DOWNSTREAM RELEASE ALTERNATIVES

PHASE 2 REPORT

R.L. HARRIS HYDROELECTRIC PROJECT

FERC NO. 2628

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June 2022

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1.0 INTRODUCTION

Alabama Power Company (Alabama Power) owns and operates the R.L. Harris Hydroelectric Project (Harris Project), licensed by the Federal Energy Regulatory Commission (FERC or Commission) (FERC Project No. 2628). The Harris Project consists of a dam, spillway, powerhouse, and those lands and waters necessary for the operation of the hydroelectric project and enhancement and protection of environmental resources.

Alabama Power began operating the Harris Project in 1983. Initially, the Harris Project operated in peaking mode with no intermittent flows between peaks. Agencies and non-governmental organizations requested that Alabama Power modify operations to potentially enhance downstream aquatic habitat. In 2005, based on recommendations developed in cooperation with stakeholders, Alabama Power implemented a pulsing scheme for releases from Harris Dam known as the Green Plan (Kleinschmidt 2018c). The purpose of the Green Plan was to reduce the effects of peaking operations on the aquatic community downstream. Although Green Plan operations are not required by the existing license, Alabama Power has operated Harris Dam according to the Green Plan criteria since 2005. A copy of the Green Plan Release Criteria is provided in Appendix B.

1.1 Study Background

Alabama Power is using the Integrated Licensing Process (ILP) to obtain a new license for the Harris Project from FERC. During stakeholder one-on-one meetings and at an October 19, 2017 Issue Identification Workshop, stakeholders requested that Alabama Power evaluate Green Plan releases compared to the pre-Green Plan peaking flows. Stakeholders also commented that alternative downstream release scenarios should be evaluated as part of the relicensing process. On November 13, 2018, Alabama Power filed ten proposed study plans for the Harris Project, including a study plan for downstream release alternatives. FERC issued a Study Plan Determination on April 12, 2019, which included FERC staff recommendations. Alabama Power incorporated FERC's recommendations and filed the Final Study Plans with FERC on May 13, 2019.

In the Study Plan, evaluation of the alternatives was divided into two "phases". Consistent with the Study Plan, Alabama Power filed the Downstream Release Alternatives Phase 1

Report (Phase 1 Report) in July 2020[1]. The Phase 1 Report described the hydrologic and hydraulic models (HEC-ResSim and HEC-RAS) developed for evaluating the alternatives and presented the results of the potential effects of pre- and post-implementation of the Green Plan operations and a continuous minimum flow of 150 cubic feet per second (cfs) (which is roughly the equivalent daily volume of three ten-minute pulses) on existing operational parameters. As indicated in the Phase 1 Report, this Phase 2 Report also evaluates the additional alternatives in Table 1-1.[2]

It should be noted that FERC also required an evaluation of a variation of the existing Green Plan where the daily volume of Harris Dam releases are 100% of the prior day's flow at the USGS Heflin stream gauge. As explained in a Harris Action Team (HAT) 3 meeting on November 5, 2020, Alabama Power already releases approximately 100% of the prior day's flow at the USGS Heflin stream gauge under the Green Plan. The Green Plan criteria states that Harris Dam release at least 75% of the prior day's flow at Heflin; translating that minimum requirement into the 10, 15, and 30 minute pulsing operations results in releases well above 75% of the prior day's Heflin flow (Figure 1-1). Therefore, there was no need to further evaluate this alternative because there is no discernible difference between these two alternatives.

Alabama Power filed the Final Downstream Release Alternatives Phase 2 Report on November 19, 2021[3] concurrent with the Final License Application (FLA). On February 15, 2022[4], FERC issued an Additional Information Request (AIR) requiring Alabama Power to analyze continuous minimum flows of 350 cfs, 400 cfs, and 450 cfs and provide potential effects of the three additional minimum flows on downstream resources (e.g., erosion and sedimentation, water use, water quality, aquatic habitat, terrestrial and botanical resources, recreation, and cultural). Therefore, Alabama Power has revised this report to

[1] Accession No. 20200727-5088

[2] Shortly after Alabama Power finalized the Phase 1 Report, FERC required Alabama Power to evaluate additional downstream release alternatives. In addition, FERC required that Alabama Power analyze three additional alternatives of 350 cfs, 400, cfs, and 450 cfs in a February 15, 2022 additional information request. Because of the timing, the effect of the additional alternatives on existing operational parameters, including reservoir levels, hydropower generation, flood control, navigation, and drought operations are included in this report.

[3] Accession No. 20211119-5041

[4] Accession No. 20220215-3039

include a complete evaluation of downstream resources as a result of the three additional minimum flows.

TABLE 1-1 DOWNSTREAM RELEASE ALTERNATIVES AND ABBREVIATIONS

Name/Description	Abbreviation
Green Plan (baseline or existing condition) – pulsing flows as described in the Green Plan release criteria	GP
Pre-Green Plan (peaking only; no pulsing or continuous minimum flow)	PreGP or PGP
Modified Green Plan[1]	ModGP
150 cfs continuous minimum flow (CMF)	150CMF
300 cfs continuous minimum flow	300CMF
350 cfs continuous minimum flow	350CMF
400 cfs continuous minimum flow	400CMF
450 cfs continuous minimum flow	450CMF
600 cfs continuous minimum flow	600CMF
800 cfs continuous minimum flow	800CMF
A hybrid Green Plan that incorporates both a base minimum flow of 150 cfs and the pulsing described in the existing Green Plan release criteria	150CMF+GP
A hybrid Green Plan that incorporates both a base minimum flow of 300 cfs and the pulsing described in the existing Green Plan release criteria	300CMF+GP
A hybrid Green Plan that incorporates both a base minimum flow of 600 cfs and the pulsing described in the existing Green Plan release criteria	600CMF+GP
A hybrid Green Plan that incorporates both a base minimum flow of 800 cfs and the pulsing described in the existing Green Plan release criteria	800CMF+GP

[1] The Modified Green Plan has been defined as moving the pulses associated with Green Plan to 2 AM, 10 AM, and 6 PM.

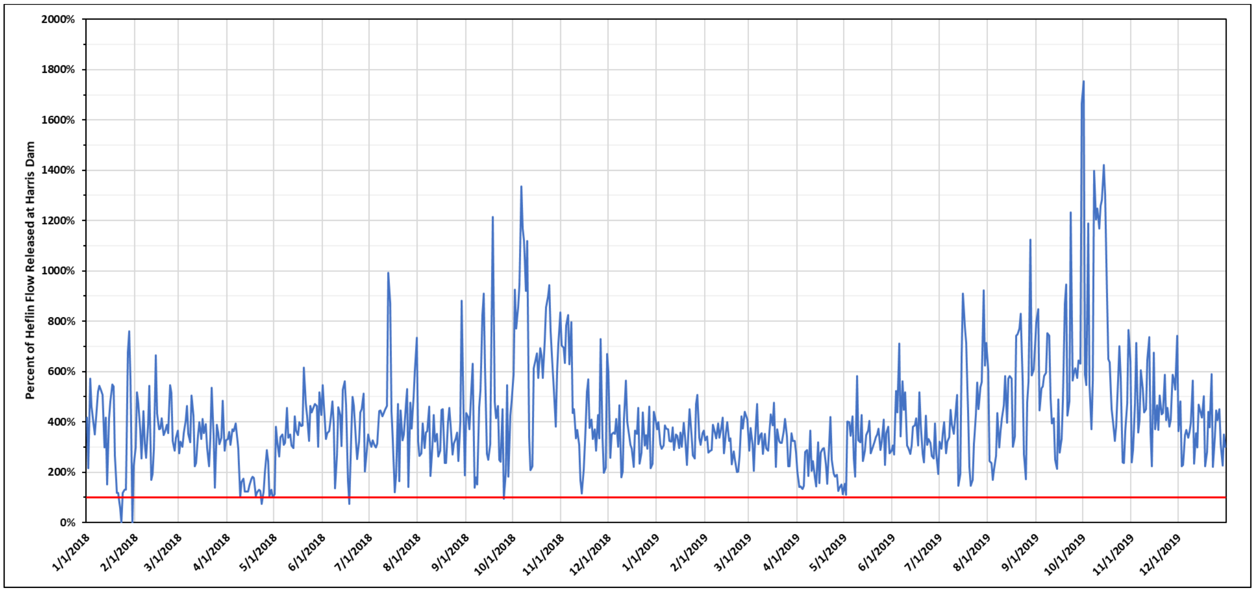

FIGURE 1–1 RELEASES FROM HARRIS DAM IN 2018 AND 2019 COMPARED TO 100% FLOW AT THE USGS HEFLIN GAGE

Note: Alabama Power suspended releases on two days in January 2018 to facilitate collecting LIDAR data around the Tallapoosa River below Harris Dam.

The purpose of this report is to present the Phase 2 analyses, consistent with the Study Plan and FERC's February 15, 2022 AIR. The Phase 2 analyses use the modeling results from Phase 1 along with FERC-approved relicensing study results and existing information to conduct quantitative and qualitative evaluations of potential resource impacts. These resources and a summary of the methods used to analyze impacts are presented in Table 1-2.

Section 2.0 of this report provides a brief overview of the models developed and described in the Phase 1 Report. Section 3.0 presents the methods and results of analysis for each resource area. Section 4.0 provides a summary of all results, including those from the Phase 1 Report.

