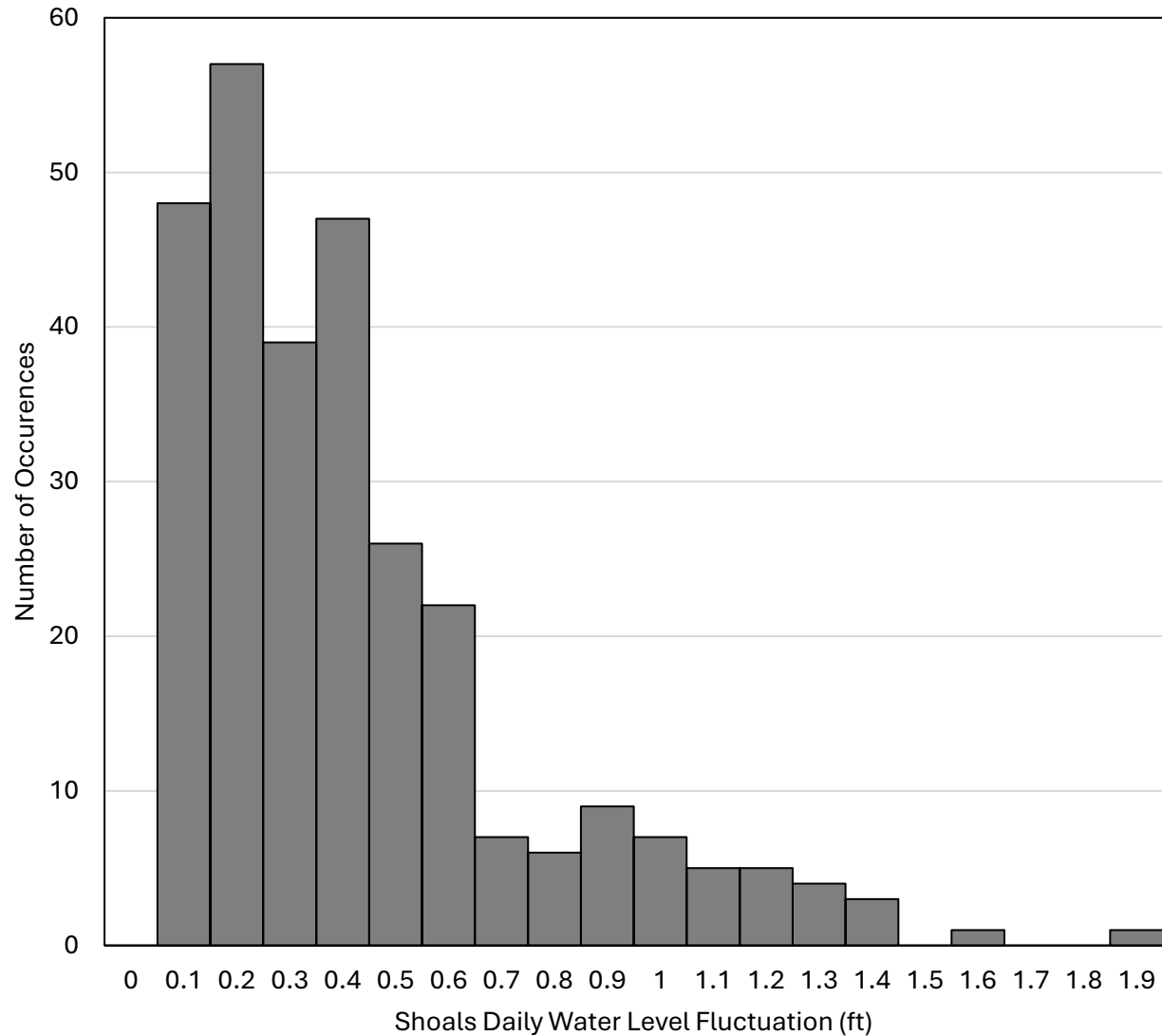
# SNSA Shoals Flow Pilot Study

- Depth Measurements at 15-minute intervals
- 9/19/2008 to 7/2/2009
- Analyzed Shoal Water Level Fluctuation Frequencies
- Compared Shoals and Pool Level Daily Fluctuation





