Alabama Rivers Alliance

February 19, 2025

VIA ELECTRONIC FILING

Ms. Debbie-Anne A. Reese, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

RE: Comments of Conservation Groups on the Draft Environmental Impact Statement for the R.L. Harris Hydroelectric Project (FERC Docket No. P-2628-066) and Recommended License Conditions and Proposed License Articles

Dear Secretary Reese:

Enclosed for filing in the above-referenced docket are comments of the Alabama Rivers Alliance and the Southern Environmental Law Center, along with recommended license conditions, proposed license articles, and an expert report on the use of adaptive management. Copies of this filing have been served on all parties of record to this proceeding via FERC's electronic service system.

If you have any questions or need additional information concerning this filing, please email me at jwest@alabamarivers.org or call 205-322-6395.

Sincerely,

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Special Projects Director
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UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Alabama Power Company	)	R.L. Harris Hydroelectric Project
	)	
	)	Project No. 2628-066

COMMENTS OF CONSERVATION GROUPS ON DRAFT ENVIRONMENTAL IMPACT STATEMENT

On November 21, 2024, the Federal Energy Regulatory Commission (FERC or the "Commission") issued its Notice of Availability of the Draft Environmental Impact Statement (DEIS) for the R.L. Harris hydroelectric project (FERC Project No. 2628) ("Harris Project") owned and operated by Alabama Power Company ("Licensee"). Pursuant to the National Environmental Policy Act of 1969, 42 U.S.C. § 4321*et seq.*, and the Commission's regulations found in 18 C.F.R. Part 380, staff for FERC's Office of Energy Projects has prepared a DEIS for the relicensing of the Harris Project. The original notice of availability and public meetings stipulated a public comment deadline of January 20, 2025; however, after receiving stakeholder requests for an extension of time to review and comment on the DEIS, FERC extended the deadline for public comments to February 19, 2025.

Alabama Rivers Alliance (ARA) is a nonprofit statewide network of groups working to protect and restore all of Alabama's water resources through building partnerships, empowering citizens, and advocating for sound water policy and its enforcement. ARA has been an active participant in FERC hydropower licensings affecting rivers in Alabama for over twenty years and has been involved in the Harris relicensing since scoping activities were initiated in 2018. We have attended stakeholder meetings and submitted comments on Harris scoping documents, draft and final studies conducted by Licensee, the Preliminary Licensing Proposal, the Final License Application, and motioned to intervene, which was granted by FERC.

The Southern Environmental Law Center (SELC) joins these comments as a partner organization. As lawyers, policy experts, and community advocates, SELC is a nonprofit that takes on the toughest environmental challenges facing the South and the country. SELC defends the air, water, climate, wildlife, lands, and the people who live here. Together, ARA and SELC are referred to in these comments as "Conservation Groups."

ARA attended both public meetings on the DEIS hosted by FERC at the Wedowee Marine South in December 2024 and appreciates the opportunity to comment on the DEIS. Conservation Groups respectfully submit the following comments, recommended license conditions, proposed draft license articles, and an expert report on the use of adaptive management processes at the Harris Project as part of the FERC licensing record. Conservation Groups sincerely appreciate FERC staff's time and attention to these comments and encourage the Commission to consider integrating our recommendations into the Final EIS and license for the Harris Project.

I. NEW FLOW REGIME WITH SEASONAL MINIMUM FLOWS

A. Conservation Groups support the flow prescription contained in DEIS

Throughout the relicensing process, ARA has and continues to advocate for a flow regime that mimics a natural, unregulated hydrograph, reduces the drastic fluctuations in flows caused by daily peaking releases, improves aquatic habitat stability, and is adaptively managed for the benefit of the aquatic ecosystem downstream of Harris dam. Achieving a more natural hydrograph at Harris requires (i) mitigating large daily hydropeaking releases and (ii) creating minimum flows with seasonal variation. FERC staff's recommendation in the DEIS provides a pathway to accomplishing the latter, which Conservation Groups support. The staff recommendation contained in DEIS Appendix I recommends releasing a continuous minimum flow from the Harris Project of "300 cfs July through November; 350 cfs May and June; 400 cfs in December; and 450 cfs from January through April."[1] This minimum flow schedule is also contained in Draft Article 404 with provisions for planned and unplanned deviations from the minimum flows.[2]

While the seasonal variation in the recommended minimum flow is small (150 cfs between lowest and highest flows), and the overall volumes are approximately 22-40% less than the seasonal continuous minimum flows recommended by DCNR, FERC staff have prescribed, in their estimate, a "flow regime [that] would provide the greatest improvement to downstream resources that could be acquired without reducing lake levels in Harris lake."[3] Conservation Groups support the project minimum flow schedules recommended by FERC staff in the DEIS with the caveat that Licensee and stakeholders may still be able to develop operational strategies to release greater minimum flows at certain times of the year that do not impact lake levels. For instance, if proposed continued peaking releases are slightly constrained, moved off-peak, and passed through the new continuous minimum flow (CMF) turbine, the seasonal minimum flows could be raised to levels closer to the Alabama Department of Conservation and Natural Resource's (ADCNR) § 10(j) recommendation #1 while not impacting lake levels. A correspondingly larger capacity CMF turbine could allow for more energy generation through that unit off of a larger minimum flow. Conservation Groups supports the greater minimum flows recommended by ADCNR, as long as these flows can be accomplished without significant impacts to summer pool lake levels.

B. FERC must provide independent check on Licensee's modeling

FERC's analysis of what levels of minimum flows impact lake levels during peak recreation months rests heavily on the HEC-ResSim models of water surface elevation developed by Licensee and its consultants and submitted as part of the licensing studies. We encourage FERC staff to triple-check the modeling work of Licensee and provide truly independent analysis in the Final EIS. For example, it is hard to square the statements that "[r]elease scenarios of 450 cfs and less would have nearly identical effects on the average lake water surface elevation if implemented in lieu of the Green Plan"[4] with the statement that the staff alternative minimum flow would provide the "greatest improvement to downstream resources that could be acquired without reducing lake

[1] Draft Environmental Impact Statement for Hydropower License (Nov. 2024), Accession No. 20241121-3056 [hereinafter "DEIS"], Appdx I, at I-4.
[2] DEIS Appdx J, at K-4.
[3] DEIS Appdx I, at I-11.
[4] DEIS Vol 1. at 3-35.

levels in Harris Lake."[5] If the first statement regarding Licensee's modeling submission is true, then 450 cfs could be released as a minimum all year long (once Green Plan pulses are curtailed) without substantially affecting lake levels.

According to Licensee's HEC-RAS modeling that is included in Table 3.3.2-25, a 450 cfs continuous minimum flow would have only a 1.1% impact on lake levels, and a 600 cfs minimum flow would have a 1.4% impact on lake levels.[6] Should a ~0.3% impact to lake levels be considered substantial enough for FERC staff to reject ADCNR's recommended flows, or a flow regime that is closer to ADCNR's § 10(j) recommendation #1 and brings aquatic habitat downstream closer to the 800 cfs "good" to "excellent" range identified by FERC?[7] FERC staff should bear in mind that the project reservoir is continually being replenished by the Tallapoosa and Little Tallapoosa upstream, able to store multiple feet of flood waters, and is, over time, getting shallower as sediment accumulates in the lake bottom.

We also support DCNR's recommendation, which FERC has adopted in its staff alternative, to "limit annual reductions in minimum flows to down to 254 cfs, as necessary for project maintenance, in the months of October through January, and for no longer than 3 consecutive weeks."[8]

Currently, the FERC staff recommendation is to continue the Green Plan pulsing for the approximately 4-year construction period that Licensee estimates will be required for installation of the new minimum flow turbine. However, a minimum flow mechanism in addition to the CMF turbine may be needed since Licensee states that its preliminary design for the CMF turbine will only pass 300 cfs, and the FERC staff recommendation calls for up to 450 cfs of minimum flow. The ultimate design of a CMF turbine may be able to accommodate 450 cfs, or the additional 150 cfs of minimum flow may be provided through modifying a spillway gate, using a non-overflow structure siphon,[9] or some other means. It is possible that this secondary minimum flow upgrade will be ready prior to the CMF turbine coming online, in which case we recommend that FERC require a 150 cfs minimum flow (in addition to Green Plan pulses) be implemented as soon as the secondary minimum flow measure is ready.

C. DEIS contains no mitigative measures to reduce peaking releases

The DEIS does not identify or recommend any protection, mitigation, and enhancement (PME) measures to materially reduce peaking releases. The staff recommended minimum flows of between 300 and 450 cfs are expected to provide minimal stabilization of river levels downstream of the Harris Project compared to the 6,500–13,000 cfs of peaking flows. As FERC notes in the DEIS, the new seasonal minimum flows "would typically be less than 5% of the total discharge".[10] No turbine ramping rates are being imposed due to the inflexible turbine design, and the retrofit of one of the two Francis turbines to pass a wider range of flows is not included in the DEIS.

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[5] DEIS Vol 1. at xxiii.
[6] DEIS Appdx G, at E-123.
[7] FERC Staff Comments on ISR and Meeting Summary (Jun. 10, 2020), Accession No. 20200610-3059, at A-2.
[8] DEIS Appdx I, at I-4.
[9] In the early 2000's as the Green Plan was being developed, Licensee studied the possibility of using a non-overflow structure siphon on the east side of the dam and found that it could enable a flow of 150 cfs through such a mechanism. *See* Preliminary Licensing Proposal, Appdx B, "Harris Downstream Flow AMP History and Research," at 416.
[10] DEIS Appdx I, at I-13.

Moreover, the fact that no downstream habitat enhancement measures are recommended due to peaking releases shows the level of impact hydropeaking releases will continue to have on the Tallapoosa River downstream of Harris under the staff alternative. FERC writes in the DEIS that "any downstream enhancement such as large woody debris and brush piles and synthetic materials would need to be properly anchored to the streambank to avoid being washed downstream during high-flow events and potentially becoming a public safety hazard."[11] Mitigation efforts at downstream habitat improvements can become a public safety hazard due to the volume of peaking releases and flood events.

ARA proposed the potential PME measure of pairing the existing hydro plant with a battery energy storage system to significantly mitigate peaking releases. See Section VI below for discussion of the BESS study and FERC's preliminary decision to not recommend this PME measure. Licensee proposes to continue peaking operations in the new license term, and mitigating the harmful effects of peaking releases should be a priority. We recommend Licensee continue to evaluate the cost of modifying one turbine to pass a wider range of flows, which could be compared to the cost of installing the proposed new CMF turbine.

D. Conservation Groups support evaluation and implementation of fish-friendly turbines

In the staff-recommended measures contained in Appendix J, as part of developing a minimum flow release plan, FERC states that Licensee should include "an evaluation (with requisite conceptual design drawings) of fish-friendly turbine design options for any proposed minimum flow unit."[12] One of the leaders in fish-friendly turbine design, Natel Energy, designs fish-safe turbines that can be used at projects "with 130 feet of head or less" and can "allow for 100% survival of entrained species, in certain cases."[13] According to the DEIS, the "normal maximum gross head of the Harris Powerhouse is 121 feet" and according to Licensee's Final License Application, the Harris Project's net head is 121 feet.[14] The Harris Project appears to be a candidate for a fish-friendly turbine design for the proposed CMF turbine. Conservation Groups also suggest that FERC require evaluation of the two existing Francis turbine runners for retrofit with a fish-friendly design as those turbines are now greater than 40 years old. Modernizing project infrastructure with the best available technology could greatly reduce or altogether eliminate fish mortality from entrainment, thereby improving the fishery in the lake and downstream. Conservation Groups support evaluation and implementation of fish-friendly turbines as an appropriate PME measure to be included in the license.

II. AQUATIC RESOURCES MONITORING, ADAPTIVE MANAGEMENT, AND SECTION 10(j) RECOMMENDATIONS

A. Adaptive management can improve outcomes for aquatic species at Harris Project

[11] DEIS Vol. 1, at 3-42.
[12] DEIS Appdx. J, at I-4.
[13] DEIS Vol. 1, at 3-44.
[14] Final License Application, Exh. E, at E-24.

In the context of natural resources, the term adaptive management "simply means learning by doing, and adapting based on what's learned."[15] Adaptive management acknowledges that we only have a partial understanding of natural systems and that remaining uncertainty can be reduced by "tracking resource conditions and using what is learned as the resources are being managed."[16] The Department of Interior's Adaptive Management Technical Guide defines the term as "a systematic approach for improving resource management by learning from management outcomes" with emphasis on "learning and adapting, <u>through partnerships of managers, scientists, and other stakeholders who learn together</u> how to create and maintain sustainable resource systems."[17] Conservation Groups continue to urge FERC and Licensee to adopt a statistically rigorous monitoring program for the next license term that measures responses of specific aquatic resources (*e.g.*, benthic macroinvertebrate assemblages) to stakeholder-informed management actions as part of an adaptive management program. Including such a provision in the new license will build upon the history of successful adaptive management in the middle Tallapoosa River and bring diverse stakeholders together to manage and restore project-impacted sections of this beloved section of Piedmont river.

To better understand prior adaptive management efforts at the Harris Project (often referred to as the Green Plan) and to show how these past learnings can inform an iterative adaptive management program in the new license, ARA has consulted with Dr. William Pine, a fisheries biologist and quantitative ecologist with over 20 years of experience in large ecosystem adaptive management programs, including supporting the Glen Canyon Dam Adaptive Management Program and using adaptive management practices to successfully restore oyster reefs in Suwannee Sound, Florida. Dr. Pine's review of the DEIS and his report with recommendations is contained in Attachment A to this filing and is incorporated by reference in these comments.

B. <u>FERC has authority to enable and oversee adaptive management programs through licenses and settlement agreements</u>

In the context of rivers affected by hydropower operations, adaptive management provides a necessary science-driven framework within which licensees, resource agencies, property owners, river advocates, and other stakeholders can cooperatively learn together to be better managers of upstream and downstream natural resources, particularly as environmental conditions like flows and water temperatures change with uncertain consequences. Adaptive management is also a useful tool for dynamically protecting sensitive aquatic life over the course of a 30-50 year license period, during which environmental conditions are nearly certain to change. In FERC's Hydropower Settlement Policy, the agency recognizes that provisions may be included in a license, which "contemplate that adjustments to measures required during the license term will be based on information gleaned from ongoing monitoring or other post-license studies…[which] is sometimes called adaptive management."[18] While the Commission must retain oversight authority of adaptive management activities, it is common for modern hydropower licenses to incorporate provisions allowing a FERC-approved adaptive management group to learn from experience and

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[15] Williams, B. K. & Brown, E.D., *Adaptive Management: The U.S. Department of the Interior Applications Guide* (2012), at p. 5, https://www.doi.gov/sites/doi.gov/files/uploads/DOI-Adaptive-Management-Applications-Guide-WebOptimized.pdf

[16] *Id.*

[17] U.S. Department of Interior, *Adaptive Management Technical Guide* (2009) at 1, https://www.doi.gov/sites/doi.gov/files/uploads/TechGuide-WebOptimized-2.pdf (emphasis added).