TABLE 1-2 PHASE 2 RESOURCE IMPACTS ANALYSIS METHODS

RESOURCE	METHOD
Operational Parameters	• HEC-ResSim model • HydroBudget
Water Quality	• HEC-RAS model • Existing information – Water Quality Baseline Report • Results from the FERC-approved Water Quality Study • Qualitatively evaluate potential effects on dissolved oxygen in the tailrace
Water Use	• HEC-RAS model • Existing information - Water Quantity, Water Use, and Discharges Report
Erosion	• HEC-RAS model • FERC-approved Erosion and Sedimentation Study (erosion portion only) • LIDAR, aerial imagery
Aquatic Resources	• HEC-RAS model • HEC-RAS to evaluate effects on wetted habitat • HEC-RAS to evaluate effects on water temperature in the Tallapoosa River below Harris Dam • FERC-approved Downstream Aquatic Habitat Study • FERC-approved Aquatic Resources Study
Wildlife and Terrestrial Resources - including Threatened, and Endangered Species	• HEC-RAS model • FERC-approved Threatened and Endangered Species Study
Recreation Resources	• HEC-RAS model • FERC-approved Recreation Evaluation Study • Existing information on boatable flows
Cultural Resources	• HEC-RAS model • LIDAR, aerial imagery, and expert opinions

2.0 HYDROLOGIC MODEL SUMMARY

The following data and models were used to conduct the downstream release alternatives analysis. More details are contained in the Phase 1 Report. In addition, the models, assumptions, and their ability to address the study questions were presented to HAT 1 on September 20, 2018 and September 11, 2019. In addition, details of the models were discussed in a January 22, 2022 technical conference.[5]

DATA

1. Alabama-Coosa-Tallapoosa (ACT) unimpaired flow database – this database was developed by the USACE with input and data from other stakeholders in the ACT comprehensive study, including both the states of Georgia and Alabama, Alabama Power, and others. The unimpaired flow data set that served as a basis for the 2010 critical yield analysis for the ACT Basin included data for the period from 1939 through 2008. Subsequently, the unimpaired flow dataset has been extended through 2011[6]. This dataset includes average daily flows from 1939 – 2011 with regulation influences removed.

2. Other data – Other data sources include daily and hourly USGS, USACE, and Alabama Power records.

MODELS

1. HEC-River Analysis System (HEC-RAS) – This model was used to route flows in the unsteady state[7] along the river. This model was used to assess effects of alternative release scenarios on boatable days, wetted perimeter, and temperature. Data was output from the model at 1-hour intervals. During Phase 2, model inputs also included data from other ongoing studies.

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[5] Accession No. 20220105-3053

[6] Although when developing the study plan Alabama Power anticipated the dataset to include the years 1939-2016, the unimpaired dataset provided by the USACE includes 1939-2011.

[7] In hydraulic modeling, simulations run in the unsteady state consider the variance of flow with respect to time.

2. HEC-ResSim – This model was used, on a daily timestep, to evaluate the ability of Alabama Power to maintain the operating curve at the Harris Reservoir under the various downstream release alternatives. In Phase 2, this model looked at operational changes at the Harris Project in conjunction with operating curve changes on an hourly timestep. It focused on the hourly flood study operations. This model, in conjunction with the HEC-RAS model, also shows impacts to Martin Dam Project operations.

3. HEC-Data Storage System and Viewer (HEC-DSSVue) – This is the USACE's Data Storage System, which is designed to efficiently store and retrieve scientific data that is typically sequential. Data in HEC-DSS database files can be graphed, tabulated, edited, and manipulated with HEC-DSSVue. This program was used to display some of the output of the other HEC models.

4. Alabama Power Hydro Energy (HydroBudget) Model – This model is a proprietary daily model that is used to evaluate the net economic gains or losses that could result from downstream flow alternatives at the Harris Project.

Model Flow Data

As indicated in the Phase 1 Report, 2001 was selected as a "normal" water year as inflows to the Harris Project were closest to the median, and hourly flow data was available for that year. Since 2001 pre-dated Green Plan implementation, hourly discharge records for Harris Dam were used to model the PreGP alternative. The GP alternative was created by applying existing Green Plan rules to the Pre-Green Plan releases. The CMF alternatives were created by amending the Pre-Green Plan alternative such that no hourly interval had a discharge less than the specified CMF. The CMF+GP alternatives were created by taking the CMF alternative and applying the Green Plan rules to the specified CMF. Appendix C contains monthly hydrographs from each of the four seasons of the year, showing the general differences between outflows from Harris Dam.

3.0 EFFECTS OF DOWNSTREAM RELEASE ALTERNATIVES ON RESOURCES

3.1 Operational Parameters

The downstream release alternatives outlined in Section 1.0 were analyzed to determine their effects on reservoir elevations, hydropower generation, flood control, navigation, drought operations, and the effect on the conditional fall extension at the Martin Dam Project.

3.1.1 Methods

The HEC-ResSim and HydroBudget models developed for the Phase 1 Report were used to analyze the downstream release alternatives. Details on these models are available in that report. Additional assumptions applicable to all alternatives for the HEC-ResSim model include:

- A rule for peaking operations is included in all simulations.[8]
- The minimum elevation for Harris Reservoir is 770.5 feet msl. No operations occur below this elevation. This is the limit for the reservoir that was established in the 2007 drought to reserve 12 hours of generation in the pool for transmission needs.

The various alternatives were further defined in the HEC-ResSim model as below:

- Pre-Green Plan: The release criteria from the Green Plan contained in the model were removed.
- Continuous Minimum Flows: A new continuous release rule replaces the current Green Plan release rule. The releases were reduced to 85 cfs when the flows at the Heflin gage drop below 50 cfs. This is the drought cutback in the current Green Plan.

[8] Peaking operations is generation that is scheduled to meet peak energy demand on a given day; pulsing operations is generation that is scheduled to meet the Green Plan release criteria. Both peaking and pulsing operations in all alternatives are made with the existing turbines.

- Continuous Minimum Flows + Green Plan: A new continuous release rule is added with the current Green Plan release rule. Both rules reduce their releases to 85 cfs when the flows at the Heflin gage drop below 50 cfs. This is the drought cutback in the current Green Plan.

For the HydroBudget model, all alternatives used inflow data from 1940 through 2019, using system lambdas from 2019.[9] As with the HEC-ResSim model, a drought cutback of 85 cfs was used, and the minimum elevation for Harris Reservoir is 770.5 feet msl. For the HydroBudget model, the continuous minimum flow releases were released by a hydroelectric unit. Structural constraints create size limitations associated with putting an additional "house" unit at Harris Dam. Therefore, a theoretical unit that pulls water from the existing penstock and is capable of discharging 300 cfs and providing 2.65 megawatts (MW) at efficient gate was evaluated. Then, based on efficiency curves for existing units in Alabama Power's hydroelectric fleet, the theoretical unit was scaled up or down to provide the required flow at efficient gate. This resulted in a unit that would provide 1.25 MW at 150 cfs, 3.08 MW at 350 cfs, 3.54 MW at 400 cfs, 3.98 MW at 450 cfs, 5.3 MW at 600 cfs, and 7.05 MW at 800 cfs.

3.1.2 RESULTS

Results for each operational parameter are presented below. With the exception of Hydropower Generation, the ModGP alternative is not included for operational parameters as the HEC-ResSim model is based on a daily timestep; therefore, there would be no differences between ModGP and GP in model results.

<u>Harris Reservoir Elevations</u>

Effects on reservoir elevation are presented in two figures; Figure 3-1 includes the GP alternative compared to PreGP as well as the CMF alternatives, and Figure 3-2 includes the GP alternative compared to all CMF+GP alternatives. The HEC-ResSim model indicates that PreGP, 150CMF, 300CMF, 350CMF, 400CMF, and 450CMF have negligible effects on average reservoir elevations using the period of record (1939 through 2011) compared to GP. The 600CMF alternative results in average reservoir elevations approximately 0.5 feet

[9] The HydroBudget model uses top-of-stack lambdas, which refer to the marginal cost of electricity for meeting the Southern Company system's total load and includes the native territorial load, long-term sale obligations, and opportunity sales.

lower than GP from May to September, and then approximately one foot lower during September. The 800CMF alternative results in average reservoir elevations approximately one foot lower than GP during May and June, and then the difference between 800CMF and GP increases to approximately four feet during September. The PreGP, 150CMF, 300CMF, 350CMF, 400CMF, and 450CMF are similar to GP from December through April, while 600CMF is approximately 0.5 feet lower and 800CMF is approximately two feet lower during these months (Figure 3-1).

The HEC-ResSim model indicates that 150CMF+GP has negligible effects on average reservoir elevations compared to GP. The 300CMF+GP results in average reservoir elevations approximately 0.5 feet lower than GP from May through October. The 600CMF+GP alternative results in average reservoir elevations approximately two feet lower than GP for May and June, increasing to approximately four feet lower during September. The 800CMF+GP alternative results in average reservoir elevations approximately four feet lower than GP during May and June, and then the difference between 800CMF+GP and GP increases to approximately 12 feet during September. The 150CMF+GP and 300CMF+GP are similar to GP from December through April, while 600CMF+GP is approximately two feet lower and 800CMF+GP is over six feet lower in December and the difference gradually lessens from January through April (Figure 3-2).

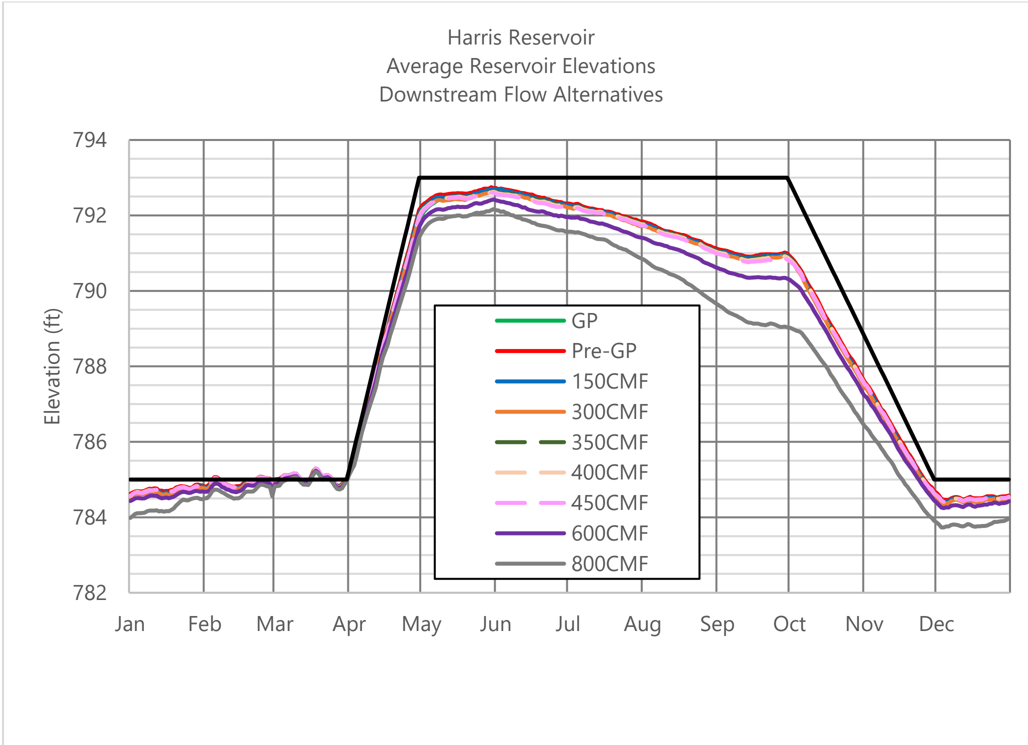

FIGURE 3–1 AVERAGE ELEVATIONS OF HARRIS RESERVOIR BASED ON HEC-RESSIM MODEL OF DOWNSTREAM RELEASE ALTERNATIVES (GP, PREGP, AND CMF)