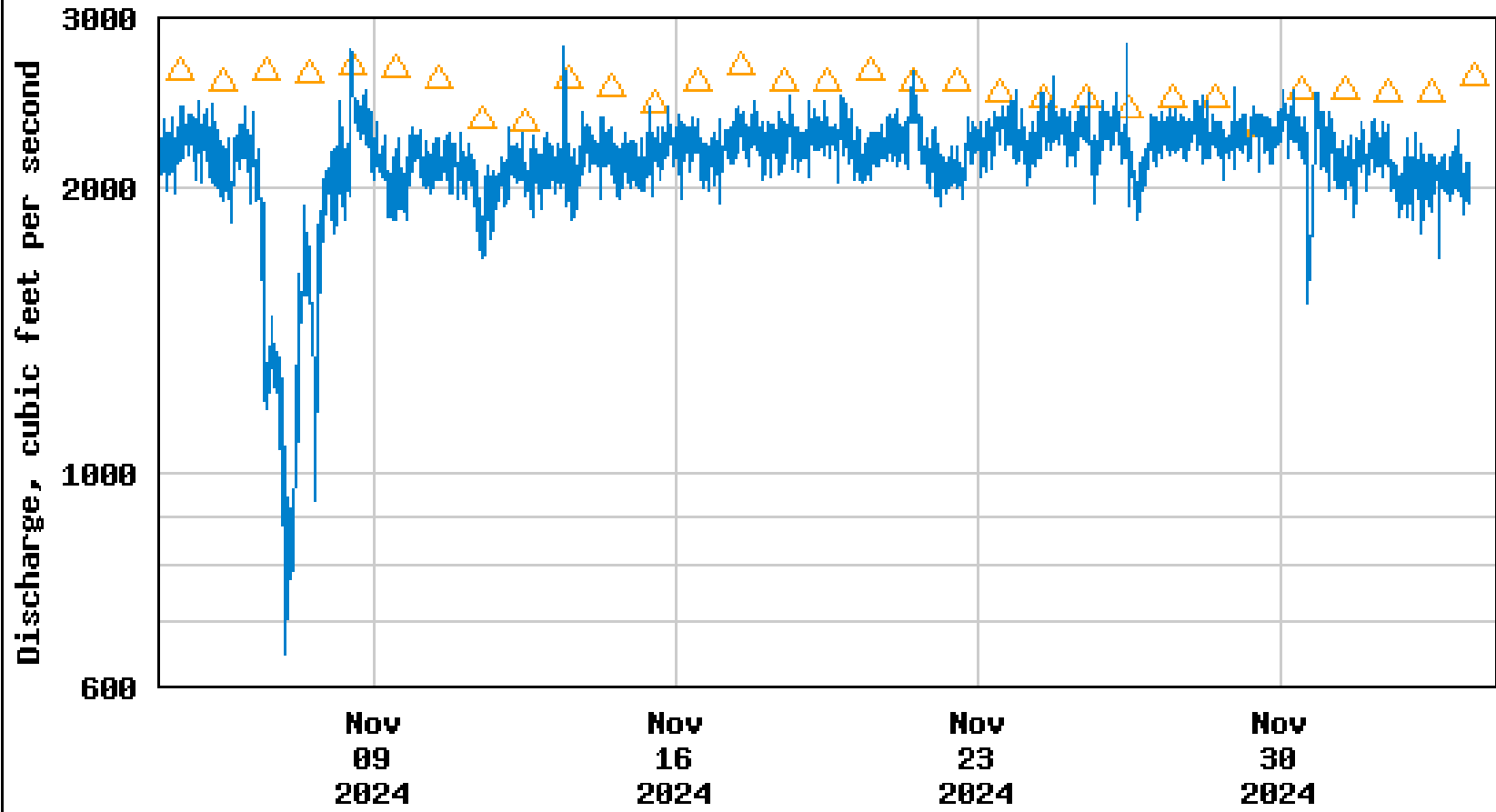
# Shoals Fluctuation Frequency Analysis



# Summary

- Empirical water level and bathymetric survey data show that the gauge at Jefferson Davis Bridge (02196670) is only representative of what is happening in small fraction of the shoals
- SNSA shoals water level data showed 91% of fluctuations < 1 ft
- Flow diversions into the Augusta Canal were not considered, but likely have effects
  - Avg daily diversion from 10/1996 to Present is ~ 2,500 cfs
  - Draining/refilling of canal can result in fluctuations in the shoals