[18] FERC Policy Statement on Hydropower Licensing Settlements, Docket No. PL06-5-000, at 17 (Sept. 21, 2006).

make adjustments as the license term proceeds.[19] In fact, the Harris Project Green Plan is an example of an adaptive management program that has shaped project operations at a FERC-licensed hydropower project for nearly twenty years, though adaptive management provisions have never been formally integrated into the license.

C. Prior learning through adaptive management at Harris Project should not be lost

The prior adaptive management efforts begun in the early 2000's, commonly called the Green Plan, arose out of stakeholder concern over the Harris Project's negative impacts on downstream resources. As stated in DOI's Adaptive Management Applications Guide case study on R.L. Harris: "Fish and invertebrate populations in one of the highest-quality segments of Tallapoosa habitat were threatened with destruction by daily extreme low flows that dried the river bed, extreme flow variation from floods to trickles, and daily temperature changed from pulsed water releases."[20] Negative impacts to recreation activities, such as boating and fishing, also led to the creation of an adaptive management program and governance structure, the R.L. Harris Stakeholder Board.

While the pulsing flow experiment provided by the stakeholder-developed Green Plan did not achieve the hypothesized biological response in fish and macroinvertebrate populations downstream, it did lead to critical learning that should be capitalized upon through an iterative adaptive management framework in the upcoming license. As Dr. Pine points out, the Green Plan "successfully demonstrated the adaptive management process" and "improved understanding that fish and aquatic macroinvertebrate communities downstream of RL Harris Dam are likely impacted by changes in river discharge and water temperature."[21] Adaptive management is by nature iterative, and this opportunity for additional learning and improved management of resources must not be lost in the new license.

As we have pointed out in past comments, the problem with the Green Plan was that there was never a recalibration of operations after monitoring showed the chosen flow regime did not result in desired biological outcomes. Instead, the experimental pulsing flow calcified into default project operations, conducted voluntarily by Licensee, but never adjusted based on biological monitoring results. Delays in data reporting, analysis, and waning stakeholder engagement can all be challenges in long-term adaptive management programs but are not cause for abandoning them. The 2019 USGS Report detailing the history of the Green Plan continues to promote the scientific approach of adaptive management: "Despite potential obstacles, an adaptive management approach still holds substantial promise for improving the management of regulated rivers by allowing managers and scientists to address the uncertainty in predicting and measuring how river fauna will respond to flow-regime alterations."[22] We recommend that following the best-available science for sustainable river management, FERC fashion an adaptive management framework into

[19] *See, e.g.*,Rock Creek Cresta project license (FERC No. P-1962) and Roanoke Rapids project (FERC No. P-2009) for adaptive management of minimum flows. The Don Pedro project (FERC No. P-2299) original license provides an example of an early form of adaptive management.
[20] Williams, *supra* note 15, at 83.
[21] Report of Dr. William Pine, Attachment A, at 16.
[22] Irwin *et al.*, *Adaptive Management of Flows from R.L. Harris Dam (Tallapoosa River, Alabama)—Stakeholder Process and Use of Biological Monitoring Data for Decision Making*, U.S. Geological Survey Open-File Report 2019-1026, at 3.

the new license, which "could be a viable path forward to ensure stakeholder satisfaction related to new management options."[23]

As discussed in Section III(A)(iv) below and in Dr. Pine's report, the use of adaptive management processes at the Tennessee Valley Authority's (TVA) Tims Ford dam on the Elk River incorporating experimental releases has led to improved conditions for warmwater native aquatic species downstream of the dam.

D. FERC staff's recommended Aquatic Resources Monitoring Program does not create an adaptive management framework

The additional measures recommended by staff contained in the DEIS include development of a Tallapoosa River Aquatic Resources Monitoring Plan (ARMP) "to measure the effectiveness of the minimum flows and water quality enhancement measures required by the license for the first 3 years after commencement of the minimum flow releases and water quality enhancement measures…."[24] The ecological goals of the plan appear to be left up to Licensee. We submit that three years of monitoring is likely not a long enough period to detect changes in fish and macroinvertebrate communities, but *beginning* an adaptive management program with a 3-year monitoring period would be appropriate. Even though the ARMP calls for some evaluation of the effectiveness of the minimum flow regime in achieving environmental objectives, without more detail or an adaptive framework, it's unclear how "effectiveness" will be measured. And since the thermal regime will also likely be changing, it is further unknown how the impacts of temperature changes will be monitored (or not).

While the staff recommendations in the DEIS build upon an undetailed aquatic resource monitoring plan submitted by Licensee, the staff-recommended ARMP still falls short of prescribing an actual adaptive management program for assessing the recommended flow and temperature changes on the aquatic ecosystem downstream. Though FERC uses the term "Aquatic Resources Adaptive Management Plan" once in the DEIS,[25] this appears to be an anomaly since the substance of FERC's recommendations do not yet create an adaptive management framework with the ability for iterative change based on learning through monitoring.

Dr. Pine notes in his report that the ARMP is not yet adaptive: "However, this plan is not linked to a decision structure that would describe how these results would be linked to changes in the Alabama Power proposed operating plan [and that] [w]ithout these linkages and decision rules, the proposed plan is not an adaptive management program."[26] The DEIS itself acknowledges that "[i]n the absence of an adaptive management mechanism, the value of the monitoring data is unclear."[27] In the final EIS, Conservation Groups recommend an adaptive framework be articulated that can provide the basis for adaptive management in the license.

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[23] *Id.* at 1.
[24] DEIS Appdx I, at I-6.
[25] *See* DEIS Appdx I, at I-15: "For the reasons discussed above, we recommend that Alabama Power develop a Tallapoosa River Aquatic Resources Adaptive Management Plan, in consultation with Alabama DEM, that includes the elements of Alabama Power's proposed Aquatic Resources Monitoring plan as well as the following additional provisions…"
[26] *See* Report of Dr. William Pine, Attachment A, at 5.
[27] DEIS Vol. 1, at 3-47.

Throughout the relicensing, ARA has stressed the need for a true adaptive management framework to be integrated into the new license. Conservation Groups continue to advocate for adaptive management of flows and water temperature to benefit aquatic species and aquatic habitat downstream of Harris over the course of the new license term.

E. Expert recommendations for FERC and Licensee regarding adaptive management

Dr. Pine has listed a set of specific recommendations in the attached report that can be used by FERC, Licensee, resource agencies, and other stakeholders to augment the current provisions of the preliminary aquatic resources monitoring program and design an adaptive program focused on learning from the upcoming changing flow and temperature conditions. These five recommendations include:

i. Define specific ecosystem response metrics
ii. Design and implement flow and temperature experiments
iii. Conduct experimental warm water releases
iv. Enhance stakeholder engagement and collaboration
v. Integrate adaptive management framework into the new license

Conservation Groups generally agree with the recommendations put forth by Dr. Pine and advise FERC and Licensee to review the full report contained in Attachment A. The entities currently tasked with developing and consulting on the Tallapoosa River Aquatic Resources Monitoring Plan[28] (Licensee, DCNR, ADEM, FWS, USGS, and USACE) could define the specific ecosystem response metrics with additional stakeholder input. The members of the Tallapoosa River Flow Advisory Committee[29] (Licensee, DCNR, and ADEM) could design and implement flow and temperature experiments, again with input from other stakeholders. To the extent feasible, experimental warm water releases could be carried out before or directly after license issuance and before a new CMF turbine is online. Once the CMF turbine and/or the alternative minimum flow release mechanism is available, additional flow experiments could be implemented as well, within a range of flows described in the new license, and with FERC retaining authority over adaptive management processes.

With regard to biological monitoring and reference conditions, we emphasize the point made by Dr. Pine that stakeholders must clearly define the reference site.[30] Conservation Groups advocate for downstream conditions that approximate to the greatest extent possible the unregulated upstream conditions on the Tallapoosa River and believe that the unregulated site near Heflin provides the best reference site available.

F. Federal and state agencies have recommended the use of adaptive management at Harris

As the DEIS notes, other stakeholders have explicitly or implicitly recommended the use of adaptive management in this relicensing: "EPA recommends the use of adaptive management approaches for the Tallapoosa River downstream from Harris Dam due to the adverse effects caused by low flows and sometimes dangerous high-flow regimes of the project that continue to affect aquatic health and public use of the Tallapoosa River."[31]

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[28] As described in DEIS Draft Article 409, Appdx J, at K-8
[29] *Id.*
[30] Report of Dr. William Pine, Attachment A, at 6 and 8.
[31] DEIS Vol. 1, at 3-19 and 3-20.

Further, the language of ADCNR's 10(j) recommendation #17 captures the essence of adaptive management, calling for an aquatic resources monitoring program that "would be implemented at determined intervals throughout the license period, include standardized sampling protocols for all aquatic species (macroinvertebrates, mollusks, crayfish, and fish), and include pre- and post-operational changes monitoring and provisions for altering project operations based on the monitoring."[32] ADCNR's 10(j) #17 recommendation of biological monitoring both before and after operational changes are made and having a decisional structure for altering project operations based on the learning is an apt description of adaptive management processes. However, FERC has preliminarily recommended NOT adopting this resource agency recommendation, even though it recognizes that the recommendation is within the scope of §10(j).[33] Conservation Groups advise that FERC reconsider its preliminary rejection of 10(j) #7 and support an aquatic resources monitoring plan with an adaptive framework for monitoring aquatic species before and after operational changes are made with a provision for altering project operations based on what is learned through monitoring.

G. Proposed Draft Article 409 – Tallapoosa River Aquatic Resources Adaptive Management and Monitoring Plan

Building on FERC's draft Tallapoosa River Aquatic Resources Monitoring Plan, we propose the following revisions to Draft Article 409:

Draft Article 409. Tallapoosa River Aquatic Resources Monitoring and Adaptive Management Plan. Within 12 months of ~~(a)~~ license issuance, ~~or (b) implementation of the minimum flows under article 404 as well as the water temperature and dissolved oxygen enhancement measures implemented under Article 408, whichever occurs first~~, the licensee must file, for Commission approval, a Tallapoosa River Aquatic Resources Monitoring and Adaptive Management Plan. The purpose of the plan is to establish a ~~3-year~~ program to iteratively evaluate the biological response and effectiveness of the required instream flows and water quality enhancement measures in the Tallapoosa River between Harris Dam and the upstream limit of Martin Reservoir, beginning with a 3-year monitoring period. The plan must include, at a minimum, the following provisions:

(1) The goals and objectives (ecological and navigational) for the Tallapoosa River in project-affected waters downstream from Harris Dam, including stakeholder-informed ecological response metrics for fish and macroinvertebrate communities;

(2) The plan must describe an approach to separate out the effects of the minimum flows, water temperature, and dissolved oxygen enhancements on the ecological objectives. ~~If effects are conducted concurrently then it will not be possible to understand the effects of the action, thus it will not be clear whether the action should continue as proposed, be modified, or abandoned.~~

(3~~2~~) Criteria for measuring the effectiveness of the required minimum flow regime at achieving the environmental objectives in item 1 and defined decision thresholds that may trigger operational changes under item (6) ~~(to include developing degree day criteria for selected fish species in consultation with the Alabama Department of Conservation and Natural Resources (Alabama~~

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[32] DEIS Appdx. I, at I-43 (emphasis added).
[33] DEIS Appdx. I, at I-43.

DCNR), the Alabama Department of Environmental Management (Alabama DEM) and the U.S. Fish and Wildlife Service (FWS);

(43) The methodologies for (a) monitoring the project-related effects of the minimum flow regime required by the license on the environmental objectives identified in item 1, including monitoring (for the first 3 years after providing the required minimum flows and water quality enhancements) water temperature and DO, as well as monitoring aquatic organisms at the same locations, and (b) the methods that will be used to isolate the effects of the minimum flows from other, nonproject-related effects;

(54) The formation of a Tallapoosa River Flow Advisory Committee, consisting of Alabama Power, Alabama DCNR, and Alabama DEM, and an at-large member with statistical expertise to design monitoring and analyses programs using modern data workflow methods to ensure data are collected in such a way, and analyses are properly conducted, to provide results in a timely way to inform decision making to the extent they are willing to participate ;

(65) Annual monitoring reports and a 3-year monitoring report that includes (a) the monitoring methods used, (b) the data collected, (c) statistically rigorous analyses of available data each year, (d) a discussion of the effectiveness of the minimum flow regime required by the license in achieving the environmental objectives identified in item 1, and (de) any recommendations to the Commission, for approval, for changes to project facilities and/or operations, including changes to the minimum flow regime and destratification practices, and any changes to the monitoring schedule, including the need for additional monitoring after the third year of monitoring is completed; and

(76) An implementation schedule.

The Tallapoosa River Aquatic Resources Monitoring Plan must be developed after consultation with the Alabama Department of Environmental Management, Alabama Department of Conservation and Natural Resources, the FWS, the U.S. Geological Survey, and the U.S. Army Corps of Engineers. The licensee must include with the plan documentation of consultation, copies of recommendations on the completed plan after it has been prepared and provided to the agencies above, statistical power analyses using data previously collected as part of ongoing monitoring within the Tallapoosa River to describe the performance of the proposed monitoring plan, and specific descriptions of how the results of the monitoring efforts and the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies and other stakeholders to comment and to make recommendations before filing the plan with the Commission for approval. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. Implementation of the plan must not begin until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

H. Conservation Groups support § 10(j) recommendation for fish, mollusk, and crayfish propagation program to mitigate impacts to aquatic resources

Federal Power Act § 10(j) requires that a license "adequately and equitably protect, mitigate damages to, and enhance fish and wildlife (including related spawning grounds and habitat) affected by the development, operation, and management of the project…."[34] Under the Commission's regulations at 18 C.F.R. § 5.26(c), "[a]ny party, affected resource agency, or Indian tribe may file comments in response to the preliminary determination of inconsistency, including any modified recommendations, within the time frame allotted for comments on the draft environmental document." In the DEIS, FERC staff found § 10(j) recommendation #16 regarding a propagation program to stabilize existing populations of rare, state-listed, species of greatest conservation need, and federally-listed mollusks, fish, and crayfish species to be outside of the scope of §10(j), apparently because it was formulated as a recommendation that Licensee establish a memorandum of agreement with a hatchery (an administrative matter), even though the recommended propagation program is a fish and wildlife measure.[35] Elsewhere in the DEIS, FERC rejects § 10(j) recommendation #16 because "it is unclear which reaches of the Tallapoosa River are intended to be enhanced through such a program."[36]

Generally, Conservation Groups support ADCNR's § 10(j) recommendation #16 to propagate native aquatic species of fishes, mollusks, and crayfishes in order stabilize declining populations of some species and reintroduce other native species. Recommendation #16 could be formulated not as a directive to enter into a memorandum of agreement but as a PME measure enforceable by FERC in the final license. Recommendation #16 should specify that the program will be focused on enhancing aquatic resources in waters affected by the Harris Project. In tandem with biological monitoring and an adaptive management framework, the propagation program recommended by ADCNR could truly begin to restore the aquatic ecosystem disrupted by the Harris Project once seasonal minimum flows and water temperature enhancements have been implemented. Establishment of an aquatic species propagation program for Project-affected waters, to include those waters within the Project Boundary and the regulated 44 miles of the Tallapoosa River between Harris Dam and Horseshoe Bend, would be an appropriate PME measure within the scope of FPA §10(j) and commensurate with the effects of the Project on aquatic resources. We recommend that FERC include such a propagation program in the Final EIS and license to equitably protect, mitigate, and enhance aquatic resources that have historically been harmed by the Harris Project.