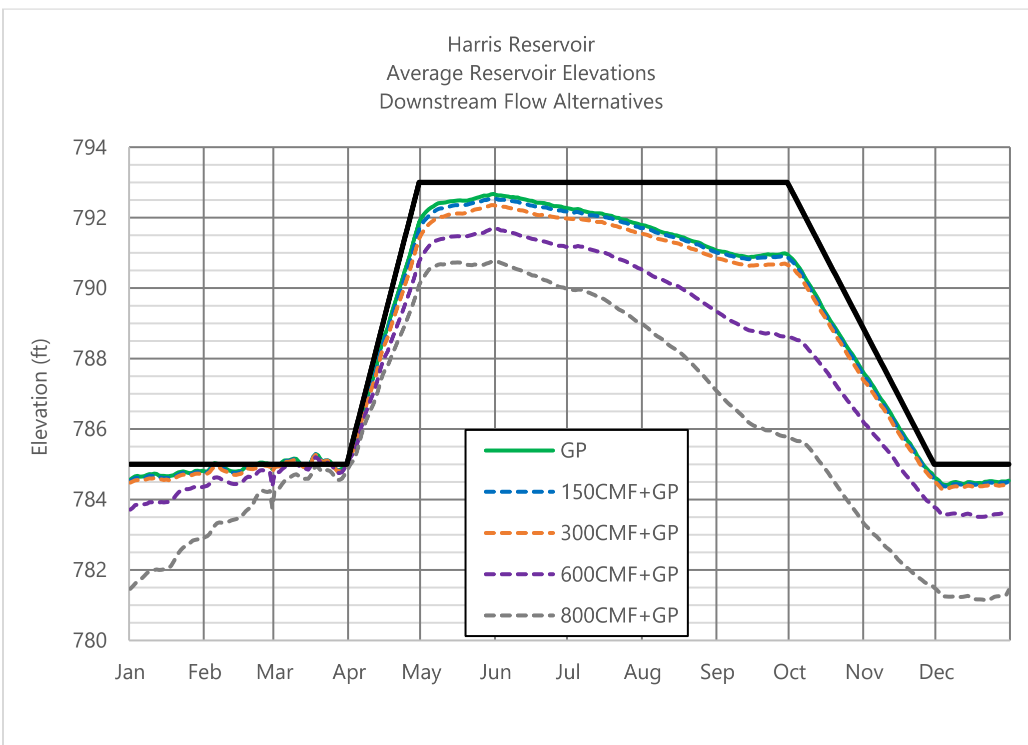

FIGURE 3–2 AVERAGE ELEVATIONS OF HARRIS RESERVOIR BASED ON HEC-RESSIM MODEL OF DOWNSTREAM RELEASE ALTERNATIVES (GP AND CMF+GP)

Figures 3-3 and 3-4 present the annual stage duration curves of Harris Reservoir elevation for each downstream release alternative. These curves show that Harris Reservoir is within its normal operating range (785 feet msl to 793 feet msl) approximately 65% of the time and always above 780 feet msl over the period of record under existing conditions (GP). The 600CMF, 800CMF, 600CMF+GP, and 800CMF+GP alternatives slightly decrease the percentage of time within the normal operating range and decrease the elevation with 100% exceedance, with the 600CMF+GP and 800CMF+GP having the greatest effects on reservoir elevation.

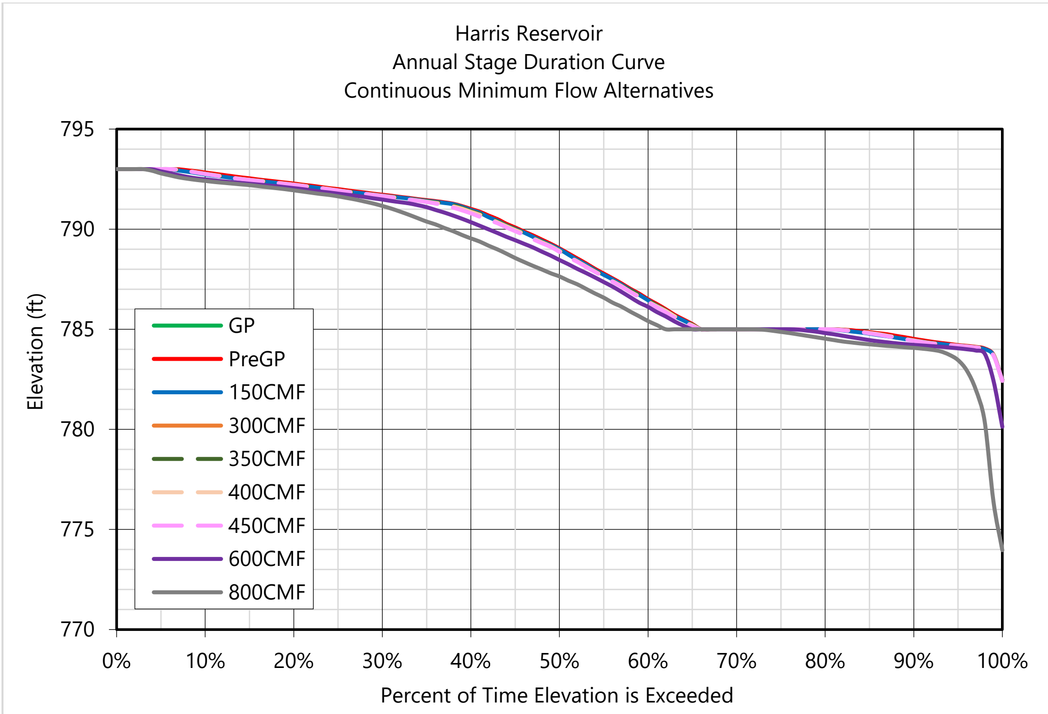

FIGURE 3–3 EXCEEDANCE CURVES OF HARRIS RESERVOIR ELEVATIONS BASED ON HEC-RESSIM MODEL OF DOWNSTREAM RELEASE ALTERNATIVES (GP, PGP, AND CMF)

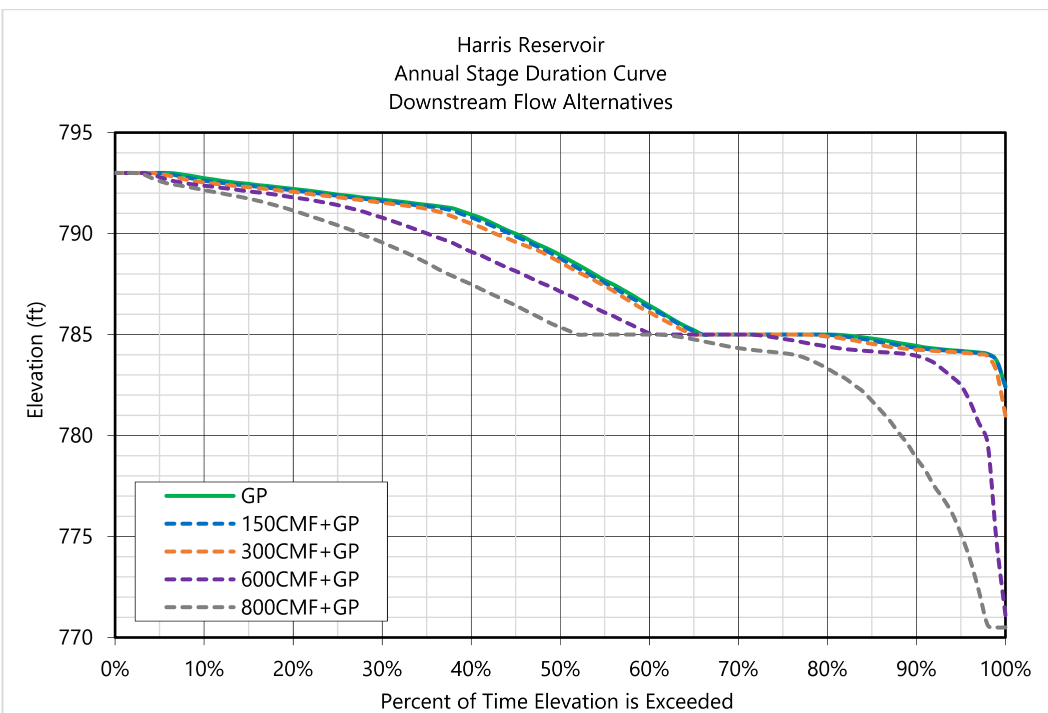

FIGURE 3–4 EXCEENDANCE CURVES OF HARRIS RESERVOIR ELEVATIONS BASED ON HEC-RESSIM MODEL OF DOWNSTREAM RELEASE ALTERNATIVES (GP AND CMF+GP)

In order to evaluate “worst case” effects on reservoir elevations from the downstream release alternatives, HEC-ResSim was used to determine the minimum reservoir elevation for each day, over the period of record. Results are presented in Figures 3-5 and 3-6. The only difference between PreGP, 150CMF, and 300CMF compared to GP occurs during April through the middle of July. During this period, the minimum reservoir elevations were higher for PGP and 150CMF compared to GP. The minimum reservoir elevation for the 300CMF alternative was somewhat higher than GP during April and May, but then fell below GP by approximately one foot during June. The 350CMF, 400CMF, and 450CMF alternatives approximated GP through April, then fell below GP in late May and were lower than GP through July for 350CMF, August for 400CMF, and mid-September for 450CMF. The minimum reservoir elevations for the 600CMF and 800CMF alternatives were consistently lower than GP except for a brief period during the month of March when they are equivalent. The minimum reservoir elevations for all CMF+GP alternatives were consistently lower from May through August, with the 150CMF+GP alternative being the only one that was approximately the same as GP.