USGS 02196485 AUGUSTA CANAL UPPER NR AUGUSTA, GA



---- Provisional Data Subject to Revision ----

△ Median daily statistic (23 years) — Discharge

Graph courtesy of the U.S. Geological Survey

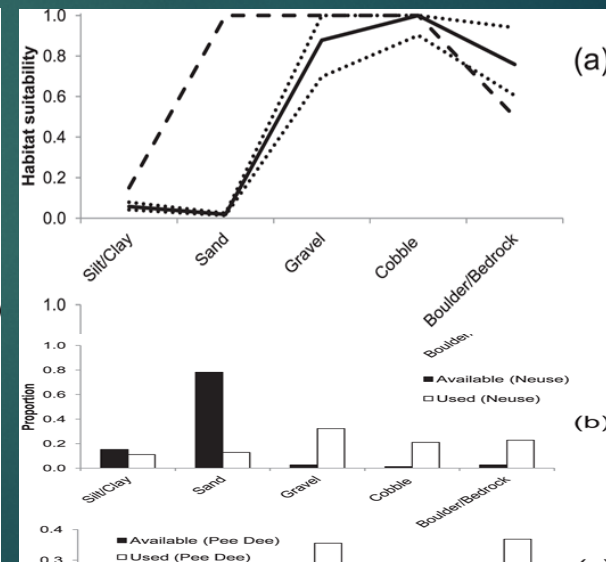
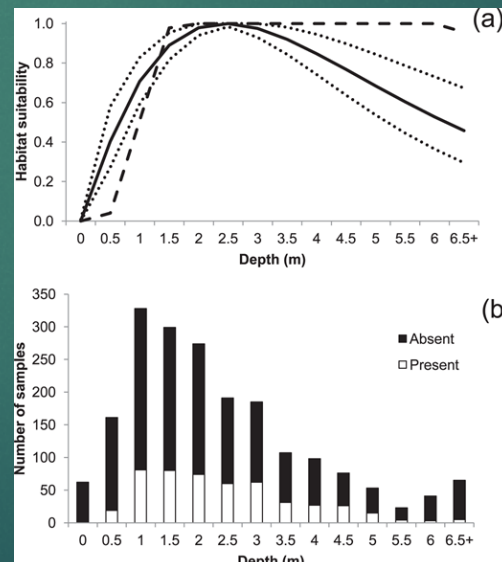
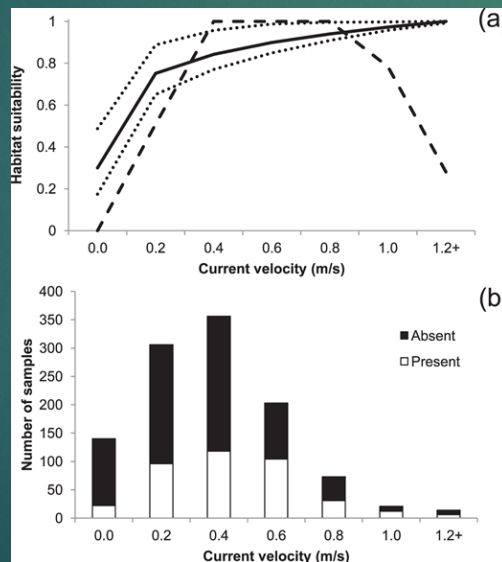
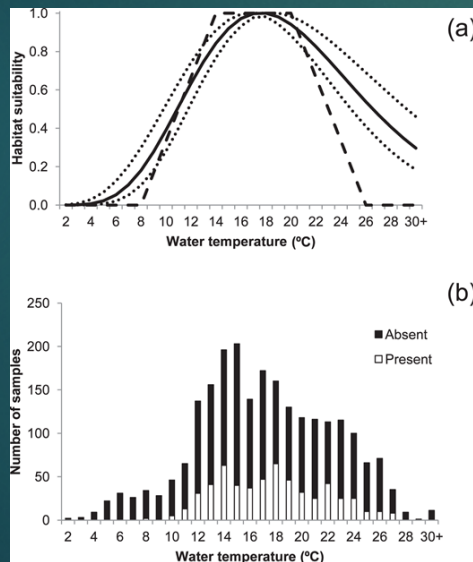