III. WATER QUALITY

A. Conservation Groups support FERC's recommended measures to enhance temperature controls and warm releases

Concern over impacts to aquatic species due to cold-water releases from Harris dam has been a prominent topic throughout this relicensing. This area of stakeholder interest stems from the rigorous scientific study and published literature created through the Green Plan and built upon by

[34] 16 U.S.C. § 803(j)(1).
[35] DEIS Appdx. I, at I-42 and I-44, FN P and Q.
[36] DEIS Appdx. I, at I-36.

other researchers.[37] FERC's analysis in the DEIS, citing some of the key published scientific literature, states that "the project has resulted in:…temperature decreases of as much as 10°C (18°F) during spring and summer generation periods" and that "[r]elease of warmer water from the reservoir results in warmer water downstream of the dam than upstream of the reservoir in fall and at times in winter."[38] Figure 3.3.2-8 of the DEIS shows the daily average water temperature upstream of Harris at the USGS Heflin and Newell gages as well as the downstream temperatures at sites in the tailrace, Malone, and Wadley over the period of May 1, 2019 through April 1, 2020. This figure shows a clear inversion of the seasonal thermal regime in which temperatures at the tailrace are lower during summer months compared to the unregulated Heflin and Newell sites and are warmer than the unregulated sites during winter months. The adaptive management work of the Green Plan identified water temperature as a parameter linked to negative impacts on aquatic life: "Water released from hydroelectric dams is typically colder than surface temperatures, which alters downstream temperatures. Although it has long been recognized that temperatures are altered below R.L. Harris Dam, specific inference regarding the influence on biotic processes has been lacking until this study, which clearly relates colonization rates (that is, recruitment of a species to a site) to increased thermal energy in the river."[39] Adequate scientific evidence exists to require warming releases as commensurate PME measure in the license.

i. Overview of Warmer Water Release Provisions in the DEIS

FERC staff note in the DEIS that "the fishery in the Tallapoosa River is primarily a warmwater fishery that depends on a warmer temperature regime than currently exists with releases of cool water from the Harris Project" and that "[r]eleasing warmer water in spring and summer as recommended by Alabama Rivers Alliance and Alabama DCNR would likely benefit native downstream fish."[40] The additional measures recommended by FERC staff in the DEIS to achieve warmer releases include a provision that, as part of Licensee's development of a water temperature and DO monitoring plan, Licensee include "a narrative description and requisite conceptual design drawings, to destratify a portion of Harris Lake to meet the staff-recommended water temperature regime and DO targets."[41] Draft Article 408 contains similar language requiring that within six months of license issuance, Licensee file a water temperature and DO monitoring plan that includes a conceptual description of how Licensee will destratify a portion of the reservoir to meet the staff-recommended water temperature regime.

Conservation Groups support the staff recommendations in Appendix J and the provision in Draft Article 408 for Licensee to submit a plan to destratify a portion of the reservoir forebay, mixing the water column near the project's intake in order to control the temperature of releases. Destratifying a portion of the reservoir forebay near the project intake is a targeted and commensurate PME measure to address project impacts on aquatic resources downstream and builds in operational flexibility for the next license term. However, Draft Article 408 is silent about the timeline for implementation of the partial destratification measures. We recommend that FERC include in the final EIS more specificity regarding the timeline for Licensee's destratification

[37] *See* ARA comments on the Preliminary Licensing Proposal recapping scientific literature, at 6.
[38] DEIS Vol. 1, at 3-25.
[39] Irwin, *supra* note 22, at 47.
[40] DEIS Appdx. I, at I-13.
[41] DEIS Appdx. I, at I-5.

submission, stakeholder input, FERC approval, and a timeline for implementation. We are concerned that the DEIS leaves much unresolved in terms of timing and that this infrastructure improvement could be long delayed without clearer provisions in the Final EIS and license.

ii. ADCNR's recommended thermal regime

ADCNR submitted a recommendation under Federal Power Act § 10(j) that the Harris Project be operated to release water to the tailrace that is similar to the natural water temperature regime of the unregulated Tallapoosa River upstream. This 10(j) recommendation (#12) states that Licensee should "[o]perate the project to follow a 90°F (32.2°C) maximum and a ±5°F (2.7°C) change from ambient water temperatures, and a 1.8°F (1°C) rate of change per hour requirement."[42] This provision is derived from state water quality standards found in ADEM's administrative code designed to protect the aquatic ecosystem from thermal pollution.[43]

ARA cited the same state water quality standards in its comments submitted to ADEM on the Clean Water Act § 401 Water Quality Certification and believe those existing standards are relevant to the unnaturally cold water the Harris Project releases in the spring/summer months and the unseasonably warm water that Harris releases in fall/winter. Conservation Groups interpret the phrase "ambient water temperatures" in ADCNR's 10(j) recommendation to mean water temperatures at an unregulated reference site outside of the influence of the Harris Project, such as the Heflin site. We see that while FERC staff recommend adopting this § 10(j) thermal regime provision in the DEIS, that the "select rate of [temperature] change [is] in consultation."[44]

Conservation Groups support the thermal regime recommendation submitted by ADCNR to bring the temperature of releases more in line with the unregulated Tallapoosa River; however, we request that FERC and ADCNR clarify exactly where "ambient water temperatures" are to be measured and update stakeholders on the select rate of temperature change once consultation has concluded. A temperature rate of change requirement should be achievable if partial destratification of the forebay is implemented. Conservation Groups recommend that the Heflin site, rather than the Newell site, be used as the reference point for upstream unregulated water temperatures since Heflin is on the mainstem Tallapoosa River and Newell is on a tributary. Further, we recommend that the Water Temperature and Dissolved Oxygen Monitoring Plan recommended by staff in Draft Article 408 be amended to specify that ambient water temperature be measured at the USGS Heflin gage and that temperature recordings at the Heflin gage are recorded throughout the license term and used as a reference point in evaluating the effectiveness of the water temperature measures implemented under Draft Article 408(5).

iii. Additional analysis of regulated vs. unregulated water temperatures

We direct FERC's attention to additional analysis of water temperatures downstream versus upstream of the Harris Project supplied by Dr. Pine (Attachment A, p. 8-15). Dr. Pine evaluated water temperatures during the limited period of data overlap for the four sites (Heflin, tailrace, Malone, Wadley) to assess the Harris Project's influence on downstream temperatures. Figure 4

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[42] DEIS Appdx. I, Table 5-1 "Fish and wildlife agency Section 10(j) recommendations," at I-41.
[43] *See* Ala. Admin Code 335-6-10-.09(iii).
[44] DEIS Appdx. I, Table 5-1 "Fish and wildlife agency Section 10(j) recommendations," at I-41

of Dr. Pine's report shows the difference in mean daily temperatures for days where common data is available across the four sites with red dashed lines showing the +/- 2.7°C (5°F) threshold of management interest expressed by ADCNR and contained in ADEM's water quality regulations. Dr. Pine writes:

> The general patterns in water temperature difference between the upstream site (Heflin) and the three downstream sites (Tailrace, Malone, Wadley) for the April-October 2018 period, show the largest water temperature differences were observed in summer and late fall between Heflin and the Tailrace (Figure 4). This is because the hypolimnetic releases from RL Harris Dam are cooler than Heflin water temperatures during summer, and warmer than Heflin during late fall. Water temperatures at all three downstream gages were warmer during fall than Heflin (Figure 4). Average daily water temperature differences of ± 2.7°C (5°F) were observed at the tailrace gage for five of the seven months, and three of the seven months at Malone and Wadley (Figure 4, Table 1).[45]

The results of this water temperature analysis show that "for the period of available data, mean daily water temperatures in the regulated river reach under Green Plan operations do change ±2.7°C from unregulated site at all three downstream sites (Figure 4)."[46] If a partial forebay destratification system or other method to warm releases is not implemented, Licensee's proposal will continue to release water with similar temperatures to those observed during the relicensing studies (Green Plan operation), which "will continue to deviate from the ambient conditions observed at the unregulated upstream site near Heflin." (Attachment A, p. 14). Conservation Groups believe that continued disruption of the thermal regime by the Harris Project would have further deleterious effects on the aquatic ecosystem, and we therefore support FERC's recommendation to destratify a portion of Harris Lake to meet the water temperature regime recommended by ADCNR.

Overall available data for water temperatures at the upstream sites at Heflin and Newell are fairly short (Dec. 2017 – Nov. 2020) compared to temperature records for the downstream sites (2000-2020). We recommend that the temperature sensor at the USGS Heflin gage be reactivated as soon as possible to gather additional temperature data from an unregulated reference site upstream of the Harris Project. The cost to fund this measure is minimal. USGS has informally estimated an annual cost of $2,500 to resume collecting temperature data at the Heflin gage.[47] Again, we advise that FERC add a provision in the water quality monitoring plan and Draft Article 408 that water temperature be recorded at the Heflin site throughout the term of the license. It is important to remember that the reference conditions for the stakeholder-developed Green Plan were the unregulated upstream site at Heflin. Because the Green Plan pulsing flows represents current baseline conditions, many comparisons drawn in relicensing study reports, the Preliminary Licensing Proposal (PLP), and Final License Application (FLA) have been based on how possible flow and temperature changes would deviate from (or stay the same as) the existing Green Plan releases. Yet the reference condition for aligning flow, thermal regime, DO concentrations, and other water quality characteristics should remain an unregulated site, such as Heflin.

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[45] Report of Dr. William Pine, Attachment A, at 13-14.
[46] Report of Dr. William Pine, Attachment A, at 14.
[47] Email communication with USGS staff (Jan. 22, 2025).

To date, Licensee and stakeholders have not conducted any experiments to see what response releasing warmer water from Harris dam would have on fish and macroinvertebrate communities downstream of Harris. Partly, this has been due to Licensee's delay in recognizing cold-water releases as creating a negative impact. Partly, this has been due to the limited existing infrastructure currently available at the Harris Project for warming releases. FERC did not require trial releases of warmer waters or other flow regimes during the study phase of the licensing, and stakeholders did not propose specific ways to test releases of warmer water. Conservation Groups are not proposing a new study at this stage of the relicensing, but we do direct FERC and Licensee's attention to the method proposed by Dr. Pine (Attachment A, p. 19) that could potentially allow for the monitoring of impacts to aquatic species of a short-term release of warmer water without changing current Harris infrastructure. Such an experiment could conceivably be carried out prior to license issuance or in the first years of the new license term as part of an adaptive management framework while the CMF turbine is under construction. We acknowledge that this method of releasing warmer water could have adverse impacts on lake aesthetics, though the extension of boat ramps contemplated by Draft Article 414 on the lake to improve boating access at lower reservoir levels could minimize any impacts to recreation.[48]

iv. Warming releases from hydropower dams on southeastern rivers have created positive biological responses

Other southeastern rivers have suffered from disrupted thermal regimes created by large hydropower impoundments. In some instances, these rivers have been rehabilitated by modifying dam operations and infrastructure to benefit aquatic life, and it is instructive to see the results of flow and temperature modifications at other sites. TVA's Tims Ford dam on the Elk River in southern Tennessee is comparable to the Harris Project in that it has normal turbine releases of 4,000 cfs, a turbine of similar age (1970) with a very small operating range, and releases hypolimnetic water. Tims Ford's cold releases had negative impacts on warmwater fishes and mussels, including the federally endangered boulder darter.[49] Beginning in 1991, TVA implemented a Reservoir Releases Improvement Plan to improve water quality, increase minimum flows, and stabilize aquatic habitat across 16 dams in its fleet, including Tims Ford.[50]

TVA had the added challenge of managing the downstream Elk River to support both coldwater species, since the reach from Tims Ford Dam to Fayetteville, TN is a designated trout stream stocked by the Tennessee Wildlife Resources Agency, as well as managing temperatures for native warm water species, such as the endangered boulder darter. By curtailing hydropower peaking during key times of year, using an extensive water temperature monitoring network, and blending sluice gate releases (colder) and spillway releases (warmer), TVA has found a method of supporting trout species, which need water less than 68 F, closer to the dam, as well as increasing native fish diversity of warmwater species in reaches further from the dam. With some informed adaptive experimentation, TVA identified an acceptable set of operations to meet temperature

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[48] DEIS Appdx. J, at K-19.

[49] Potoka *et al.*, *Multispecies Occupancy Modeling as a Tool for Evaluating the Status and Distribution of Darters in the Elk River, Tennessee* (2016), https://doi.org/10.1080/00028487.2016.1201002

[50] Bednarek, A. & Hart D., *Modifying Dam Operations to Restore Rivers: Ecological Responses to Tennessee River Dam Mitigation*, Ecological Applications Vol. 15(3) (2005) at 999, https://doi.org/10.1890/04-0586

requirements by both modeling release simulations and then conducting field trials of release scenarios.

B. Standards for dissolved oxygen will likely be met if measures in DEIS are implemented

In prior comments, we have pointed out instances where the Harris Project has failed to meet a minimum dissolved oxygen (DO) level of 5.0 mg/L. Releasing water with sufficient levels of DO is fundamental to aquatic ecosystem health but remains a persistent problem in rivers regulated for hydropower operations. The § 401 WQC issued by ADEM for the Harris Project requires that project operations, including releases of the existing turbines and the proposed CMF turbine "shall be managed such that no less than 5.0 mg/L of dissolved oxygen (DO) shall be maintained at all times in the tailrace waters."[51] FERC's staff recommendations include a water temperature and DO monitoring plan, as well as a provision for partially destratifying the Harris forebay through either the use of surface mixers or a bubble plume system. In its recommendations, FERC writes, "In consideration of the various alternatives to improve water quality downstream of the powerhouse, Commission staff concludes that a partial destratification system, which is estimated to have an annual levelized cost of $100,000, would provide the most appropriate balance among water quality protection, fishery habitat enhancement, and project cost."[52] Conservation Groups agree with this conclusion.

We believe that DO concentrations in project releases would likely be increased after the implementation of either surface mixers or bubble plume systems. Using impellers to push warmer surface water with higher DO concentrations down into a mixed zone closer to the intake would likely result in more oxygen-rich water being released through the turbines. Combined with the existing but limited turbine aeration abilities, as well as the new CMF turbine, we believe it is likely that the partial destratification will allow Licensee to meet the § 401 WQC condition for DO concentrations at all times.

The standard of 5.0mg/L DO required by ADEM's 401 WQC is a floor, a very minimum level that must not be dropped below. We encourage FERC and Licensee to go beyond the bare minimum of 5.0mg/L and strive to release water from the Harris Project that contains DO concentrations on par with the unregulated Tallapoosa River at the USGS Heflin gage 02412000. To our knowledge, this USGS gage has never collected DO data. We recommend the Water Temperature and DO Monitoring Plan described in Draft Article 408 include a provision to record DO data at the USGS Heflin gage and that one of the goals and objectives of the plan be to evaluate enhancements in downstream DO levels in the context of the Heflin site DO concentrations.