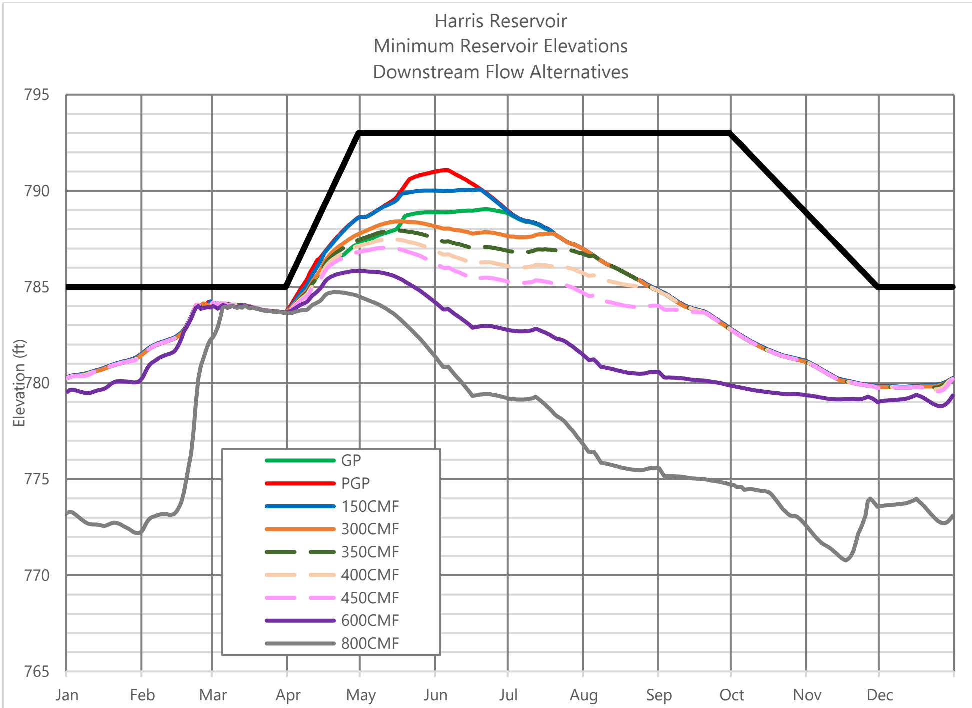

FIGURE 3–5 MINIMUM ELEVATIONS OF HARRIS RESERVOIR OVER THE PERIOD OF RECORD (1939-2011) BASED ON HEC-RESSIM MODEL OF DOWNSTREAM RELEASE ALTERNATIVES (GP, PREGP, AND CMF)

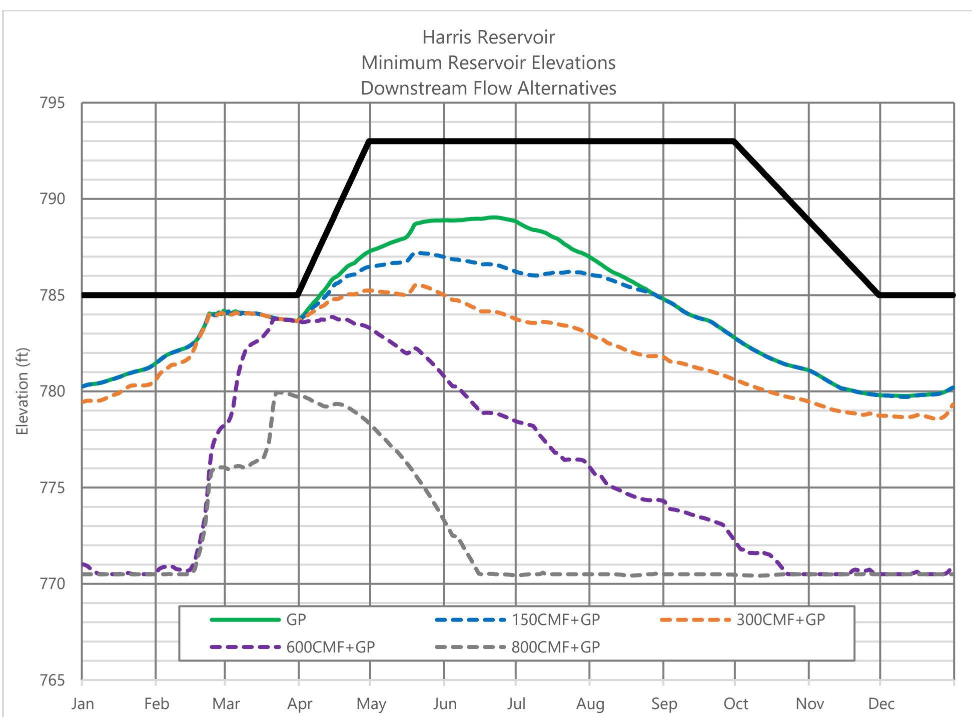

FIGURE 3–6 MINIMUM ELEVATIONS OF HARRIS RESERVOIR OVER THE PERIOD OF RECORD (1939-2011) BASED ON HEC-RESSIM MODEL OF DOWNSTREAM RELEASE ALTERNATIVES (GP AND CMF+GP)

Evaluating reservoir elevations for the period of record can mask differences in elevations at the project during low flow years. Figures 3-7 and 3-8 shows how the downstream release alternatives could have affected the peak elevations in 2006 through 2008, capturing two periods with historically low inflows. Figures 3-9 and 3-10 show the reservoir elevation for each alternative in 2000, which was another drought year.

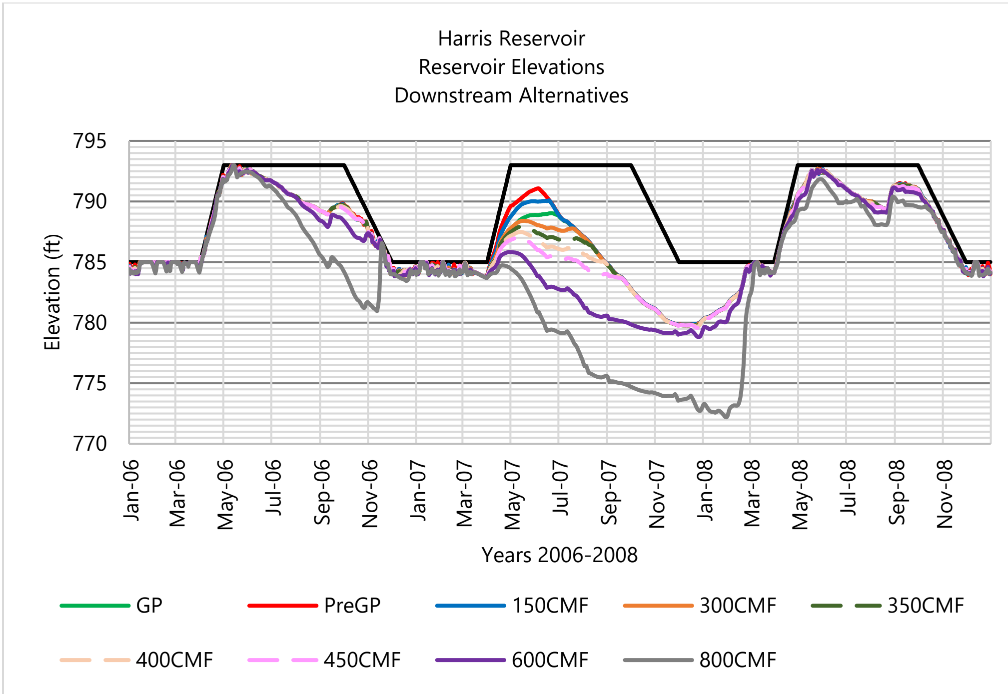

FIGURE 3–7 HARRIS RESERVOIR ELEVATIONS FROM 2006 THROUGH 2008 BASED ON HEC-RESSIM MODEL OF DOWNSTREAM RELEASE ALTERNATIVES (GP, PREGP, AND CMF)

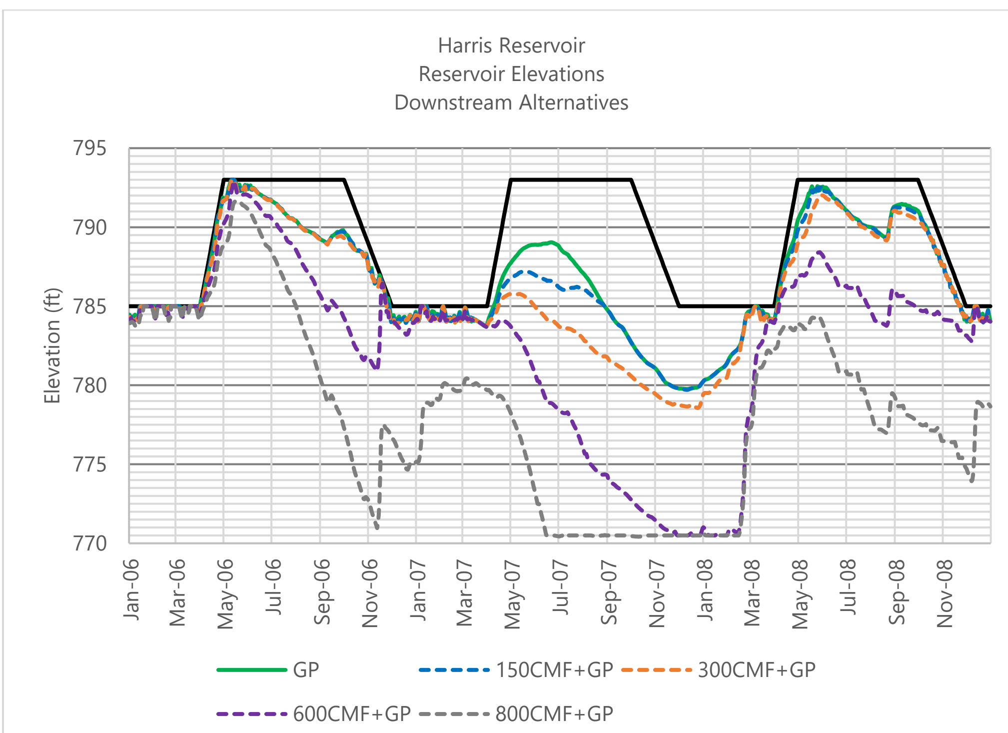

FIGURE 3–8 HARRIS RESERVOIR ELEVATIONS FROM 2006 THROUGH 2008 BASED ON HEC-RESSIM MODEL OF DOWNSTREAM RELEASE ALTERNATIVES (GP AND CMF+GP)