# Stevens Creek Habitat Suitability Study

PREPARED BY: DOMINION ENERGY CORPORATE BIOLOGY

# Habitat Suitability Model

- ▶ Hightower et al. 2012 updated American Shad HSI from Stier and Crance (1985)
- ▶ Currently considered most accurate HSI for American Shad
- ▶ Uses geometric mean of resource selection function values to assign a suitability of 0-1

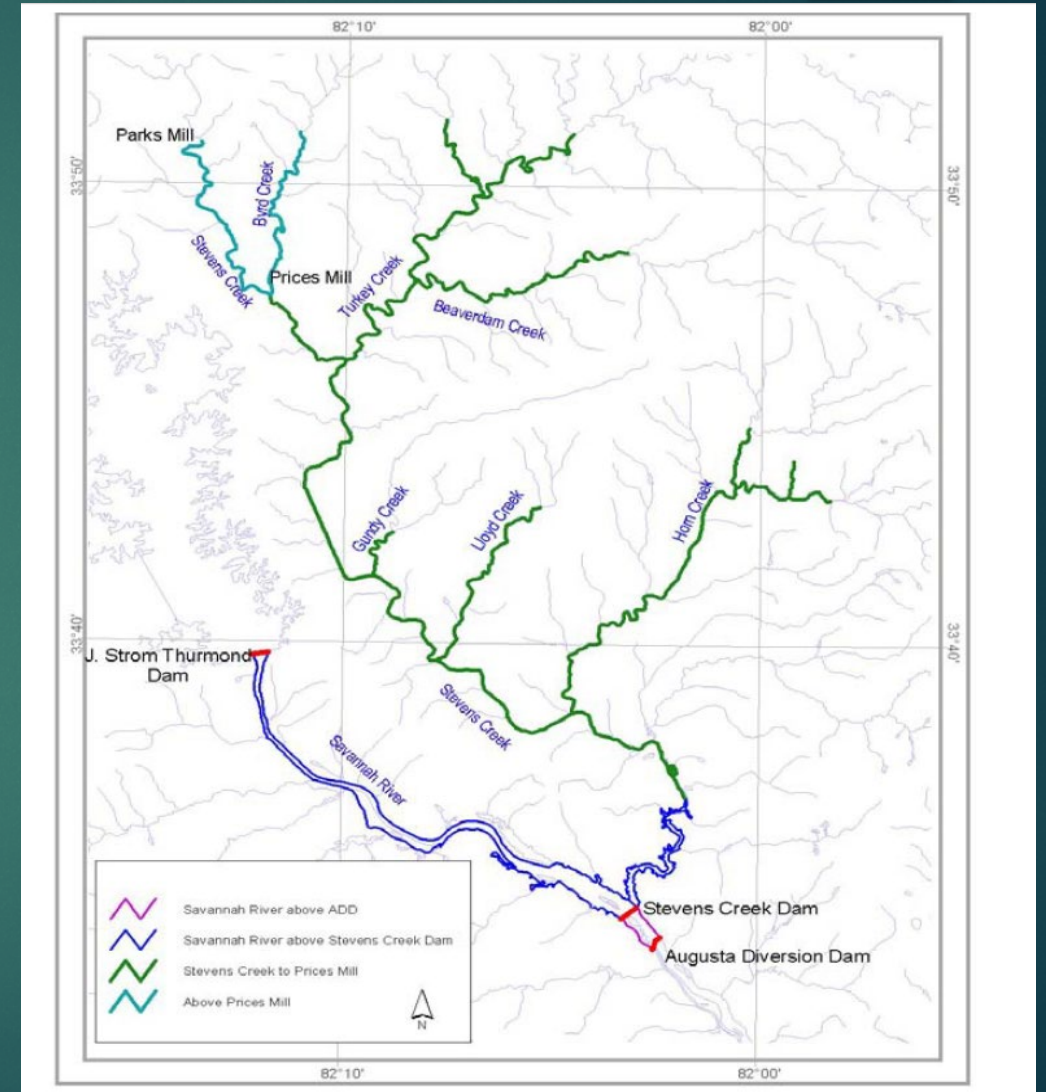


Joseph E. Hightower, Julianne E. Harris, Joshua K. Raabe, Prescott Brownell, C. Ashton Drew; A Bayesian Spawning Habitat Suitability Model for American Shad in Southeastern United States Rivers. *Journal of Fish and Wildlife Management* 1 December 2012; 3 (2): 184–198. doi: <https://doi.org/10.3996/082011-JFWM-047>



# Methods

- ▶ Will be applied to Stevens Creek watershed through measuring habitat values used in the resource selection functions throughout the potentially suitable that would be made available by passage.
  - ▶ Substrate (% by type)
  - ▶ Mean depth
  - ▶ Mean current velocity
  - ▶ Temperature?
    - ▶ Removed in Hightower's example application because of high Spring variability
  - ▶ DO cutoff of 5.0 mg/L
    - ▶ Any station where lower DO detected would have suitability automatically set to 0
  - ▶ Other parameters recorded would include wetted width, PH, Conductivity, types of cover present, and Turbidity





# Sampling Locations

- ▶ 30 sampling stations located on Stevens Creek and Turkey Creek