IV. PUBLIC ACCESS, SAFETY, EDUCATION, AND RECREATION

A. Conservation Groups support river and reservoir recreation enhancements

In addition to continuing operation of 11 project recreation sites, the Recreation Plan filed by Licensee with its FLA includes proposals to create new recreation sites within the project boundary—a new day use park on Lake Wedowee at Highway 48 and a new canoe/kayak access

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[51] Ala. Dept. of Env. Mgmt. § 401 Water Quality Certification, DEIS Appdx. C.
[52] DEIS Appdx. I, at I-13.

point located in the project tailrace below the dam. FERC staff have recommended including creation of a "new day use park with amenities including swimming, picnicking, boat launch and pier, fishing piers, and parking" on Alabama Highway 48 near the existing Wedowee South Marina and a "barrier-free access kayak/canoe access area and a barrier-free trail to the launch from the existing Harris Dam tailrace fishing pier parking lot" in the DEIS.[53] Conservation Groups support both of these recreation enhancements proposed by Licensee and recommended by FERC that will provide river and lake recreationists with additional points of access and facilities for enjoying the Tallapoosa River.

We believe that the addition of the CMF turbine, as well as a potential secondary minimum flow release mechanism recommended in the DEIS by FERC staff, will be a boon to river recreationists downstream accessing the river at the enhanced Harris tailrace site. The seasonal continuous minimum flow will provide a more stable and dependable level of flow for paddlers, though Licensee plans to maintain peaking operations, which will continue to present a danger for recreationists. Conservation Groups stress the importance of improving public safety and real-time notification of peaking releases from Harris Dam to keep all boaters who use the new tailrace boating access point safe and informed.

The Shorelines (formerly SmartLakes) app upgrades that allows users to opt-in to receive notifications of releases are useful, and we thank Licensee for making that improvement. Receiving Shorelines app notifications is still dependent upon having wireless service, which is not a given on the Middle Tallapoosa, but the feature is positive step. The Shorelines app states that "generation schedule and subsequent water releases from dams are subject to change without notice," and we again request that Licensee provide a programmable, updatable digital sign in the tailrace that will give all recreationists, including hearing-impaired individuals, as much advance notice of generation schedule and peaking releases as possible.

Since Licensee anticipates a four-year period of construction for the new CMF turbine, we recommend that Licensee proceed with the implementation of the new tailrace put-in upon license issuance and not wait until the new minimum flow has been established. While it may be necessary to wait until a minimum flow is established to safely open and operate the new canoe/kayak access point, having the access point ready once the CMF turbine is operational would be preferable.

B. Increasing public safety

As part of comprehensive efforts to increase public safety at the Harris Project, Conservation Groups recommend that the Public Education and Outreach Plan developed in consultation with ADCNR to share information about the project's recreational opportunities, water levels, shoreline classifications, and best management practices described in Draft Article 416 also contain information about the current fish tissue consumption advisories on Lake Harris. In 2024, the Alabama Department of Health issued three fish consumption advisories for the lower Harris reservoir dam forebay for blue catfish, channel catfish, and spotted bass due to mercury.[54] To raise awareness about fish consumption advisories and the health risks posed by eating contaminated fish, ARA has worked with ADCNR and other NGO partners to create and post fish tissue

[53] DEIS Appdx. I, at I-3.
[54] Alabama Fish Consumption Advisories 2024, Ala. Dep't. of Public Health, https://www.alabamapublichealth.gov/tox/assets/2024_fishadvisory.pdf

consumption advisory signage at public fishing areas and boat ramps across the state, including at five boat ramps on Harris Lake.[55]

We previously commented on the recreation study report that information about fish consumption advisories is pertinent to safe fishing recreation on Lake Harris, but neither Licensee nor FERC have responded to these comments. FERC is aware of these consumption advisories and describes them in the DEIS section on Water Quality Impairments and Advisories.[56] We continue to ask Licensee, ADCNR, and FERC to integrate notification of state-issued fish consumption advisories into the Public Education and Outreach Plan contained in Draft Article 416, and we will gladly partner with Licensee and ADCNR to provide additional fish consumption advisory signage at other Harris Project boat ramps, fishing piers, and recreation areas.

C. Additional public access points downstream of project boundary are needed

Recounting the Tallapoosa River paddling opportunities that existed prior to the construction of Harris Dam, John Foshee wrote in his 1975 book *Alabama Canoe Rides and Float Trips* about a prized section of river now inundated by Harris Lake:

> The Tallapoosa River is, at the time of the writing of this book, free-flowing from its headwaters in Georgia to its entrance into Martin Lake…However, the construction of a dam above Malone, Alabama will flood the river almost back to the Georgia line and leave only 42 miles still open…As this dam is not due to begin backing up water until late 1976, I have also included an additional [section about the] 9.5 miles above the dam site. Hopefully, you can see this beautiful section of the river before it vanishes forever.[57]

Though the recreational, aesthetic, ecological, and cultural value of the drowned section of the Tallapoosa River will not be restored in the upcoming license term, it is possible to enhance river recreation downstream of the project in the 44-mile reach between Harris dam and Horseshoe Bend. The new canoe/kayak access point in the tailrace to become part of the FERC license is positive first step, but once paddlers put-in at the dam, they are unable to take-out on public land again for many river miles. The Alabama Scenic River Trail's (ASRT) "paddle planner" map shows a non-state-owned boat ramp at Bibby's Ferry (more than a day's paddle from the dam) as the first possible public take-out point downstream.[58] In particular, the lack of public access sites at Malone and Wadley leave paddlers dependent on the permission of private landowners. FERC recognizes this lack of access between Harris Dam and Bibby's Ferry in the DEIS: "There are no public river access points along the Tallapoosa River between Harris Dam and the two privately owned portages at Malone and Wadley."[59] ARA believes that the private portage at Malone is altogether closed to the public.

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[55] For a map of current fish consumption advisory signage sites around Lake Wedowee, including White's Bridge boat ramp, Fox Creek boat ramp, Swagg boat ramp, Hwy 48 boat ramp, and Road end boat ramp, *see* https://www.google.com/maps/d/u/0/viewer?mid=1oznLdP0TI-O0pR-xAESsCAjIUkM0jM0&ll=33.32872075514456%2C-85.51463971230024&z=13

[56] DEIS Appdx. F, at F-6.

[57] Foshee, J., *Alabama Canoe Rides and Float Trips*, University of Alabama Press (1975), at 168.

[58] *See* Alabama Scenic River Trail's "Paddle Planner Map" at https://www.alabamascenicrivertrail.com/plan-your-trip/paddle-planner/

[59] DEIS Appdx. F, at F-30 (emphasis added).

We understand that Licensee supports creation of one or more public paddling/fishing access points downstream of the project boundary. It is unlikely that such an access point would be owned by Licensee or included in the project boundary but would rather be supported financially by Licensee and owned/operated by another party such as ADCNR, ASRT, or others. We encourage Licensee to work with the town of Wadley and private landowners to acquire property rights to create and maintain one or more downstream public access sites. Providing funding for the ASRT to extend the existing Harold Banks Canoe Trail upstream of Bibby's Ferry on the Middle Tallapoosa would be one way to accomplish this. We encourage Licensee to designate funding for supporting one or more paddling/fishing access points between Harris Dam and Bibby's Ferry.

V. EROSION AND SEDIMENTATION

Regular peaking releases from the Harris Project and fluctuating reservoir levels continue to drive erosion and sedimentation along the river banks downstream. Conservation Groups are concerned about the health of riparian buffers along the banks of the Tallapoosa downstream of the Harris Project, which are an essential terrestrial-aquatic interface for many species, including amphibians, birds, and mammal. FERC recognizes that existing erosion sites downstream of the Harris Project "are partially attributable to adjacent land use/clearing and riverine processes, but the process has likely been exacerbated by sediment trapping in the impoundment and water level fluctuations from project peaking flows and would be expected to continue with the continuing presence of the impoundment and under peaking operations."[60]

Licensee previously proposed an Erosion Monitoring Plan that did not include provisions for stabilizing or repairing existing erosion hot spots such as those reported by downstream landowners or identified by Trutta's High Definition Stream Survey. FERC's Draft Article 402 of the DEIS describes an Erosion Monitoring Plan very similar to what Licensee proposed that only calls for further monitoring without remediation. The DEIS admits that "Although it does not include any measures to address erosion, developing the details of the plan in consultation with Alabama DCNR and other resource agencies would help to ensure that project-related effects are identified and that provisions to avoid or minimize these effects could be considered."[61] We contend that *consideration* of ways to avoid negative project effects is simply not enough.

No remediation of existing erosion, which should have been prohibited and enforced by the Commission through existing license Article 20, is contemplated in the DEIS. We urge the Commission to require more than just monitoring and reporting of erosion and sedimentation as project releases continue to destabilize and wash away sections of the banks of the Tallapoosa River downstream.

We recommend that FERC require an erosion and sedimentation remediation fund under Draft Article 402 to be used for stabilizing and repairing problematic erosion and sedimentation sites that have already been identified during the relicensing studies and that will likely be identified during the upcoming license term. Only by requiring Licensee to be financially responsible for the erosive impacts of the Harris Project will erosion and sedimentation problems brought to FERC's attention during the relicensing be solved.

[60] DEIS Vol. 1, at xxii.
[61] *Id.*

Finally, we recommend that the Public Outreach and Education Plan in Draft Article 416 be modified to include education and outreach on erosion and sedimentation issues. Public outreach to and education for downstream landowners, lake property owners, and recreationists can help to reduce overall erosion and sedimentation issues in the project boundary and downstream to Horseshoe Bend National Military Park. Such public outreach should include information about best management practices for forested riparian buffers and the importance of healthy riparian buffers for aquatic species habitat and water quality.

VI. MITIGATION MEASURE TO REDUCE HYDROPEAKING--BATTERY ENERGY STORAGE SYSTEM

During the study phase, ARA recommended a study of pairing a battery energy storage system (BESS) with the Harris Project as a mitigation and enhancement measure that could reduce the negative impacts of hydropeaking on downstream resources while unlocking operational flexibility, grid benefits, and potentially improving project economics for Licensee. FERC granted ARA's study request, but the resulting report produced by Licensee did not comprehensively analyze the costs of installation for the BESS or meaningfully assess the benefits of implementing such a mitigation measure.

We are disappointed to see FERC accept without scrutiny the cost projections and slim evaluation of environmental benefits submitted by Licensee. In a page and half, FERC staff summarily conclude in the DEIS that "[g]iven the high costs and limited benefits to aquatic habitat, battery storage would not provide benefits that justify the cost; therefore, we do not evaluate this measure in further detail."[62] Conservation Groups submit that both the cost projections and the environmental benefits detailed by Licensee were incomplete.

As ARA pointed out to Licensee and FERC in comments on the Preliminary Licensing Proposal in 2021, Licensee should not have only evaluated costs for lithium-ion BESS technologies and should have also evaluated costs of advanced chemistry BESS technologies, such as the iron-air battery produced by Form Energy. That particular battery chemistry and supplier is especially relevant in this licensing because Alabama Power's sister utility, Georgia Power (also a subsidiary of Southern Company), is currently installing a Form Energy iron-air battery projected to come online next year.[63] Iron-air batteries are "less than 1/10th the cost of lithium-ion battery technology" and can discharge across 100 hours.[64] Form Energy has at least 15 battery projects under development in the U.S., including a project in Maine sized at 85 MW/8,500 MWh (larger than either of the BESS systems studied for Harris).[65] The Form Energy multi-day storage system is

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[62] DEIS Appdx. E, "Alternatives Considered but Eliminated from Detailed Analysis," at E-3.
[63] *See* Form Energy's website at https://formenergy.com/form-energy-georgia-power-continue-forward-with-15-megawatt-iron-air-battery-system-agreement/
[64] *See* Form Energy's website at https://formenergy.com/technology/battery-technology/
[65] Peters, A., *In West Virginia, a former steel mill is now home to a cutting-edge battery plant* https://www.fastcompany.com/91215982/in-west-virginia-a-former-steel-mill-is-now-home-to-a-cutting-edge-battery-plant (Oct. 25, 2024).

now appearing in utility Integrated Resource Plan (IRP) modeling, and the company has released operational and cost assumptions.[66]

a. Costs for advanced chemistry BESS are far less than Licensee's assumed costs

Using the high end of an "all-in installed capital cost of $15-20/kWh"[67] from Form Energy, as opposed to the $298.5/kWh ($1,194/kW for a 4-hour battery) figure presented in Licensee's BESS study, would reduce estimated costs for a 60-MW/240-MWh battery from $96.6M to approximately $6.76M and costs for a 20-MW/80-MWh battery system from $41M to $2.87M. Even if FERC accepts Licensee's undocumented initial estimate of ~$20M to replace or modify one of the turbines to accommodate a wider range of flows, FERC should quantify and subtract from overall costs the amount of turbine damage reduction and reduced unit degradation that could result from addition of BESS since research from national labs reveal: "It is shown that compared to hydro-only case, the damage breakdown for hydro-hybrids is reduced by 31.63%, and the percent damage reduction will increase as the storage size increase…economic benefits from damage reduction can be as high as $9.5M when replacement cost is about $1–2 M per MW."[68] The economic benefits from equipment damage reduction over the license term could cover a large portion of the installation costs cited by Licensee and FERC. Additionally, the BESS would not have to be co-located with the Harris Project, which could significantly reduce the transmission costs cited by Licensee and enable more flexibility for siting, two objections FERC poses in the DEIS.[69]

Moreover, under a scenario where BESS is integrated with Harris, the CMF turbine and associated costs ($10M+) would no longer be needed as PME measures since hybridization with BESS and turbine modification could achieve greater river stability downstream by drastically reducing or altogether eliminating peaking flows and enable Licensee to pass flows that truly do mimic unregulated hydrologic conditions upstream, which would likely exceed the flow recommendations of ADCNR. Integrated BESS could enable wetted perimeter benefits equivalent to a 600-800 cfs minimum flow release and a daily average minimum flow of 701 cfs, "though it would range substantially higher and lower on a daily basis" (based on a theoretical hydrograph of over the course of the 2001 calendar year).[70] Measures to improve DO levels and water temperatures would still be needed in a BESS scenario.

Since FERC has dismissed BESS due to cost, not technical feasibility, we recommend that FERC include in the final EIS cost estimates for commercially available long-duration storage such as Form Energy's iron-air battery technology.

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[66] *See* https://formenergy.com/wp-content/uploads/2024/06/Form-Energy-Navigating-the-Pacific-Northwest-Energy-Challenges-06.26.2024-1.pdf and Appendix F from the Great River Energy 2023-2037 Integrated Resource Plan, Docket No. ET-2/RP-22-75.

[67] *See* https://formenergy.com/wp-content/uploads/2024/06/Form-Energy-Navigating-the-Pacific-Northwest-Energy-Challenges-06.26.2024-1.pdf, at 30.