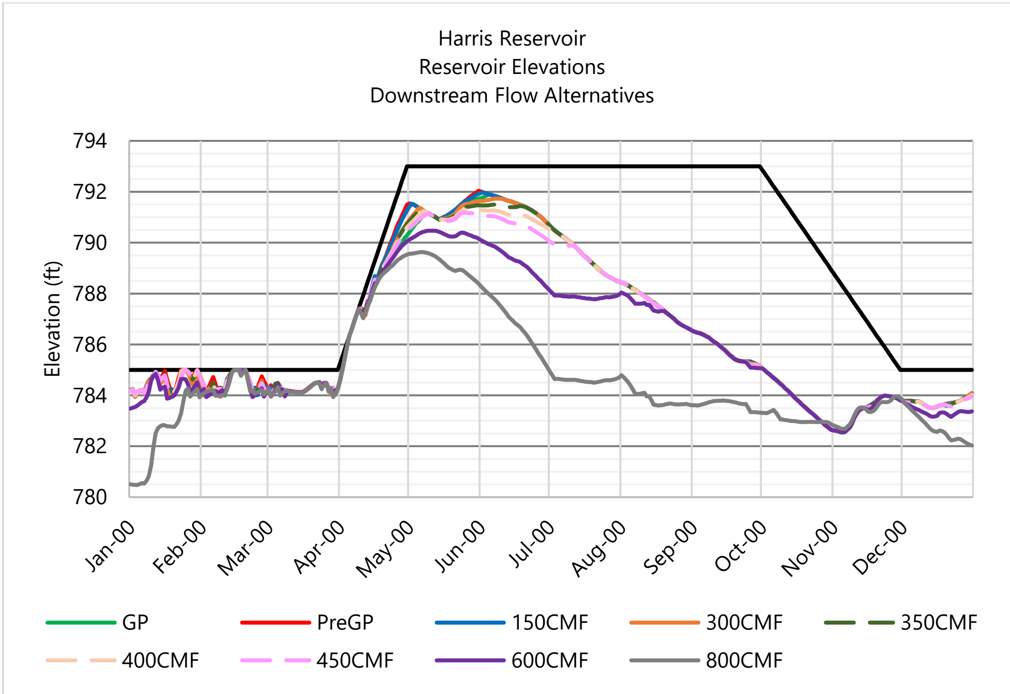

FIGURE 3–9 HARRIS RESERVOIR ELEVATIONS IN 2000 BASED ON HEC-RESSIM MODEL OF DOWNSTREAM RELEASE ALTERNATIVES (GP, PREGP, AND CMF)

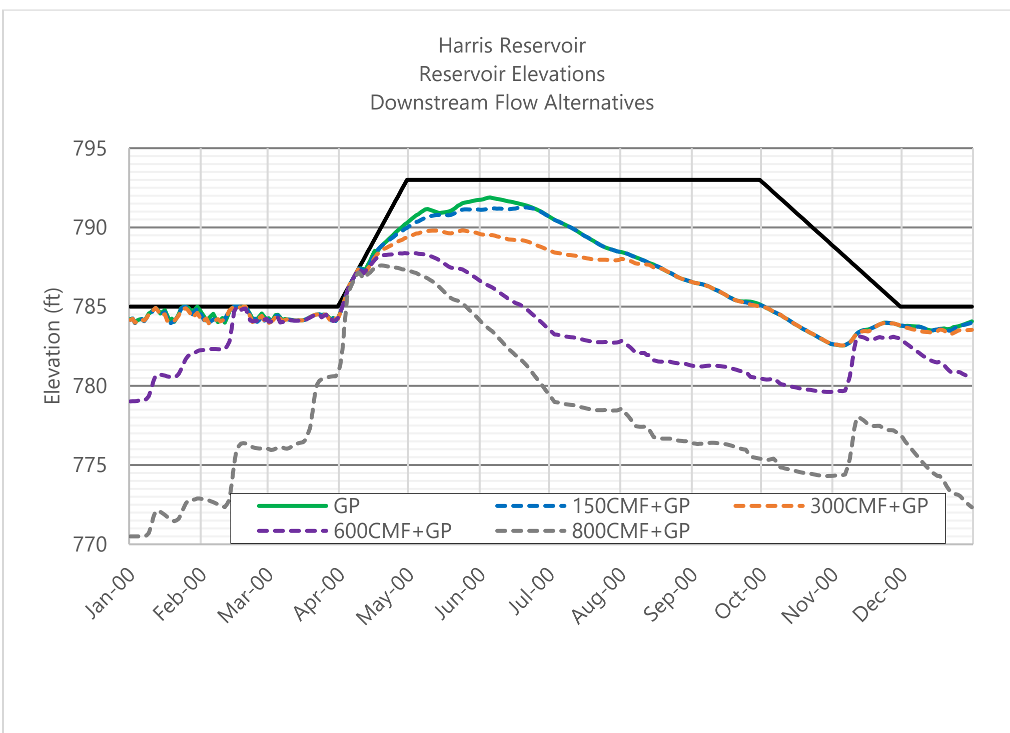

FIGURE 3–10 HARRIS RESERVOIR ELEVATIONS IN 2000 BASED ON HEC-RESSIM MODEL OF DOWNSTREAM RELEASE ALTERNATIVES (GP AND CMF+GP)

Hydropower Generation

Results from releasing the downstream release alternatives on hydropower generation and revenue both at Harris Dam and the Alabama Power hydroelectric fleet are presented in Figures 3-11 through 3-14. As described above, these results are based on all alternatives being discharged through a theoretical hydroelectric unit. Generally, any of the CMF alternatives decrease the average annual generation at Harris Dam, with little difference between the CMF alternatives and associated CMF+GP alternative. This is due to less water being available in the reservoir for peaking operations when compared to existing conditions (GP). This translates into less revenue from generation at Harris Dam due to running the CMF unit during off-peak hours. The only alternative that increases revenue from Harris Dam is PreGP, attributable to more water being used for peak generation. When the overall hydroelectric fleet is taken into consideration, the generation and revenue losses may appear to be smaller in proportion to the losses at Harris Dam alone. This is due to the way that the hydro projects work as a system. Releasing more water from Harris Dam means that the downstream projects (e.g., Martin, Yates, and Thurlow) would be forced to release the same volume of water, creating additional generation from all three hydro projects.

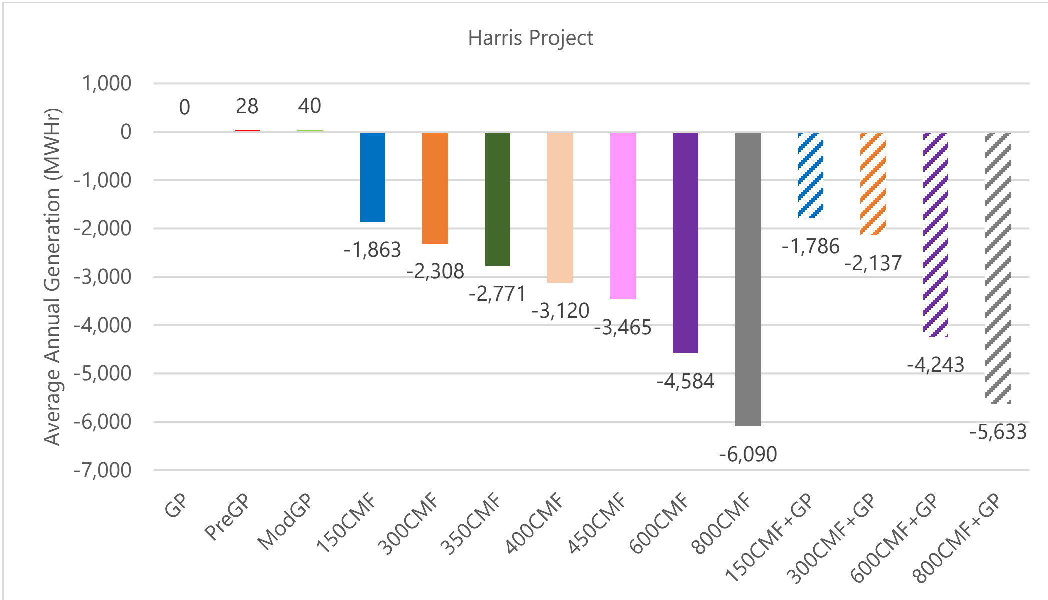

FIGURE 3–11 CHANGE IN AVERAGE ANNUAL GENERATION FOR HARRIS DAM BASED ON HYDROBUDGET MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

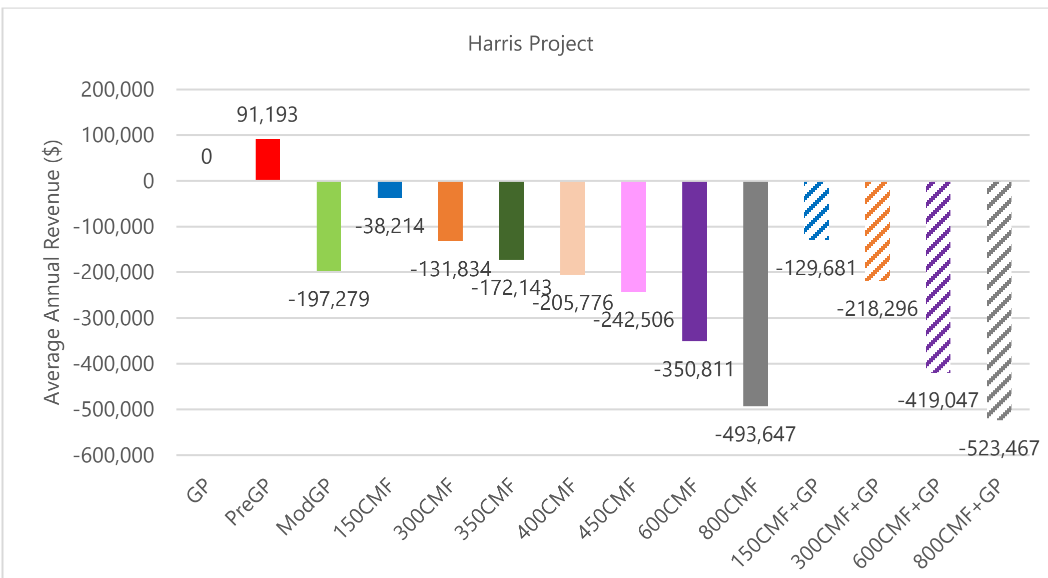

FIGURE 3–12 CHANGE IN AVERAGE ANNUAL REVENUE FOR HARRIS DAM BASED ON HYDROBUDGET MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