  - ▶ 9 Stations identified in 2005 Diadromous Fish Restoration Plan
  - ▶ 21 other stations every 2.5 rkm for the 55 km of Stevens Creek and Turkey Creek identified as potential habitat in the Diadromous Fish Restoration Plan

Table 2. 2004 Field Data for Stevens Creek and Turkey Creek.

Creek	Substrate	Avg. Width (ft)	Avg. Depth (ft)	Mean Spring Flow (cfs)	Mean Spring Flow (ft/sec)	Mean Summer Flow (cfs)	Mean Summer Flow (ft/sec)	Mean Fall Flow (cfs)	Mean Winter Flow (cfs)
Stevens Creek at Price's Mill	Bedrock, cobble, gravel, coarse sand	80	3	253	1.1	74	0.31	67	256
Stevens Creek at Modoc	Large cobble, gravel, coarse sand	30	7	641	3	186	0.89	169	650
Stevens Creek at Gundy Creek	Small gravel, coarse sand	40	>1.0	665	N/A	193	N/A	175	674
Stevens Creek at Lloyd Creek	Small gravel, coarse sand	40	>1.0	690	N/A	201	N/A	182	700
Stevens Creek at Horn Creek	Small gravel, coarse sand	40	>1.0	794	N/A	231	N/A	209	805
Stevens Creek at reservoir	Sand, gravel	80	>1.0	854	N/A	248	N/A	225	866
Turkey Creek at SSR 35	Cobble, gravel, sand	30	6	236	1.3	69	0.05	62	240
Turkey Creek at Beaverdam Creek	Bedrock, gravel	30	6	322	1.8	94	0.52	85	327
Turkey Creek at Stevens Creek	Bedrock, gravel	30	6	628	3.5	183	1.02	166	637

\*Winter =Dec.-Feb., Spring = Mar.-May, Summer = Jun.-Aug., Fall = Sep.-Nov.

\*\*Mean seasonal flows were derived through IHA analysis using the USGS 02196000 Stevens Creek near Modoc, SC.