[68] Durvasulu, *et al.*, *Rationale for adding batteries to hydropower plants and tradeoffs in hybrid system operation: A review*, Renewable and Sustainable Energy Reviews (2024), at 9, https://www.sciencedirect.com/science/article/pii/S136403212400399X?via%3Dihub

[69] DEIS Appdx. E, at E-3.

[70] *See* Final BESS Report, Accession No. 20211119-5039, at 20.

b. Benefits of implementing BESS to reduce hydropeaking would be much greater than acknowledged by Licensee and FERC

ARA originally proposed BESS as a measure to mitigate the Harris Project's peaking impacts on the aquatic ecosystem, though reduced peaking would also benefit downstream erosion and sedimentation, recreation, and public safety. In a 2024 paper published by researchers at Idaho National Laboratory and Argonne National Laboratory, experts in the area of pairing hydro with BESS write:

> Water flow and environmental assessment studies are an important part of hydropower plant re-licensing. The hydropower owner must consider all stakeholders that are directly or indirectly affected by the plant. This additional degree of flexibility [enabled by BESS] to schedule power market activity somewhat independently of the water releases has the potential to generate greater levels of market revenue and result in optimal aquatic ecology conditions. Such flexibility and studies on such flows can greatly benefit many hydropower owners who are going for their relicensing process.[71]

Decoupling water releases from energy generation and transmission, even partially, is a goal worth pursuing at hydropeaking projects like Harris where large peaking releases have severe consequences for aquatic resources, habitat, water quality, recreation, erosion, and public safety.

Conservation Groups are sensitive to obstacles FERC faces in recommending BESS as a PME measure over the objection of a licensee. As Alabama Power has pointed out, the FERC-licensed hydropower projects with integrated BESS have been hybridized with storage at the request of the hydropower owner/operator. We continue to seek a collaborative partner in Alabama Power to discuss this PME measure at the Harris Project and comprehensively explore the benefits to hydropower plants, the grid, ratepayers, as well as to our fragmented rivers and the species that depend on them.

At this stage, Conservation Groups recommend that FERC include in the Final EIS analysis of costs for advanced chemistry iron-air batteries, as well as a more independent assessment of the benefits BESS would likely have on downstream resources if peaking releases are reduced. Conservation Groups acknowledge that hybridization of hydropower facilities with BESS on this scale is bold thinking that requires partnerships to be successful, which is what hydropower-impacted rivers like the Tallapoosa deserve.

VII. CONCLUSION

While the DEIS contains many carefully considered and targeted PME measures to enhance water quality and improve recreation opportunities, additional measures should be included in the Final EIS to commensurately address Project impacts to aquatic species and habitat. These additional measures include, creating an adaptive management framework for iterative adjustment of project

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[71] Durvasulu, *et al.*, *Rationale for adding batteries to hydropower plants and tradeoffs in hybrid system operation: A review*, Renewable and Sustainable Energy Reviews (2024), at 10, https://www.sciencedirect.com/science/article/pii/S136403212400399X?via%3Dihub

operations (flow and temperature) based on what is learned through biological monitoring; a propagation program for stabilizing and reintroducing freshwater fish, mollusk, and crayfish species impacted by the Project; and remediation of ongoing erosion and sedimentation impacts exacerbated by Project operations. Conservation Groups appreciate the opportunity to comment on the DEIS and look forward to the issuance of the Final EIS. Any questions or concerns about this filing should be directed to Jack West at jwest@alabamarivers.org or by phone at (205)-322-6395.

Dated this 19th day of February, 2025.

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that I have caused the foregoing document to be served via the Federal Energy Regulatory Commission's electronic service system or by email upon each person designated on the official service list compiled by the Secretary for this proceeding this 19th day of February, 2025.

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ATTACHMENT A

[Report of Dr. William Pine]

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Ms. Debbie-Anne A. Reese, Secretary
Federal Energy Regulatory Commission
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My name is Dr. William Pine, and I am writing to support efforts to inform hydropower operations related to the relicensing of the RL Harris Dam. My relevant professional training includes a BS in Fisheries Management from Auburn University, an MS in Fisheries Science from the University of Florida, a PhD in Zoology from North Carolina State University. My professional experience includes nearly two decades as a faculty member at the University of Florida where I achieved the highest academic rank of Full Professor (Tenured, retiring from the University of Florida in May 2024) with research and teaching expertise related to rivers and coastal ecosystems and quantitative ecology. I have published almost 100 peer-reviewed publications, and this work has been supported by more than $22 million dollars in grants primarily from state and federal agencies. I have experience with large ecosystem experiments as part of formal adaptive management programs including more than twenty years of work supporting efforts of the Glen Canyon Dam Adaptive Management Program (GCD-AMP) in the lower Colorado River basin and using adaptive management practices to successfully restore oyster reefs in Suwannee Sound, Florida.

At the request of Alabama Rivers Alliance, I have reviewed the Draft Environmental Impact Statement for the RL Harris Hydroelectric Project Docket No. P-2628-066-Alabama. This report represents my recommendations on to how to reduce persistent uncertainties related to aquatic ecosystem response to RL Harris Dam operations, and how reducing these uncertainties could improve management decisions related to RL Harris Dam as part of the regulatory license renewal process.

As a summary of my report, I have five specific recommendations related to the operation of RL Harris Dam and the Alabama Power and FERC staff proposed actions:

(1) Integrate Adaptive Management Framework into the New License:
The new license should implement a detailed adaptive management program for learning how to improve operations of RL Harris Dam. This framework should explicitly outline:

- Management Objectives: Clear, stakeholder informed, ecological and operational goals, such as specific flow and temperature conditions (based on learning from Green Plan operations and experimental temperature manipulations) and detailed predictions on specific aquatic ecosystem responses to these changes in flow and temperature. Stakeholders should assess what operational conditions are required of the RL Harris project (reservoir and dam) to trigger conditions necessary to meet downstream aquatic ecosystem management objectives. If those conditions are not known, this uncertainty should be resolved through an active adaptive management program.
- Monitoring Protocols: Develop robust, statistically sound, monitoring and analytical plans that include measurable targets (e.g., persistence and colonization rates of specific fish and invertebrate species, abundance of key fish populations of management interest, fishery catch rates, temperature thresholds, flow stability). Use data from previous efforts to inform how likely

proposed monitoring programs are to provide data that are useful for informing decision making or evaluating actions.

- Decision Rules: Establish specific thresholds or triggers, based on monitoring data and analytical results, that dictate when and how operational changes will be made in response to observations from monitoring program. For example, if site occupancy for a specific fish species drops below a target level, and this change in occupancy is in response to flow or temperature factors, an adjustment in minimum flow or temperature management would be required.
- Iterative Learning: Ensure the framework allows for continuous evaluation and refinement of management actions based on observed outcomes, fostering long-term improvements in management of RL Harris Dam.

(2) Conduct Experimental Warm Water Releases:
Before committing to costly engineered solutions, stakeholders should implement experimental warm water releases to evaluate their potential ecological benefits. These experiments could be conducted during the 48-month period of construction of the new continuous minimum flow turbine proposed by Alabama and recommended by FERC staff. This would inform stakeholders whether the costs for the engineered solutions are warranted. In addition to the engineered solutions provided in the DEIS, a simpler strategy to evaluate could include:

- Lowering the reservoir level year-round to allow warmer epilimnetic or metalimnetic water to pass through the existing skimmer at 764 ft msl.
- Monitoring downstream temperature changes and their effects on specific components of the aquatic ecosystem during these experimental releases.
- Analyzing the results to determine whether warmer water led to changes in identified aquatic ecosystem components, and what specific temperature ranges are necessary for these changes to be observed.
- Comparing the effectiveness of this approach with predictions from existing models to validate or refine future management strategies.

(3) Define Specific Ecosystem Response Metrics:
Alabama Power, FERC, and stakeholders should collaborate to identify and prioritize response metrics that assess the success of flow and temperature modifications. These metrics could include:

- Fish Population Metrics: Abundance, biomass, persistence, colonization rates, and recruitment success for key species identified in state or federal management plans or identified by stakeholders. Use existing data to determine the statistical likelihood of detecting different possible responses such as a change in abundance or biomass of specific taxa by 25%.
- Macroinvertebrate Community Metrics: Diversity, abundance, and species composition of macroinvertebrates as indicators of ecological health. Aquatic insect communities may respond faster to flow and temperature modifications than fish communities because of their shorter life spans. This would reduce the lag time between an action (flow or temperature modification) and an observed response in an ecosystem constituent.
- Water Quality Metrics: Mean daily temperature, degree-day criteria, and dissolved oxygen levels in habitats important to the fish and macroinvertebrate communities identified above. These water quality metrics are generally simple to measure, but it is uncertain how fish or

invertebrate communities will respond to changes in water quality characteristics. This is why an experimental approach is needed.

- Decision thresholds should be developed, such as the degree of deviation from ambient temperature or a minimum level of fish recruitment, which would trigger operational changes.
- The reference condition must clearly be defined. Is the reference state for the aquatic ecosystem an unregulated reach of the Tallapoosa River, or is it the regulated reach under Green Plan operations?

(4) Design and Implement Flow and Temperature Experiments:
Conduct large-scale experiments to systematically evaluate the effects of different minimum flow levels (e.g., 300 cfs, 450 cfs, 600 cfs) once the continuous minimum flow system is operational. These flow experiments would ideally be across the widest possible range in flows and in systematic combination with varied temperature management strategies. Key components include:

- Designing experiments to test how changes in flow magnitude, timing, and frequency impact aquatic species with and without warming river water.
- Incorporating the learning from the Green Plan and results from experiments 2 and 4 (described above) to update predictions on how the aquatic ecosystem may change to different management actions from RL Harris Dam.
- Use experiments with high contrast in the factor of interest, such as a wide range of experimental flows, to refine models predicting aquatic responses to flow and temperature modifications. It will likely be difficult to detect differences in fish or aquatic invertebrate responses to small variations in flow, such as a difference in 300 and 350 cfs, unless the resulting difference in stage has a disproportionately large effect on temperature, primary production, or available habitat required for fish and aquatic invertebrates of interest.
- Ensure rigorous data collection and analyses to determine causal relationships between operational changes and ecological outcomes. Evaluate experimental design and analyses frameworks using simulated data prior to conducting the experimental flows to inform statistical power of proposed sampling programs.
- Work with USGS to fund water temperature and dissolved oxygen collections at the USGS Tallapoosa River Heflin gage 02412000. Use information from the Heflin gage as a reference to compare temperature and dissolved oxygen information for locations in the regulated reach (e.g., tailrace, Malone, and Wadley locations).

(5) Enhance Stakeholder Engagement and Collaboration:
Strengthen collaboration with stakeholders, including conservation groups, state and federal agencies, and local communities, by:

- Holding regular stakeholder meetings to share monitoring results, experimental findings, and proposed operational changes. Shorten the period between data collection, analyses, and availability of results to inform regulatory decision making and stakeholders by incorporating modern “living data” practices (Lowndes et al. 2017; Yenni et al. 2019).
- Incorporating stakeholder input into adaptive management decisions to align ecological, social, and economic priorities.

- Providing transparent reporting and decisions that demonstrate how experimental results are used to improve management practices and the costs of these actions. Adopt an open-science policy for historic and future data (Lowndes et al. 2017).
- Developing educational initiatives to increase public awareness and support for adaptive management measures, fostering a shared commitment to sustainable river management through learning. Make the licensing process and operations of RL Harris Dam an example for improving management for other regulated rivers in the southeast.

These recommendations aim to build on the lessons learned from the Green Plan while addressing key uncertainties in flow and temperature management. By adopting a science-driven and collaborative approach, Alabama Power, FERC, and stakeholders can achieve long-term ecological and operational benefits. This will both improve management of RL Harris Dam during the license period and serve as a tangible example of science-based, stakeholder informed, program for other hydropower operations throughout the United States.

Background

In the early 2000s, stakeholders in the Tallapoosa River basin recognized a need to modify the operations of RL Harris Dam to better meet stakeholder interests while also accommodating power generation objectives of the dam (Irwin and Freeman 2002; Freeman et al. 2019). The resulting iterative process developed a scientifically informed plan through a formal process involving stakeholders such as management agencies, Alabama Power, and advocates for different river interests including fishing and boating. The process emphasized four main steps: developing and agreeing on management objectives, modeling hypothesized relationships between dam operations and ecological outcomes, implementing operational changes, and evaluating ecological responses through a rigorous, externally reviewed monitoring program. The plan's flexibility allowed adjustments based on ongoing research and stakeholder feedback, thereby improving river management, and reducing uncertainties regarding future costs and ecological outcomes (Irwin and Freeman, 2002). This plan ultimately became known as the Green Plan, and was conceived as an adaptive management strategy (Walters 1986) in an attempt to balance hydropower generation with competing stakeholder interests such as the preservation of native fish and macroinvertebrate communities that had been adversely impacted by altered flow and thermal regimes due to dam operations (Travnichek and Maceina 1994; Freeman et al. 2001; Irwin and Freeman 2002; Lamb et al. 2023). Only a single flow option was tested under the Green Plan, one that was preferred by stakeholders and mimicked the inflows to RL Harris Reservoir as measured at an upstream, unregulated, location (Irwin 2019).

Information on the construction and operation of the RL Harris dam, how dam operations have altered the biological and physical attributes of the Tallapoosa River, Alabama, and the process that led to the development and implementation of an adaptive management program to inform dam operations called the Green Plan are covered elsewhere (Irwin and Freeman 2002; Williams and Brown 2012; Irwin 2019; DEIS Vol. 1 and 2).

My comments focus on FERC staff's proposed operations of the RL Harris Dam as outlined in the EIS documents (DEIS Vol. 2, Appendix I and J), which include replacing the current Green Plan with proposed operations involving the installation of a new minimum flow unit that will allow the implementation of seasonally adjusted between seasonal minimum flows, and a partial destratification system in Harris Lake to increase water temperatures downstream of RL Harris Dam (DEIS Vol. 2,

Appendix I). The proposed operational plan will focus on operating this minimum flow unit alongside peaking power production from the two existing main generating units. The introduction of the minimum flow unit is expected to increase base flow releases from the RL Harris Dam during non-generation periods, leading to a more stable downstream wetted area in the tailrace region, with minimal changes at other downstream locations. Under the proposed operations from FERC staff, Alabama Power would continue operating the two existing main generating units according to a proposed hydropeaking schedule (see FERC staff comment on DEIS Vol. 2), employ a skimmer weir in the on the reservoir side of the RL Harris Dam to capture water for generation from the highest possible elevation, and use a turbine aeration system to enhance dissolved oxygen levels in the tailrace during power generation. Seasonal water level management will continue to maintain Harris Lake at an elevation of 793 feet from May through September, followed by a gradual drawdown to 785 feet from October through November. The water level will remain steady through March before being restored to full pool in April (DEIS, Vol. 1, Section 2.2).