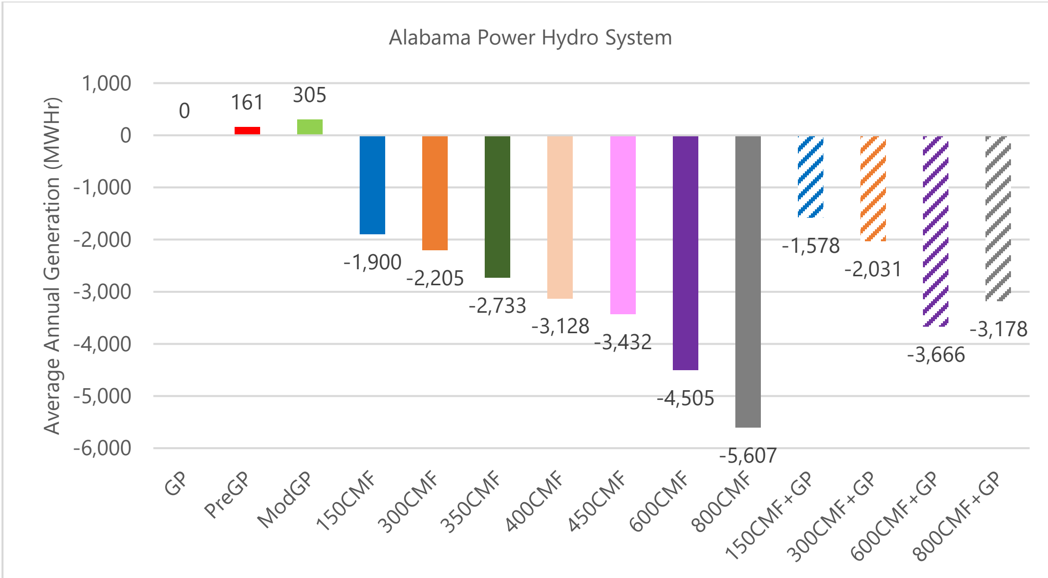

FIGURE 3–13 CHANGE IN AVERAGE ANNUAL GENERATION FOR ALABAMA POWER'S HYDRO SYSTEM BASED ON HYDROBUDGET MODEL OF DOWNSTREAM RELEASE ALTERNATIVES AT HARRIS DAM[10]

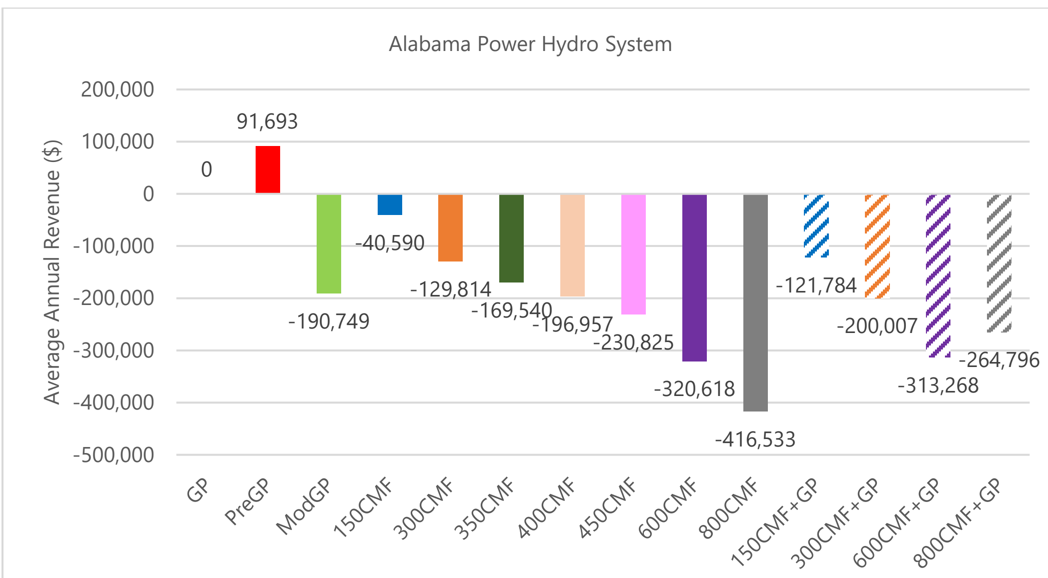

FIGURE 3–14 CHANGE IN AVERAGE ANNUAL REVENUE FOR ALABAMA POWER'S HYDRO SYSTEM BASED ON HYDROBUDGET MODEL OF DOWNSTREAM RELEASE ALTERNATIVES AT HARRIS DAM[10]

[10] The 800CMF+GP alternative results in slightly more generation and revenue for Alabama Power's hydro system compared to the 600CMF+GP alternative. The 800CMF+GP alternative forces more generation at the downstream Martin, Yates, and Thurlow dams, resulting in slightly more generation and revenue across the system. However, due to this water being used at Harris (and the downstream developments) during non-peak periods, it still results in a net loss compared to baseline (GP).

Flood Control

The downstream release alternatives were modeled with the current USACE-approved flood control procedures that are incorporated into the daily HEC-ResSim model. Modifying the downstream releases would not impact this operation.

Navigation

Navigation levels are triggered by inflow for the Alabama-Coosa-Tallapoosa (ACT) basin. The required basin inflow to support each navigation channel depth includes a volume historically contributed by the storage projects on the Coosa and Tallapoosa Rivers and USACE's assumptions for dredging the navigation channel in the Alabama River. Altering the downstream releases at Harris would not impact this trigger. Therefore, there is no impact to the number of days over the period of record that each alternative would support navigation releases under each of the downstream release alternatives (Table 3-1).

Drought Operations

The HEC-ResSim model was used to evaluate how drought operations may be positively or adversely affected by the downstream release alternatives. Two of the three triggers in Alabama-ACT Drought Response Operations Plan (ADROP) are based on factors independent of Harris Reservoir: basin inflow and state-line flows. The impact of the release alternatives to the volume of water in the Harris Reservoir is negligible with respect to the third ADROP trigger, basin-wide composite storage (since little storage is available in Harris Reservoir compared to other storage projects within the ACT basin). Therefore, there is no change in the percentage of time spent over the period of record in each drought intensity level (Table 3-2).

TABLE 3-1 PERCENT OF TIME THAT NAVIGATION FLOW IS PROVIDED FROM ALABAMA POWER HYDRO PROJECTS IN THE ACT BASIN BASED ON HEC-RESSIM MODEL OF DOWNSTREAM RELEASE ALTERNATIVES AT HARRIS DAM

Navigation	Percentage of Time Each Navigation Flow is Provided												
	GP	PGP	150 CMF	150 CMF+GP	300 CMF	350 CMF	400 CMF	450 CMF	300 CMF+GP	600 CMF	600 CMF+GP	800 CMF	800 CMF+GP
9.5 ft	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%	74%
7 ft	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
None	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%

TABLE 3-2 PERCENT OF TIME THAT EACH DROUGHT INTENSITY LEVEL IS TRIGGERED BASED ON HEC-RESSIM MODEL OF DOWNSTREAM RELEASE ALTERNATIVES AT HARRIS DAM

Drought Intensity Level[1]	Percentage of Time in Each Drought Intensity Level												
	GP	PGP	150 CMF	150 CMF+GP	300 CMF	350 CMF	400 CMF	450 CMF	300 CMF+GP	600 CMF	600 CMF+GP	800 CMF	800 CMF+GP
0	82%	82%	82%	82%	82%	82%	82%	82%	82%	82%	82%	82%	82%
1	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%	13%
2	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%	4%
3	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%	1%

[1] Drought Intensity Level is a term used in the Alabama-ACT Drought Response Operations Plan (ADROP) and refers to the number of triggers, as defined in ADROP, that are being met.

Martin Project Conditional Fall Extension

Article 403 of the Martin Project license[11] requires Alabama Power to evaluate four conditions annually, beginning July 14, to implement the conditional fall extension (CFE), where the flood control curve remains at elevation 491 feet msl from September 1 to October 15. These conditions are:

1. Lake Martin is above its operating curve during September (487 to 488.5 feet msl);
2. the rolling 7-day average total basin inflow (i.e., the average of the total daily basin inflow for the previous 7 days recalculated on a daily basis for a given period of time) on the Tallapoosa River, calculated at Thurlow Dam, is at or higher than the median flow (i.e., the median of the recorded daily flows over the period of record for the particular day of interest);
3. the rolling 7-day average total basin inflow on the Coosa River, calculated at Jordan Dam, is at or higher than the median flow; and
4. the elevations at the Weiss, Neely Henry, and Logan Martin developments on the Coosa River and the R.L. Harris Project on the Tallapoosa River must all be within 1 foot of their respective operating curves.

The HEC-ResSim model was used to determine the number of years that the Martin CFE was implemented over the period of record (Table 3-3). The PreGP, 150CMF, 300CMF, 350CMF, 400CMF, and 450CMF all increase the number of times the Martin CFE is implemented. All other alternatives decrease the number of times the Martin CFE is implemented.

[11] 153 FERC ¶ 61,298

TABLE 3-3 NUMBER OF YEARS OVER THE PERIOD OF RECORD (1939-2011) THE CONDITIONAL FALL EXTENSION IS IMPLEMENTED AT THE MARTIN DAM PROJECT BASED ON HEC-RESSIM MODEL OF DOWNSTREAM RELEASE ALTERNATIVES AT HARRIS DAM

Alternative	Implementation of Martin Conditional Fall Extension		
	Number of Years (Over Period of Record)	Number of Years Compared to Baseline	Percent of Time (Over Period of Record)
GP (Baseline)	19	-	26%
PreGP	25	6	34%
150CMF	22	3	30%
300CMF	20	1	27%
350CMF	21	2	29%
400CMF	20	1	27%
450CMF	21	2	29%
600CMF	14	-5	19%
800CMF	14	-5	19%
150CMF+GP	18	-1	25%
300CMF+GP	13	-6	18%
600CMF+GP	10	-9	14%
800CMF+GP	6	-13	8%

3.2 Water Quality

3.2.1 METHODS

Alabama Power used existing data from the Pre-Application Document (PAD) (Alabama Power and Kleinschmidt 2018), Baseline Water Quality Report (Kleinschmidt 2018a), and results from the FERC-approved Water Quality Study (Kleinschmidt 2021d) to qualitatively describe potential effects on dissolved oxygen in the tailrace and forebay water quality that may occur due to change in downstream releases.