In the DEIS FERC staff acknowledge the potential role of adaptive management in evaluating the proposed action (DEIS, Vol 2., I-15, specifically in its aquatic resources monitoring efforts and flow management practices. The potential of adaptive management to improve management of RL Harris Dam is recognized by stakeholders, who emphasizes the importance of incorporating a flexible adaptive management mechanism to respond to inform flow management under changing environmental conditions (Section 3.3.2.2, Environmental Effects). Alabama Power and FERC's proposed plans, as outlined in section 3.3.2.2 (Environmental Effects, Minimum Instream Flow Releases) and Appendix I (P I-6), lacks a specific mechanism for modifying the minimum flows or water temperature (from FERC staff recommended partial destratification) in the proposed action based on monitoring results of aquatic resources that are designed to evaluate aquatic ecosystem response to the flow action. Clearly identified monitoring program objectives, including predictions of the expected response of target resources, monitoring plan, expected precision, decision triggers, and how this information will modify the minimum flow or other aspects of the operating license is missing. Together, these component parts make up one of the core elements of an adaptive management program (Walters 1986; Walters and Holling 1990).

These missing objectives are recognized by FERC staff and stakeholders (DEIS Volume 2, Appendix I). For example, within the discussion of a "Tallapoosa River Aquatic Resources Adaptive Management Plan" FERC staff (DEIS, Vol. 1, I-15) suggest incorporating degree-day criteria for selected fish species in consultation with Alabama DCNR, USFWS, and Alabama DEM, establishing monitoring programs to measure these degree days and specific fish species responses to different degree days, and developing routine reporting mechanisms to communicate the effectiveness of environmental measures. However, this plan is not linked to a decision structure that would describe how these results would be linked to changes in the Alabama Power proposed operating plan. Without these linkages and decision rules, the proposed plan is not an adaptive management program.

Degree days were used in analyses of fish communities in the Tallapoosa River during the Green Plan (Goar 2013; Irwin 2019). Irwin (2019) used degree days as a covariate to inform estimates of the probability of persistence and colonization from a site occupancy model in the Tallapoosa River during the Green Plan. While these parameters are informative in an occupancy context to better understand fish spawning patterns (Irwin 2019), it is not clear how stakeholders would use this type of information to evaluate the Alabama Power or FERC staff proposed action. Would the performance measure in a monitoring program be measurements of specific fish species persistence in space? Or will there be comparisons of how different sites are occupied by specific fish or macroinvertebrate species during Green Plan operations, and then after the implementation of the proposed operating plan? Or is the reference site for persistence in an upstream, reach that is not impacted by RL Harris Dam release such as near Heflin, Alabama? If these comparisons are made, what levels of change (positive or negative) in a parameter such as colonization (and the uncertainty around this estimated parameter) would trigger an action, and what would that action look like? These are the basic types of questions that would need to be included as part of an adaptive management plan to assess how aquatic resources of stakeholder interest respond to the new operating plan.

RL Harris stakeholders may be interested in other characteristics of fish populations including abundance and biomass of specific species, or fishery characteristics such as angler catch rate. As part of an adaptive management program, these fish population or fishery characteristics could be developed in cooperation with stakeholders and then used as response metrics to evaluate how the fish population or fishery responses to the Alabama Power proposed continuous minimum flow turbine system at 300 cfs or the FERC staff proposed 300 to 450 cfs seasonally adjusted minimum flow. Specific monitoring programs would need to be developed to track these response metrics to the action.

For example, the 300 cfs operating level for the continuous minimum flow turbine system was identified using predictions from the HEC-ResSim and related models (DEIS Vol. 1, Section 3.3.2.2) by considering ecological benefits, operational feasibility, and minimizing impacts of RL Harris Lake levels. Other alternatives such as 600 cfs and 800 cfs alternatives were also evaluated (DEIS Vol. 2, Appendix G) and predictions made for factors such as water temperature at different locations in the regulated reach under the proposed alternatives and operations under the Green Plan (Figure 3.3.2-29).

Within an active adaptive management program, experimental dam operations such as different minimum flows would be designed with stakeholder input to learn how dam operations can be modified to meet stakeholder objectives and operational needs of the dam. These experiments would be implemented at RL Harris Dam in different years to learn whether the changes in dam operations trigger the desired response in the aquatic ecosystem. Critically, predictions should be made for specific aspects of the aquatic ecosystem (e.g., abundance of a rare fish species, changes in numbers of specific flow sensitive aquatic insects) will respond to the experimental action, such as an increase or decrease in abundance or the number of sites occupied. The contrasts in the experimental actions should be as large as possible to create the strongest "treatment" effects. General goals of an experimental flow action such as "improve aquatic ecosystem health" are more difficult to quantify, and thus it is harder to evaluate whether the ecosystem responded as predicted to the flow experiment. Using multiple specific metrics that respond over different time scales, such as aquatic insects and fish, could be a useful approach, because insect populations are likely to respond more quickly in positive or negative ways to a flow experiment because of their shorter life space than most fish populations (see Bednark and Hart 2005 and Shea et al. 2014 for examples from TVA reservoirs).

Statistically sound monitoring efforts would then be used to understand how the biological factor of interest (abundance of rare fish in this example; Shea et al. 2014) changes in response to the flow treatment, and then the process is repeated for each experimental treatment until decisions are made as to which operation is best (Walters 1986; Loughin et al. 2021). It is important to note that this type of experiment does not focus on understanding the mechanisms of why specific fish or aquatic insect populations changed (i.e., changes in survival or reproductive physiology) but instead focuses on whether the experimental action led to the desired outcome, such as an increase in fish population abundance. Learning about the mechanisms leading to that response (or lack of a response) could be viewed as a secondary benefit of the flow experiments.

If only a single experimental policy, such as a single minimum flow release (i.e., 300 cfs only) is chosen, then it is not possible to learn if other flow releases would cause different (positive or negative) responses to different experimental flows. This type of experimentation and adaptive learning is critical to a successful active adaptive management program (Walters et al. 1988; Loughin et al. 2021). The Green Plan implemented at RL Harris Dam in 2005 did not deliberately contrast water releases but instead contrasted operations prior to 2005 with flow releases that matched the inflows to Harris Lake. Thus, while RL Harris Dam releases did vary over time under the Green Plan, this variation was based on inflows and not deliberate experiments (Irwin 2019). This lack of deliberate contrasts in flows combined with similar, cold, hypolimnetic water releases across observed flows, are likely reasons the fish communities did not respond as predicted to the Green Plan. A series of experiments combining contrasting flows and water temperatures would be more likely to resolve persistent uncertainties as to the roles of water flow and water temperatures in modifying aquatic resources downstream of RL Harris Dam and how to improve dam operations to meet stakeholder goals.

For example, in the Elk River, Tennessee, Tennessee Valley Authority (TVA) implemented different management actions as part of an adaptive management program (described as adaptive resource management [ARM]) to identify factors that influenced fish and mussel populations downstream of Tims Ford Dam, while also meeting other management objectives of the dam including flood protection, power production, and recreation (Bednarek and Hart 2005; Shea et al. 2014). Discussions between USFWS and TVA related to operational changes at the dam began in 1990, and an agreement to modify operations was signed in 2006 with the intent of warming downstream water temperatures and stabilizing streamflow to benefit existing populations of warmwater fish and mussels (Shea et al. 2014; Potoka et al. 2016). There were two specific, quantifiable goals of the operational changes at Tims Ford Dam, and both focused on the Endangered boulder darter *Etheostoma wapiti* (1) improve boulder darter survival, reproduction, and recruitment in the mainstem Elk River, (2) promote re-colonization of boulder darters in specific stream reaches where they were no longer found (Shea et al. 2014). Management actions implemented at Tims Ford Dam included periods when peaking hydropower operations were stopped and minimum flows implemented for boulder darter spawning and rearing and increasing dissolved oxygen levels with blowers and diffusers. Habitat associations and colonization of sixteen darter species, including the boulder darter, were assessed using multi-species occupancy models (Shea et al. 2014; Potoka et al. 2016) following the implementation of this plan. Results of the monitoring demonstrated boulder darters were more likely to colonize stream patches with warmer water, suggesting a positive response to management actions to increase water temperatures below Tims Ford Dam.

Broadly, these changes to Tims Ford Dam were part of changes in sixteen TVA dams in the 1990s as part of TVA's Reservoir Releases Improvement Plan (RRI; Bednarek and Hart 2005) which focused on reducing flow fluctuations and increasing DO levels downstream of major dams. Nine of these sixteen dams had long-term macroinvertebrate data available over a five-year period to assess changes in macroinvertebrates following the changes in dam operations. There was not a formal experimental design in the changes in dam operations, so it is not possible to separate effects of changes in flow fluctuations from DO levels in these data, but overall aquatic macroinvertebrate richness by family increased across all sampling stations at the nine hydroelectric dams following the implementation of the RRI operations, and the percent of macroinvertebrates considered tolerant to pollution decreased.

Desirable macroinvertebrate species (orders Ephemeroptera, Plecoptera, and Trichoptera) also increasing in response to the RRI operations at locations near the dams. The RRI project demonstrates measurable responses in an aquatic ecosystem constituent (macroinvertebrates) over a relatively short period (5-years) which may be a more suitable time for assessing ecosystem responses to experimental dam operations than the decades required to detect changes in population or community metrics of longer-lived fish species of management interest such as channel catfish or largemouth bass.

A distinction between an adaptive resource monitoring program (ARM) and an adaptive management program (AMP) is that under an ARM program (like the Elk River project) changes were made to the dam operations and then the downstream resources were monitored. This is also called a "passive" adaptive management program because it lacks the deliberate experimentation of different treatments, such as different experimental flow releases (active experiments), in which to compare ecosystem response. Regardless of whether a program is active or passive, the Elk River, TVA RRI, and Green Plans all represent successful examples of changing dam operations with the expectation to create warmer, and more stable downstream conditions to benefit native species. It is likely that one reason these projects were able to maintain their commitments to their adaptive process was because of a "champion" within the program that kept the process moving and the stakeholders engaged. The success of any program is dependent on the people who participate, and the project champion has been identified as particularly critical in helping programs stayed focused on the deliberate process of an adaptive management program (Walters 2007; Conroy and Peterson 2013).

Understanding the frame of reference to compare the proposed action

Within the DEIS, models are used to predict specific physical characteristics including water temperature of the Tallapoosa River downstream of RL Harris Dam under different proposed operations and the Green Plan at distinct locations (Figure 3.3.2-29). Predictions made by the Hec-ResSim and related model components by Alabama Power and FERC staff show that water temperatures under 300, 600, and 800-cfs continuous minimum flow are very similar to each other and overall are predicted to be less variable within a day, than what is predicted under the current operations from the Green Plan (i.e., Figure 3.3.2-29). Depending on the time of year, and even the day within the week simulated, predicted Green Plan temperatures are estimated to be higher or lower for several hours compared to the continuous minimum flow alternatives. But it is likely that on daily or weekly time steps the average predicted water temperatures for the three alternatives and the Green Plan operations are nearly the same and are probably within ±2°C based on visual assessments of predicted results in Figures 3.3.2-29 to 3.3.2-31. Predicted water temperatures under the different alternatives in this downstream reach are not compared to observed water data from the unregulated reach near Heflin. This is an important point because it presents the frame of reference for assessing changes in water temperature from the proposed action not to a location that is in an unregulated part of the Tallapoosa River, but instead the comparison is made to the current operations (Green Plan) within the regulated river, which is known to have an altered temperature regime already (Irwin 2019; DEIS, Vol. 1, Section 3.3.2.2, Environmental Effects). In this case, the frame of reference compares the predicted water temperature in the regulated reach under Green Plan operations to predicted water temperature in the regulated reach under the proposed action. This approach only compares how different operations (Green Plan or proposed action) may impact water temperature in the impacted reach downstream of RL Harris dam (which is dominated by hypolimnetic water from Harris Lake) and does not compare how the Green Plan or proposed action operations compared to Tallapoosa River water temperature in unregulated, ambient conditions.

I compared Tallapoosa River water temperatures in the regulated river reach downstream of RL Harris Dam and an unregulated upstream location (Tallapoosa River near Heflin, Alabama). I then used information from the Alabama DEM administrative guidelines (Alabama DEM Administrative Code 335-6-10) and Alabama DCNR comments within the DEIS 10(j) #12 which describe limiting temperature fluctuations to ± 2.7°C from ambient (unregulated river reach). I used the data from USGS Gage 0241200 (near Heflin, Alabama) as representative ambient conditions for the Tallapoosa River, and compared these temperature records to Tallapoosa River water temperatures in the regulated river reach (characterized by tailrace, Malone, and Wadley gages referred to in FSR_Aquatic_Resources, Appendix D for example). This assessment uses temperature data from the gages as a representation of average temperature for the entire wetted channel (same as model results in Figures 3.3.2-46 to 3.3.2-49). This analysis differs from analysis of temperature data by Auburn University described in the FSR_Aquatic_Resources, Appendix D, because those analyses focus on data from 2000-2019 from monitoring locations at the tailrace, Malone, and Wadley gages (FSR_Aquatic_Resources, Appendix D).

Water temperature data from the Heflin gage location are not affected by reservoir releases from RL Harris Dam. Mean daily water temperature data from Heflin gage were available from December 5, 2017, to November 24, 2020, and data were retrieved using program R and the waterData package. A total of 1084 observations were retrieved and 1058 of these observations were quality code "A" (approved for publication by USGS standards). I am aware that Auburn University deployed temperature loggers at Lee's Bridge (DeVries et al. 2021, page 6 within the FSR_Aquatic_Resources document, document page 105) but I was unable to locate those data within the online document library or find summaries of these data within the FSR_Aquatic_Resources document.

Water temperature data at hourly or fifteen-minute intervals were available for three downstream locations (tailrace, Malone, and Wadley) as a public data source ("Corrected Tallapoosa River Temp Data 2000-2018.xls"; FERC Accession Number 20210816-5246 https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20210816-5246&optimized=false). These data were combined into a single file using program R. No QA/QC standards were described with the available data. Basic QA/QC data summaries of data from the three downstream sites identified 16 hourly observations at Wadley of 103,202 observations in the data file that were possible data errors because they were ≥ 35C. Six observations were recorded at the tailrace of 110,340 observations that were ≥ 35C. Of the 94,576 observations recorded at Malone, none were ≥ 35C. These possible data errors represent about 0.007% of the available temperature data from the three downstream sites, so no data records were removed from the combined data file. Mean daily water temperature values were calculated for each downstream site to create comparable values to available Heflin data.

The water temperature from the one upstream site of RL Harris Lake (Heflin) and the three downstream sites (tailrace, Malone, Wadley) were merged into a single file for subsequent analyses. Water temperature data at each site have been collected from different periods of time (Figure 1) in 17 different years, but not all years have all months, and not all months have complete records of data for the three downstream sites. The available water temperature data across all four sites overlap during a period from 1 March – 31 October 2018 (Figure 2) and this period of overlap is also described in DEIS Vol. 2, Appendix G, Table 3.3.2-21. Compiled data and R code to summarize data and create figures are provided in an online repository (https://github.com/billpine/rlharris).

Figure 1. Approximate periods of publicly available water temperature data for each station on annual time steps. The data for Heflin was obtained from USGS gage 0241200 near Heflin, Alabama and the tailrace, Malone, and Wadley data were from a publicly available spreadsheet described in the text. Monthly data availability are described in Figure 2.

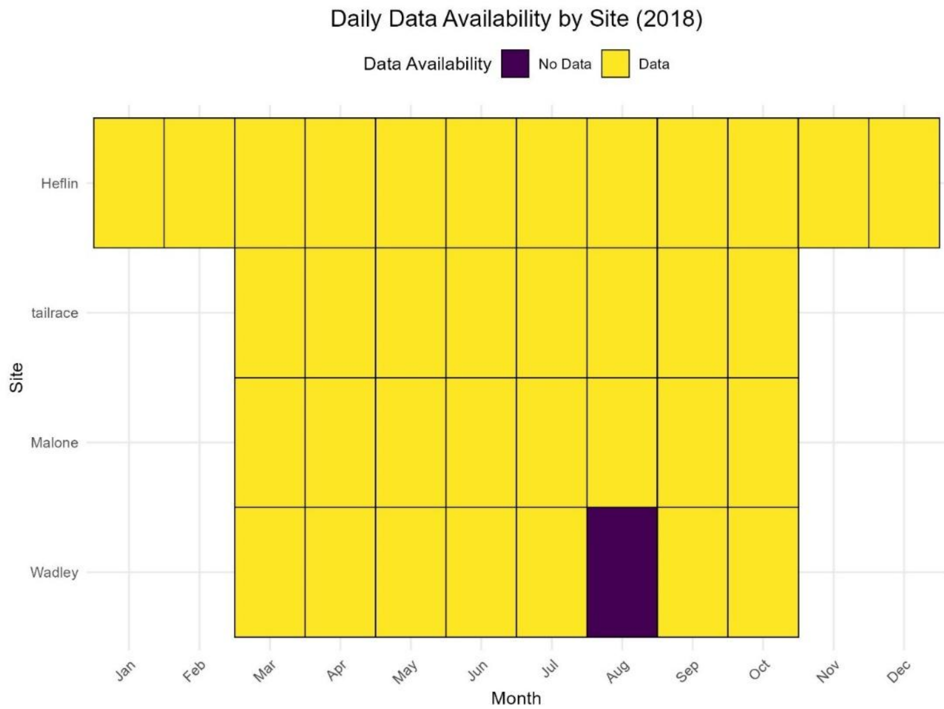

Figure 2. Availability of water quality data by month for each station. Yellow boxes are months when water quality was available, and a black box indicates the data were not available for that month.

I examined water temperature during this period of overlap to assess patterns in water temperature between the upstream Heflin gage (ambient, not modified by RL Harris Dam water releases) and the three downstream gages (tailrace, Malone, Wadley) that are impacted by RL Harris Dam water releases. A similar graph is included in DEIS Vol. 2, Appendix G, Figure 3.3.2-8.

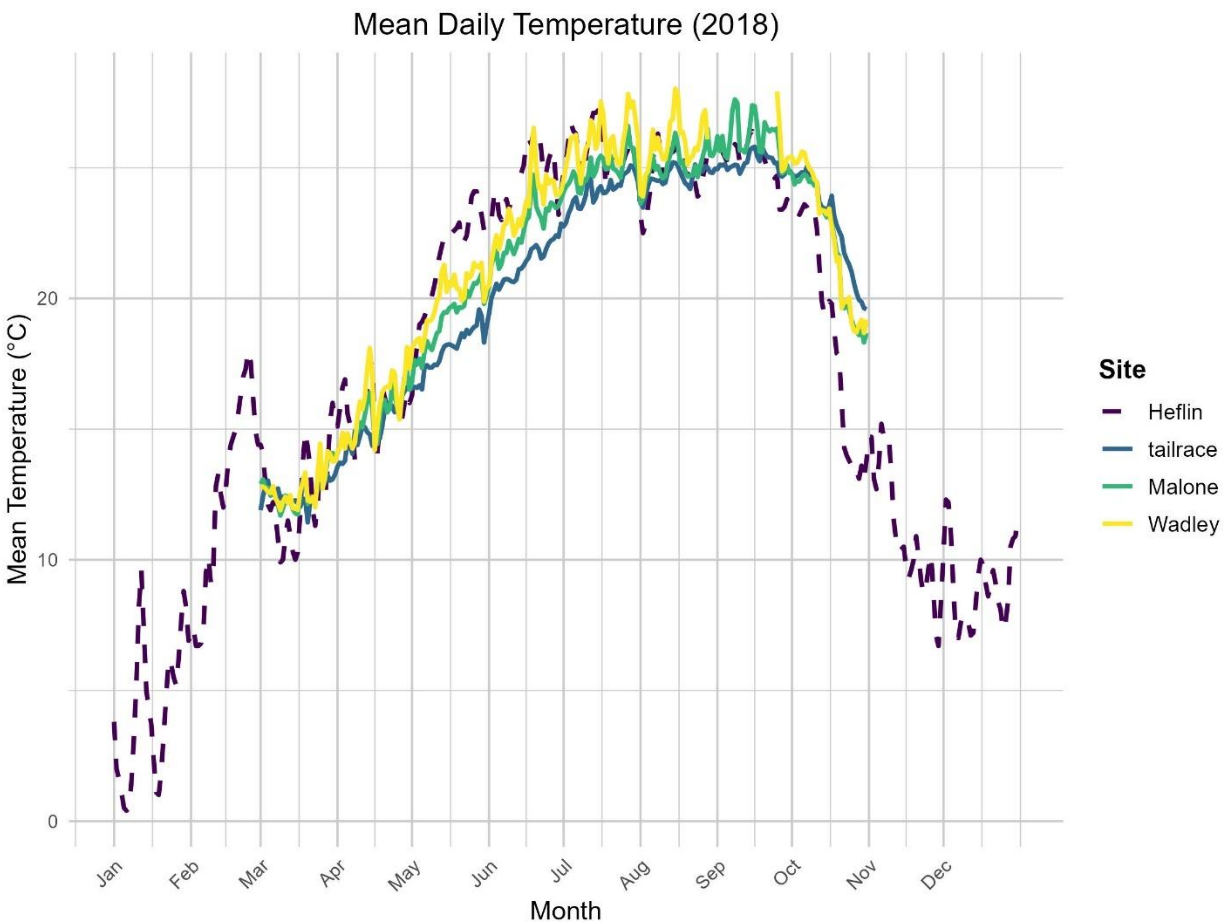

Figure 3. Mean daily water temperature for each of four stations (colored lines) for 2018. Data were available for the full year from Heflin gage, but only for a portion of the year from the other three gage sites. Data from the tailrace, Malone, and Wadley locations are plotted from 1 March – 31 October 2018.

The Heflin site demonstrates seasonal variation in temperature with the lowest temperatures in winter, warming during spring, highest temperatures in summer, and cooling temperatures in fall. During the months when data are available for all sites, a seasonal pattern also occurs at the downstream gages (tailrace, Malone, Wadley) with lowest temperatures in the available data in spring and highest temperatures in summer. Spatial patterns vary depending on the season with warmest temperatures during summer were generally found at the upstream site (Heflin) and the furthest downstream site from RL Harris Dam (Wadley). During summer water temperatures were coolest at the tailrace, and the tailrace also had warm fall temperatures, likely because of the hypolimnetic water releases from RL Harris Dam (Figure 3).

I then examined the difference in mean daily temperature between the upstream site not impacted by RL Harris dam releases (Heflin) and the three gages downstream of RL Harris Dam. I subtracted the mean daily temperature at each downstream gage (tailrace, Malone, or Wadley; from 1 March – 31 October 2018) from the mean daily temperature at Heflin for the same day and plotted the differences (Figure 4). In this graph, if there is no difference in mean daily temperature for a day between the downstream gage of interest and Heflin, then the y-axis value would be zero. Positive y-axis values indicate that the downstream gage is warmer than Heflin on a given day, and negative values indicate the downstream gage of interest is cooler than Heflin on a given day. Dashed horizontal reference lines are included at ±2.7 C (about 5F) as reference points for temperature change from the Heflin gage. This is because of reference points related to water temperature modifications in Alabama waters described in guidelines such as 335-6-10-.09iii Alabama DEM Administrative Code which state "The maximum in-stream temperature rise above ambient water temperature due to the addition of artificial heat by a discharger shall not exceed 5°F in streams, lakes, and reservoirs in non-coastal and non-estuarine areas" which informs comments from Alabama DCNR 10(j)#12 in the draft EIS as a recommendation that the R.L. Harris Project be operated to maintain a maximum water temperature of 90°F (32.2°C) and limit temperature fluctuations to ±5°F (2.7°C) from ambient conditions. Note that the Alabama DEM Administrative Code specifies 5°F rise above ambient temperature and Alabama DCNR 10(j)#12 (Appendix I, comment 12, page I-41) specifies ±5°F (2.7°C).

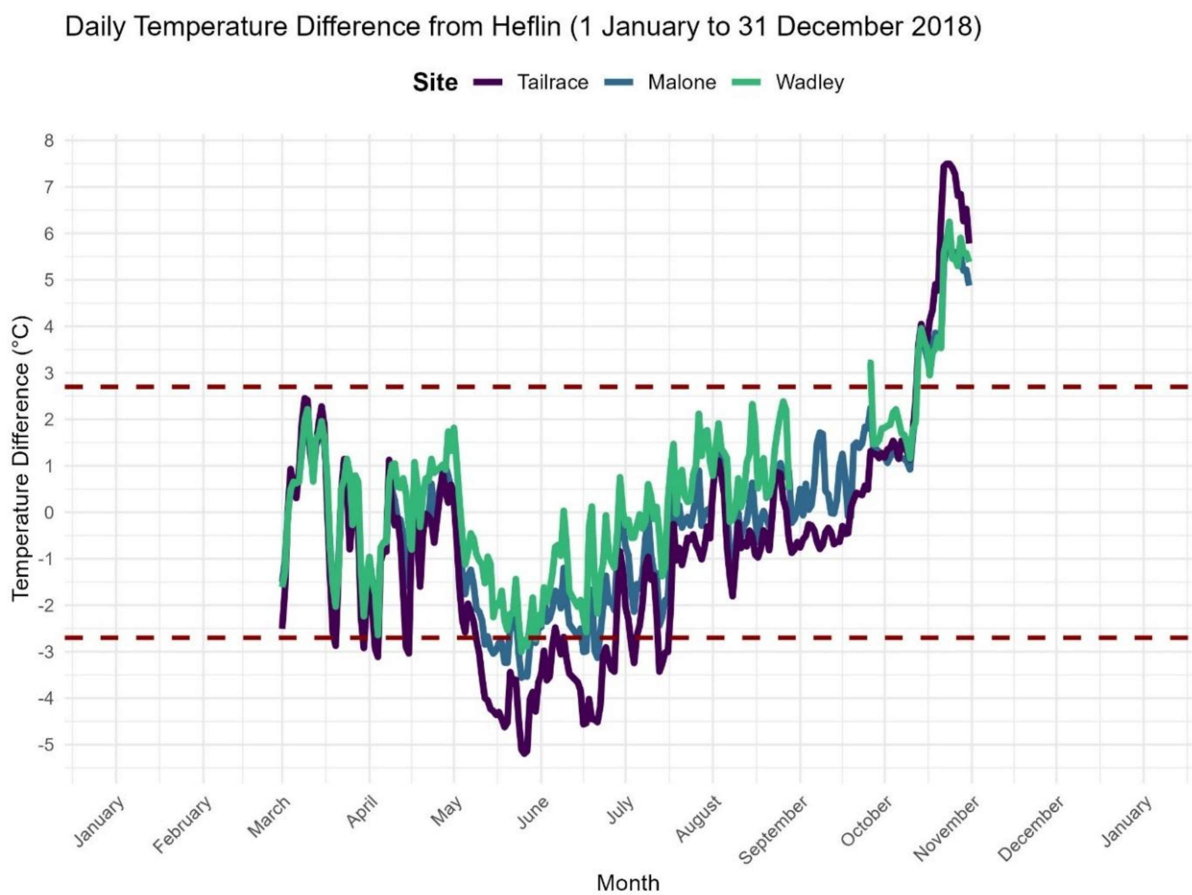

Figure 4. Difference in mean daily temperature, for days that common data are available among the Heflin, tailrace, Malone, and Wadley gage sites for the period 1 January to 31 December 2018. Values of zero represent no difference in mean daily temperature on that day (x-axis) between Heflin and the other gage site of interest (either tailrace, Malone, or Wadley). Positive values indicate that downstream gage is warmer than Heflin on a given day, and negative values indicate the downstream gage of interest is cooler than Heflin on a given day. The red dashed lines represent ± 2.7°C (5°F) as a level of difference of management interest based on Alabama DEM guidelines.

The general patterns in water temperature difference between the upstream site (Heflin) and the three downstream sites (Tailrace, Malone, Wadley) for the April-October 2018 period, show the largest water temperature differences were observed in summer and late fall between Heflin and the Tailrace (Figure 4). This is because the hypolimnetic releases from RL Harris Dam are cooler than Heflin water temperatures during summer, and warmer than Heflin during late fall. Water temperatures at all three downstream gages were warmer during fall than Heflin (Figure 4). Average daily water temperature differences of ± 2.7°C (5°F) were observed at the tailrace gage for five of the seven months, and three of the seven months at Malone and Wadley (Figure 4, Table 1).

Table 1. The number of days at each Site, in each Month when common data are available for all sites (April-October 2018), when mean daily water temperature difference between the Heflin gage and the three gage locations downstream of RL Harris (tailrace, Malone, Wadley) is ≥2.7°C.

Site	Month	Days water temperature difference ≥ 2.7 C to Heflin gage site
tailrace	Apr	4
Malone	Apr	0
Wadley	Apr	0
tailrace	May	23
Malone	May	14
Wadley	May	4
tailrace	Jun	23
Malone	Jun	4
Wadley	Jun	0
tailrace	Jul	6
Malone	Jul	0
Wadley	Jul	0
tailrace	Aug	0
Malone	Aug	0
Wadley	Aug	0
tailrace	Sep	0
Malone	Sep	0
Wadley	Sep	2
tailrace	Oct	19
Malone	Oct	19
Wadley	Oct	19

These results show that for the period of available data, mean daily water temperatures in the regulated river reach under Green Plan operations do change ±2.7°C C from unregulated site at all three downstream sites (Figure 4). The Alabama Power proposed alternatives (DEIS Vol. 1, Section 2.2) are predicted to result in water temperatures within the regulated reach that are similar to those observed in the Green Plan (See Figure 3.3.2-29 - Figure 3.3.3-31) thus, it is likely that the proposed alternatives will continue to deviate from the ambient conditions observed at the unregulated upstream site near Heflin (Figure 4, Table 1). FERC staff do propose the consideration of a partial destratification system, but it is not clear what the predicted temperatures would be across a range of operations and reservoir levels using a destratification system.