3.2.2 RESULTS

Harris Reservoir

The impacts of downstream release alternatives on forebay water quality in Harris Reservoir were qualitatively assessed. The higher (600 and 800) CMF alternatives result in lower elevations in Harris Reservoir compared to GP, 150CMF, 300CMF, 350CMF, 400CMF, and 450 CMF alternatives, both average and minimum elevations (Figures 3-1 and 3-5). The lower elevations in Harris Reservoir during summer months compared to existing conditions (GP) could reduce retention time. Changes in retention time could result in changes in reservoir stratification (Soares et al. 2008). Adding Green Plan pulses to any of the CMF alternatives further decreases average Harris Reservoir elevations compared to existing conditions (GP) (Figure 3-2). Minimum Harris Reservoir elevations with 800CMF+GP dropped to 770.5 ft msl (Figure 3-6) in summer months. During low flow years, reservoir elevations throughout the year would be significantly lower at minimum flows of 600CMF and 800CMF and 600CMF+GP and 800CMF+GP compared to GP and the lower CMF alternatives (Figures 3-7 through 3-10).

Tallapoosa River Downstream of Harris Dam

Based on existing data and results from the Water Quality Study, overall water quality conditions support the designated uses of the tailrace. Each downstream release alternative that results in lower average lake level elevations would likely result in changes to tailrace water quality. As the depth from the lake surface to the intake becomes shallower, water withdrawn by Harris Dam for generation would likely be warmer and have higher dissolved oxygen concentrations.

The effects of the downstream release alternatives on downstream water temperature are discussed in Section 3.5 (Aquatic Resources).

3.3 Water Use

As indicated in the Study Plan, water use was assessed using existing information and the models developed for the Phase 1 Report.

3.3.1 Methods

The effects of downstream release alternatives on existing and potential water withdrawals in Harris Reservoir and the Tallapoosa River downstream of Harris Dam were qualitatively assessed using the results of the HEC-ResSim modeling, HEC-RAS modeling, and existing information from the Water Quantity, Water Use, and Discharges Report (Kleinschmidt 2018d). HEC-ResSim models were used to determine the ability to maintain Harris Reservoir at the current operating curve under each downstream release alternative. The HEC-RAS models were used to assess increases in water availability on water users downstream of Harris Dam.

3.3.2 Results

Harris Reservoir

The Lakeside Campground and Marina withdraws groundwater near Cohobadiah Creek, a tributary to Harris Reservoir (Kleinschmidt 2018d); however, the well is located at an elevation greater than 793 feet msl, which is outside of Harris Reservoir and the Harris Project Boundary (Project Boundary). The Wedowee Water, Sewer, and Gas Board (WSGB) withdraws from and discharges to the upper Little Tallapoosa River (Kleinschmidt 2018d) and is the only water user that withdraws within the Project Boundary.

The Wedowee WSGB withdraws from the upper Little Tallapoosa River a daily average of 0.411 million gallons per day (mgd) (0.636 cfs) and a permitted daily maximum of 0.50 mgd (0.774 cfs) and discharges a daily average of 0.045 (0.070 cfs) mgd and a daily maximum of 0.150 mgd (0.232 cfs) (Kleinschmidt 2018d).

Downstream release alternatives of 800CMF and 600CMF+GP would lower the average winter pool elevation approximately 0.5 ft, and 800CMF+GP would lower the average winter pool elevation approximately two feet below the current winter pool elevation of 785 feet msl. These alternatives could occasionally draw the reservoir level nearly fifteen feet below winter pool, reducing the amount of available water for use in Harris Reservoir.

Tallapoosa River Downstream of Harris Dam

The Roanoke Utilities Board has two surface water intakes and one discharge point in Highpine Creek (Kleinschmidt 2018d), a tributary leading to the Tallapoosa River downstream of the Harris Project. Water use by the Roanoke Utilities Board would not be impacted by any downstream release alternative, because the intakes are located over fourteen miles upstream of the confluence of Highpine Creek and the Tallapoosa River. The Town of Wadley Water System has one discharge in Hutton Creek (Kleinschmidt 2018d), a tributary leading to the Tallapoosa River downstream of the Harris Project. Downstream release alternatives could increase the assimilative capacity of the Tallapoosa River downstream of Harris Dam, but this is unlikely to affect the Town of Wadley Water

System due to the location of their discharge in Hutton Creek. Furthermore, there are no reported issues with the existing assimilative capacity.

3.4 Erosion

As indicated in the Study Plan, erosion was assessed using existing information and the models developed for the Phase 1 Report.

3.4.1 Methods

Alabama Power used the results of the Erosion and Sedimentation Study (Kleinschmidt 2021b) and outputs from the HEC-RAS model to quantitatively and qualitatively assess the effects of downstream release alternatives on erosion in the Tallapoosa River downstream of Harris Dam and on Harris Reservoir.

HEC-RAS model results were used to produce daily average water surface fluctuations for the study area (Harris Dam through Horseshoe Bend). The HEC-RAS model results were further analyzed to produce fluctuation exceedance curves at representative locations downstream of Harris Dam. Daily fluctuations were calculated for each day of the year for each downstream release alternative. Daily fluctuations were calculated by determining the difference between the daily maximum and minimum water surface elevations. The values were then ranked from greatest to least and assigned an exceedance probability. These factors were weighed against bank and soils conditions to qualitatively assess potential for bank degradation or erosion.

3.4.2 Results

Harris Reservoir

Existing areas of erosion on Harris Reservoir will not be affected by any of the downstream release alternatives. The identified erosion areas on Harris Reservoir exist at or above the existing full pool elevation. None of the proposed downstream release alternatives will result in reservoir elevations above the current full pool elevations. While lower reservoir elevations could reduce wind and boat induced wave action affecting these areas, the proposed downstream releases will not affect identified erosion areas on Harris Reservoir.

Tallapoosa River Downstream of Harris Dam

Abbreviated results of the HEC-RAS model of water surface elevation fluctuations downstream of Harris Dam are found in Table 3-4, and the delineation of miles downstream of Harris Dam is presented in Figure 3-15. Generally, results show that river fluctuations are lower with increasing continuous minimum flows. These model results were used to estimate water surface elevation fluctuations at each of the impaired streambank segments identified in the Erosion and Sedimentation Study (Kleinschmidt 2021b).

TABLE 3-4 DAILY AVERAGE WATER SURFACE ELEVATION FLUCTUATIONS (IN FEET) IN THE TALLAPOOSA RIVER DOWNSTREAM OF HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

Alternative	Miles Below Harris Dam										
	0.2	1	2	4	7	10	14	19	23	38	43
PreGP	4.67	4.38	4.17	4.47	3.26	2.68	3.66	3.06	2.03	0.92	1.80
GP	4.62	4.24	3.99	4.22	3.20	2.56	3.60	3.01	2.01	0.92	1.79
ModGP	4.18	3.96	3.80	3.95	3.00	2.45	3.53	2.96	1.98	0.90	1.74
150CMF	4.10	3.94	3.81	4.07	3.15	2.56	3.63	3.02	2.01	0.93	1.80
300CMF	3.59	3.51	3.44	3.72	2.96	2.34	3.54	2.99	1.99	0.92	1.74
350CMF	3.43	3.43	3.32	3.61	2.89	2.28	3.48	2.97	1.99	0.92	1.74
400CMF	3.29	3.29	3.22	3.51	2.82	2.22	3.42	2.94	1.97	0.92	1.73
450CMF	3.16	3.16	3.12	3.41	2.75	2.17	3.36	2.92	1.96	0.92	1.72
600CMF	2.84	2.87	2.86	3.14	2.56	2.01	3.17	2.82	1.92	0.90	1.68
800CMF	2.50	2.57	2.57	2.85	2.34	1.83	2.97	2.70	1.85	0.88	1.63
150CMF+GP	4.06	3.86	3.71	3.91	3.04	2.44	3.54	2.99	2.00	0.91	1.75
300CMF+GP	3.53	3.43	3.33	3.56	2.84	2.23	3.41	2.92	1.96	0.91	1.72
600CMF+GP	2.78	2.80	2.77	3.03	2.46	1.95	3.11	2.77	1.88	0.89	1.65
800CMF+GP	2.43	2.49	2.49	2.76	2.26	1.79	2.95	2.67	1.82	0.86	1.61