This is an important contrast to descriptions in EIS documents (i.e., DEIS Volume 1, 3-39) which compare predicted water temperatures under Alabama Power proposed operations (including proposed 300 cfs continuous minimum flow) as reducing daily temperature fluctuations relative to existing conditions (i.e., Green Plan) and not to ambient conditions in the unregulated reach. If, as demonstrated through the development of the Green Plan (Irwin 2019), a goal of the DEIS process is to identify RL Harris Dam operational plans such that environmental conditions in the regulated reach that are more similar to the non-regulated reach, then the evaluations of the alternatives should be made for the unregulated, instead of regulated reach as shown in Figures 3.3.2-29 to 3.3.2-31. This would follow recommendations of stakeholders including Alabama DCNR [10(j) no.2] that "…the project be designed to provide tailrace temperatures that mimic the natural water temperature of the system." (DEIS Vol. 2, I-13) as warmer water is anticipated by stakeholders to benefit native fish downstream of RL Harris Dam (Alabama River Alliance 10(a) no. 2.B and Alabama DCNR [10(j) no 2.). Whether this benefit would be realized is unknown, and a reason for conducting the appropriate experiment.

Addressing Persistent Uncertainties in the Role of Water Temperature and Aquatic Ecosystem Constituents

River water temperature downstream of RL Harris Dam is impacted by hypolimnetic water releases (FSR_Aquatic_Resources, Appendix D). Water temperature from the three downstream locations (tailrace, Malone, Wadley) have been analyzed extensively to assess changes in temperature following implementation of the Green Plan (Irwin et al. 2019; DEIS Vol. 2, Environmental Effects, F-7; Lamb et al. 2023) and different field and lab studies have assessed fish and invertebrate individual and population responses to water releases and water temperature levels (e.g., Early and Sammons 2018; Goar 2013; Irwin et al. 2019; Devries et al. 2021 [as in FSR_Aquatic_Resources]; Erickson et al. 2021). Despite extensive research and more than a decade of observations under the Green Plan operation of RL Harris dam, uncertainties persist as to the effects of dam operations on water temperature, flow characteristics, and individual and fish community characteristic in the regulated river reach downstream of RL Harris dam (DeVries et al. 2021 as in FSR_Aquatic_Resources].

Irwin (2019) identified that one potential reason the fish and macroinvertebrate communities in the regulated reach of the Tallapoosa River did not respond as predicted to the flow modifications implemented as part of the Green Plan as predicted (Irwin 2019), is because the Green Plan flow modifications failed to achieve the desired increases in water temperature in the impacted reach downstream to more closely match water temperatures observed at an unimpaired site near Heflin. Under the current Alabama Power proposed action and monitoring program, the predicted action is likely to result in water temperatures that, based on field observations from 12 years of annual monitoring under the Green Plan, may limit colonization and recruitment of some fish and macroinvertebrate fish species (Irwin 2019) and growth of young-of-year individuals (Goar 2013). Stakeholders should carefully consider the possibility that while the proposed action is likely to result in more stable flows, which could benefit native fish communities (Travnichek et al. 1995; Freeman et al. 2001) these stable flows are likely to be similar in water temperature to those observed during the Green Plan (measured as absolute values, degree days, or other metrics) which may impair native fish communities (Irwin 2019). So, while the Alabama Power proposed action may stabilize flows in the impacted reach downstream of RL Harris Dam, predicted water temperatures under the proposed action are likely similar to the Green Plan, potentially impairing native fish communities or changing characteristics of individual fish such as growth as observed under the Green Plan operations (Goar 2013; Irwin 2019).

Irwin (2019) present results of fish monitoring programs under the Green Plan that demonstrate under warmer thermal conditions an increased probability of fish colonization downstream of RL Harris Dam in some years, but the overall probability of persistence and colonization was negatively affected by river regulation for almost all fish species (Irwin and Freeman 2002; Irwin 2019). These results suggest that if the proposed action is likely to result in the same water temperature conditions as observed under the Green Plan, then the same outcome of poor thermal conditions and potentially negative effects on fish communities is likely to occur.

Recognizing the likelihood of this outcome and making changes to the proposed action before implementation would demonstrate a commitment by Alabama Power to practicing adaptive management by incorporating learning from the Green Plan, into the proposed alternative. This would be a true example of how systematic monitoring, stakeholder collaboration, and iterative adjustments, through an adaptive management can enhance environmental outcomes while ensuring compliance with regulatory and ecological requirements (DEIS, Vol. 1, Section 2.2; Vol. 2, Appendix D).

Using double-loop learning to inform RL Harris Dam operations

Single-loop learning and double-loop learning are foundational concepts in adaptive management. Single-loop learning focuses on incremental improvements in decision-making routines. Double-loop learning occurs when this iterative process (the single-loop) causes stakeholders and decision makers to reevaluate the framing of the problem, which may lead to changes in things like the actions being taken or monitoring program design (Paul-Wostl 2009; Pine et al. 2022). The Green Plan is an example of single-loop learning where changes were made to RL Harris Dam operations with the expected outcome to create physical (flow and water temperature) and biological (fish and aquatic invertebrate community) conditions that were more similar to the pre-dam conditions characterized by an unimpaired site near Heflin (Irwin and Freeman 2002; Irwin 2019).

Key outcomes from the Green Plan include improved understanding that fish and aquatic macroinvertebrate communities downstream of RL Harris Dam are likely impacted by changes in river discharge and water temperature that result from power production and RL Harris Dam operations (Irwin and Freeman 2002; Irwin 2019). The Green Plan successfully demonstrated the adaptive management process, and the implementation of an experimental flow policy from RL Harris Dam did change river discharge patterns downstream of the regulated from conditions observed prior to implementing the Green Plan flow actions. However, the biological community in this regulated river reach only partially changed as predicted to the Green Plan flow actions, likely because while flow fluctuations were reduced compared to pre-Green Plan conditions, and there were some fish and invertebrate responses as predicted (Irwin 2019), the expected temperature changes (to be more like an upstream unimpaired site) were not realized. This is because the different dam operations (pre- and post-Green Plan) were all dependent on hypolimnetic water releases, and these water temperatures are often below unimpaired ambient temperatures during summer critical periods for native fish recruitment and growth, and above ambient conditions during fall and possibly winter.

This does not mean that the single-loop learning of the Green Plan was a failure. The Green Plan was a success by implementing the process that led to changes in dam operations and experimentally learning how the Tallapoosa River, including fish and aquatic invertebrates, responded to these changes in dam operations. In the Green Plan case, because the temperature objectives in the downstream were not met, the Green Plan is primarily a test of a single variable – river discharge, and how changes in discharge magnitude, timing, and frequency may impact fish and aquatic macroinvertebrate communities.

Double loop learning in the next FERC license period

I recommend that the current FERC licensing process should build on the success of the single-loop learning demonstrated by the Green Plan and implement a double-loop learning framework for the next license period. Under a double-loop learning framework, stakeholders and decision makers would recognize the learning from the Green Plan and continue the adaptive management process by designing a new set of experiments that would include knowledge gained from the extensive learning that has taken place in this system (e.g., Freeman et al. 2001; Irwin 2019; DeVries et al. 2021 [as in FSR_Aquatic_Resources]; Lamb et al. 2023). This iterative process would build on the learning of the Green Plan related to reducing flow fluctuations through the implementation of the Alabama Power or FERC staff proposed minimum releases from RL Harris through the installation of a new minimum flow unit, but would also formally recognize the observations from the Green Plan, and Alabama Power's HEC-RES results which show the Alabama Power proposed action will not have the desired river water temperature outcome in the regulated reach. Empirical observations and model predictions suggest that any operational plan that depends on cold-water hypolimnetic releases is likely to have similar downstream river temperatures as observed in the Green Plan. While the Alabama Power and FERC staff proposed actions will reduce daily flow fluctuations beyond what was observed in the Green Plan, without concurrent warming of the river, the stakeholder objectives of restored and maintained fish and macroinvertebrate communities are not likely to be achieved.

In a double-loop context, recognizing the limitations of not understanding the role of water temperature on aquatic resources downstream of RL Harris Dam as part of the licensing process would capture the learning related to flow fluctuations from the first learning loop (the Green Plan) and then as part of the second learning loop resolve uncertainties related to water temperature. This type of experimental action, coupled with rigorous monitoring and evaluation of specific fish and aquatic macroinvertebrate community and/or population response metrics, is a central aspect of adaptive management (Walters 1986).

Other approaches to inform how the aquatic ecosystem may respond to proposed actions, such as additional modeling efforts or indirect field assessments using spatial or temporal replacements for the imperiled reach, are likely to be hampered by the same types of "mesoscale" uncertainties that are extremely difficult to resolve (i.e., juvenile fish survival rates in response to changes in flow operations) and encouraged the development of adaptive management in the first place. For example, detailed bioenergetics modeling and field work of DeVries et al. (2019) was hampered by unresolved information on temperature requirement information for the target species, even for widely studied species such as Channel Catfish *Ictalurus punctatus* and field monitoring efforts to assess fish community and individual responses to RL Harris Dam operations have been limited by challenges in monitoring program design. It is unlikely that the type of fine scale information required to fully model fish population responses to changes in river discharge such as how fish recruitment patterns change in response to available habitat under different river flow regimes can ever be fully understood (Pine et al. 2017). This is in fact one of the strongest arguments for large-scale experiments in aquatic ecosystems as part of an adaptive management program (Walters 1986; Walters and Holling 1990; Carpenter 1996).

Adding warm water effects on aquatic ecosystems in the second loop of learning

Withdrawal of warmer water from RL Harris Lake and passing this water to the Tallapoosa River downstream of the dam to create warmer-water conditions is discussed in DEIS, vol. 1, Section 3.3.2.2 (3-28) and in the document "08-29-2022 FERC Additional Information Request" which contains a response letter from Alabama Power to FERC, related to options for "a theoretical high level intake and analyses for seven additional operating scenarios for such intake." This intake or similar features would create the ability to manage water quality and water temperature at RL Harris Dam differently than the existing facilities, through creation or modification of structures to allow passage of water from different reservoir elevations, which are different temperatures, downstream. Alabama Power presents a variety of scenarios including different types of intakes, pumps, and siphons and describes how these could or could not be implemented as an alternate or additional pathway for water to pass RL Harris Dam in these documents. In the DEIS vol. 2, Appendix I, FERC staff conclude that a partial destratification to provide warmer releases downstream of RL Harris Dam when the lake stratifies would provide "the most appropriate balance among water quality protection, fishery habitat enhancement, and project cost." In total more than a dozen options are presented by Alabama Power and FERC staff as engineered solutions to increase downstream temperatures. In general, these approaches are evaluated under the assumption that downstream warming is a necessary condition, as FERC staff describe under the proposed Alabama Power actions, "…water temperatures would still frequently remain cooler than natural conditions and DO may not meet the water quality standards set to protect aquatic life." DEIS, vol. 1, Section 3.3.2.2 (3-33).

There are at least three key points that are not clear related to downstream temperature management that should be addressed (1) What are the specific predictions for the downstream aquatic community in response to warming water? (2) Are these predictions likely to happen if the water is warmed, and how do we know this? (3) How warm does the water need to be to trigger the expected response? Answering these basic questions is important because it is possible that if any of the proposed water warming actions are undertaken, including the FERC staff preferred alternative of a partial destratification system (DEIS, Vol. 2, I-13), that the downstream aquatic ecosystem will not respond as anticipated. This is one of the key lessons from implementing the Green Plan – the system may not respond as expected.

A key challenge with "engineered" solutions to resource problems is that the engineers must be given specifications in which to design and build the solution to the problem. For example, if it were known exactly what water temperature requirements were needed downstream of RL Harris Dam in which to achieve the stakeholder goals for the aquatic ecosystem, then engineering work could be done to determine how to achieve those desired conditions, and the costs and benefits evaluated. However, those water temperature requirements are not known, nor is it even known if any temperature modification would have the desired aquatic ecosystem response, or even what this expected response would be.

Incorporating double-loop learning into the management of RL Harris Dam would likely allow for the development of a more effective operational plan for the new FERC license. For example, rather than solely focusing on reducing effects of flow fluctuations, double-loop learning would prioritize addressing the long-standing uncertainty of how both flow and temperature modifications may lead to changes in the current downstream aquatic ecosystem by integrating adaptive experiments to test new flow and temperature management strategies. Critically, if these experiments could be conducted using existing RL Harris Dam infrastructure, such as continuing Green Plan flow operations while modifying downstream temperatures through low reservoir levels, through different experiments (such as releasing different downstream water temperatures) this could provide the critical information including (1) what are the specific anticipated aquatic ecosystem responses to temperature modification given existing (and future) flow fluctuations, (2) what is the ecosystem response to sustained downstream river warming (as compared to warming between hydropeaking events), (3) if the aquatic ecosystem does respond to warming, what is the level of warming needed for this response (determined experimentally) all of which would be needed to determine whether a temperature modifying structure is needed, and if so, what the operational goals of this structure need to be.

Instead of an engineering approach to create the river warming infrastructure to conduct the experiment, I propose an alternative warming scenario be evaluated such as experimentally holding the reservoir at lower elevations year-round to allow for epilimnetic or metalimnetic water to enter the existing skimmer at the 764 ft msl elevation. Under the current rule curve, RL Harris Lake already fluctuates between 785 (winter) and 793 ft msl (summer). Potentially, if the lake surface elevation were held at a lower level, this would allow for warmer water releases while not requiring any structural modifications to the dam or changes in the current Green Plan operations. This target lake level could be determined for average summer conditions that create the temperature stratification using existing data and methodologies used for evaluating other alternatives in the DEIS such as higher winter pool (DEIS, Vol. 2, Appendix E).

Within an adaptive management framework, this warming of the release temperatures through lower reservoir levels would be integrated into the existing Green Plan operations, allowing for testing of both reduced flow fluctuations and warming temperatures on downstream aquatic resources experimentally before incurring the costs of further engineered solutions that would de-stratify the forebay or structurally modify the dam. If evaluations using existing modeling frameworks suggest this action could work, then stakeholder discussions would have to be conducted to assess whether the short-term costs during the experiment are less than resolving the persistent uncertainty related to temperature or the cost of building temperature modification structures which may or may not be needed. The full costs and benefits of this type of experiment using lower reservoir levels could then be compared to the benefit in better understanding how the downstream ecosystem would respond to warmer water and better inform the costs and benefits of engineered solutions to downstream warming, if such action were warranted to meet the desired future conditions of the downstream reach. Furthermore, double-loop learning emphasizes continuous stakeholder engagement and iterative policy adjustments. Engaging local communities, conservation organizations, and hydropower operators ensures that management decisions reflect diverse ecological and social priorities, fostering collaboration and shared responsibility. This type of engagement was critical to the successful development of the Green Plan adaptive management program (Irwin 2019).

Conclusions

The relicensing of the RL Harris Dam represents a critical opportunity to advance sustainable river management through an enhanced adaptive management framework. Building on the successes and lessons of the Green Plan, the next phase of management must address persistent uncertainties related to aquatic ecosystem responses to flow and temperature modifications. Implementing a double-loop learning approach will allow stakeholders to integrate existing knowledge, refine management objectives, and experiment with innovative strategies, such as warm water releases and varying flow regimes, to improve management. Collaborative engagement with stakeholders in this process is critical to fostering trust and long-term commitment to the adaptive management process. By embracing a science-driven, flexible approach, the RL Harris Project can serve as a model for balancing hydropower production with ecological integrity and the flexibility to adapt to the challenges that the RL Harris Project, and stakeholders, will face over the next license period.

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