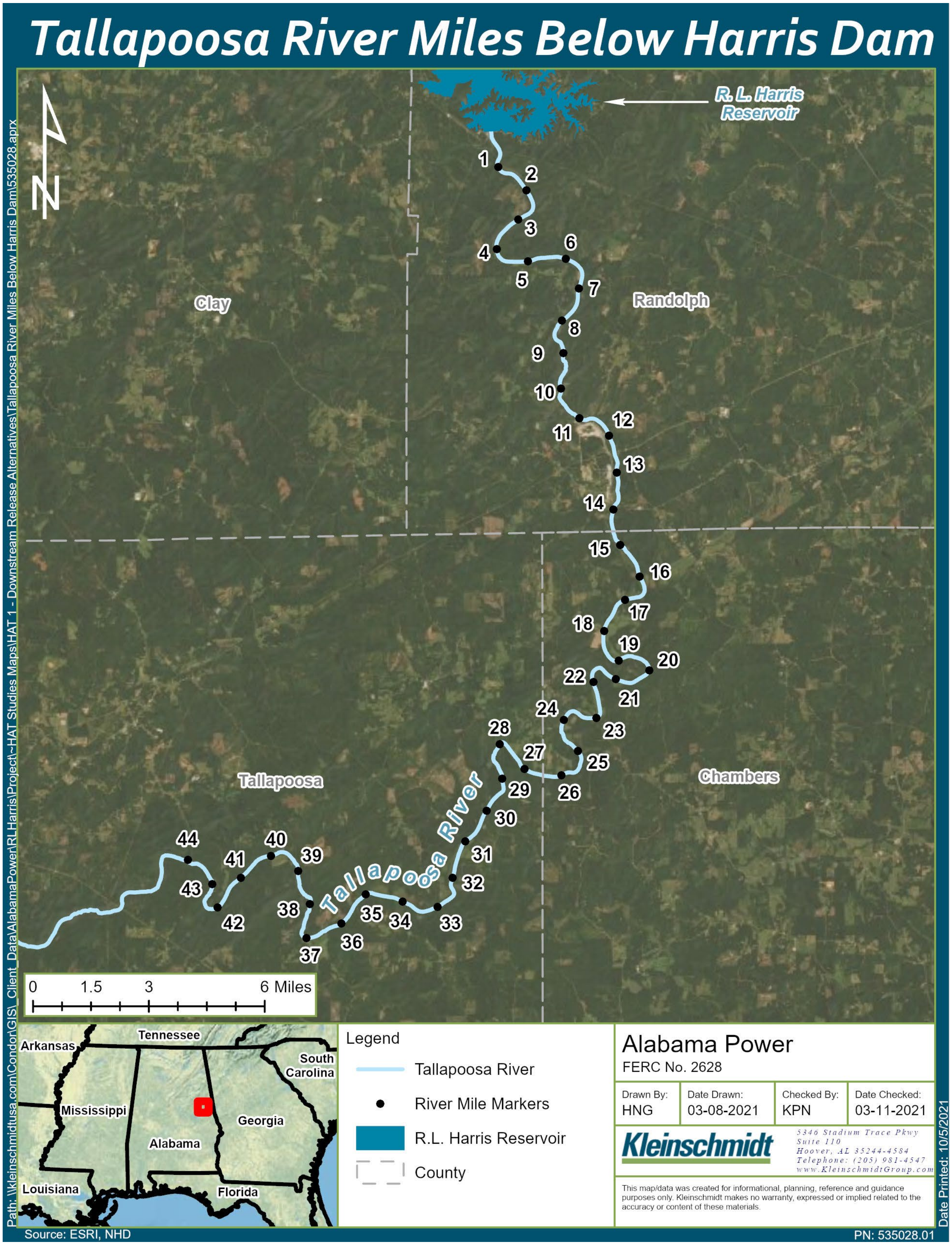

FIGURE 3–15 DELINEATION OF MILES OF THE TALLAPOOSA RIVER DOWNSTREAM OF HARRIS DAM

The primary existing erosion areas identified downstream of Harris Dam as reported in the Erosion and Sedimentation Study include the riverbank segments[12] identified as slightly impaired or worse by the high definition stream survey. The 15 most impaired streambank segments downstream of Harris Dam are presented in Table 3-5. Of note, six of the 15 identified segments occur 16 miles below Harris Dam. This portion of the river consists of adjacent agricultural lands and banks that have been intentionally cleared of vegetation that naturally inhibits erosion. The results in Table 3-4 were used to calculate the expected average fluctuation depth at each of the 15 most impaired segments. Results of these calculations are included in Table 3-6.

TABLE 3-5 15 MOST IMPAIRED STREAMBANK SEGMENTS ON THE TALLAPOOSA RIVER DOWNSTREAM OF HARRIS DAM

Bank[1]	Miles Downstream of Harris Dam	Condition Score[2]
Right Bank	7.7	3.57
Left Bank	10.0	3.22
Right Bank	16.3	3.35
Right Bank	16.4	3.18
Right Bank	16.5	3.55
Right Bank	16.6	3.96
Right Bank	16.7	4.45
Right Bank	16.9	3.20
Left Bank	17.9	3.09
Left Bank	19.2	3.11
Left Bank	20.6	3.05
Right Bank	34.4	3.07
Left Bank	36.5	3.05
Left Bank	36.6	3.04
Right Bank	43.8	3.17

[1] Left bank or right bank is a reference to the side of the river when traveling downstream.

[2] Bank Condition Scores: 1-Fully Functional 2-Functional, 3-Slightly Impaired, 4-Impaired, 5-Non-Functional

Source: Trutta 2019

[12] Segments are 0.1 miles in length.

TABLE 3-6 DAILY AVERAGE WATER SURFACE ELEVATION FLUCTUATIONS (IN FEET) AT THE 15 MOST IMPAIRED STREAMBANK SEGMENTS ON THE TALLAPOOSA RIVER DOWNSTREAM OF HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

Bank[1]	Miles Downstream Of Harris Dam	Condition Score[2]	Daily Average Water Surface Fluctuations (ft)													
			PreGP	GP	ModGP	150CMF	300CMF	350CMF	400CMF	450CMF	600CMF	800CMF	150CMF+GP	300CMF+GP	600CMF+GP	800CMF+GP
Right Bank	7.7	3.57	3.26	3.20	3.00	3.15	2.96	2.89	2.83	2.76	2.56	2.34	3.04	2.46	2.84	2.26
Left Bank	10	3.22	2.75	2.64	2.52	2.63	2.42	2.36	2.31	2.25	2.08	1.89	2.51	2.01	2.31	1.85
Right Bank	16.3	3.35	3.37	3.32	3.26	3.34	3.28	3.24	3.19	3.15	3.01	2.85	3.28	2.95	3.18	2.82
Right Bank	16.4	3.18	3.37	3.32	3.26	3.34	3.28	3.24	3.19	3.15	3.01	2.85	3.28	2.95	3.18	2.82
Right Bank	16.5	3.55	3.37	3.32	3.26	3.34	3.28	3.24	3.19	3.15	3.01	2.85	3.28	2.95	3.18	2.82
Right Bank	16.6	3.96	3.34	3.29	3.23	3.31	3.25	3.21	3.16	3.12	2.99	2.83	3.25	2.93	3.15	2.80
Right Bank	16.7	4.45	3.34	3.29	3.23	3.31	3.25	3.21	3.16	3.12	2.99	2.83	3.25	2.93	3.15	2.80
Right Bank	16.9	3.2	3.31	3.26	3.20	3.28	3.22	3.18	3.14	3.10	2.97	2.82	3.22	2.91	3.13	2.79
Left Bank	17.9	3.09	3.22	3.17	3.12	3.19	3.14	3.10	3.07	3.03	2.92	2.78	3.14	2.86	3.06	2.75
Left Bank	19.2	3.11	3.08	3.04	2.98	3.05	3.01	2.98	2.95	2.93	2.84	2.71	3.01	2.78	2.94	2.68
Left Bank	20.6	3.05	2.72	2.68	2.64	2.69	2.66	2.64	2.62	2.60	2.53	2.42	2.66	2.48	2.61	2.39
Right Bank	34.4	3.07	0.26	0.27	0.28	0.29	0.31	0.31	0.31	0.32	0.32	0.32	0.29	0.32	0.31	0.32
Left Bank	36.5	3.05	1.03	1.03	1.02	1.04	1.03	1.03	1.02	1.02	1.01	0.98	1.02	0.99	1.02	0.96
Left Bank	36.6	3.04	1.01	1.01	1.00	1.02	1.02	1.02	1.01	1.01	0.99	0.96	1.01	0.97	1.00	0.95
Right Bank	43.8	3.17	2.00	1.99	1.93	2.00	1.93	1.92	1.91	1.90	1.86	1.80	1.94	1.83	1.91	1.78

[1] Left bank or right bank is a reference to the side of the river when traveling downstream.

[2] Bank Condition Scores: 1-Fully Functional 2-Functional, 3-Slightly Impaired, 4-Impaired, 5-Non-Functional (Trutta 2019).

Daily average fluctuations at the 15 most impaired streambank segments downstream of Harris Dam range from less than one foot to more than three feet depending on the downstream release alternative. Fluctuations generally tend to decrease at locations farther downstream due to flow attenuation. In addition, fluctuations tend to decrease in magnitude for alternatives with increased continuous minimum flows.

Because water surface fluctuations can exacerbate bank erosion, the HEC-RAS model results were further analyzed to produce fluctuation exceedance curves at representative locations downstream of Harris Dam. Daily fluctuations were calculated for each day of the year for each downstream release alternative. Daily fluctuations were calculated by determining the difference between daily maximum and minimum water surface elevations. The values were subsequently ranked from greatest to least and assigned an exceedance probability. The results of this analysis at representative locations are provided in Tables 3-7 through 3-9 and Figures 3-16 through 3-18.

TABLE 3-7 AVERAGE DAILY WATER SURFACE FLUCTUATION (IN FEET) EXCEEDANCE 7.7 MILES BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

Percentage of Days Equaled or Exceeded	Downstream Release Alternative													
	PGP	GP	ModGP	150CMF	300CMF	350CMF	400CMF	450CMF	600CMF	800CMF	150CMF +GP	300CMF +GP	600CMF +GP	800CMF +GP
1	6.48	6.47	6.4	6.4	5.91	5.77	5.64	5.5	5.21	4.97	6.31	5.89	5.19	4.97
5	5.88	5.92	5.9	5.81	5.52	5.42	5.3	5.2	4.91	4.56	5.83	5.52	4.91	4.56
10	5.47	5.53	5.53	5.46	5.21	5.12	5.03	4.96	4.75	4.43	5.44	5.19	4.73	4.43
20	4.53	4.54	4.54	4.52	4.46	4.43	4.4	4.36	4.23	4.05	4.54	4.46	4.23	4.05
30	4.16	4.16	4.12	4.09	3.77	3.63	3.5	3.4	3.1	2.73	4.05	3.72	3.08	2.72
40	3.91	3.69	3.53	3.89	3.61	3.5	3.38	3.27	2.96	2.61	3.58	3.3	2.79	2.52
50	3.24	3.01	2.93	3.23	3.02	2.96	2.88	2.83	2.65	2.43	2.95	2.74	2.4	2.28
60	2.69	2.4	2.32	2.67	2.46	2.4	2.36	2.33	2.23	2.12	2.32	2.16	1.9	1.82
70	2.13	1.86	1.81	2.08	1.82	1.72	1.63	1.57	1.41	1.19	1.79	1.54	1.22	1.07
80	1.48	1.49	1.22	1.45	1.22	1.16	1.06	0.99	0.81	0.67	1.4	1.16	0.78	0.62
90	0.85	0.83	0.59	0.78	0.79	0.77	0.74	0.7	0.59	0.43	0.85	0.84	0.57	0.4
95	0.62	0.66	0.4	0.63	0.63	0.6	0.59	0.58	0.49	0.32	0.63	0.59	0.45	0.29
99	0.46	0.37	0.33	0.46	0.48	0.45	0.44	0.43	0.37	0.2	0.33	0.27	0.29	0.21

Note: Table cells are shaded based a 3-color scale where green represents the lowest value, yellow is midpoint (50% value), and red is highest value in the table.

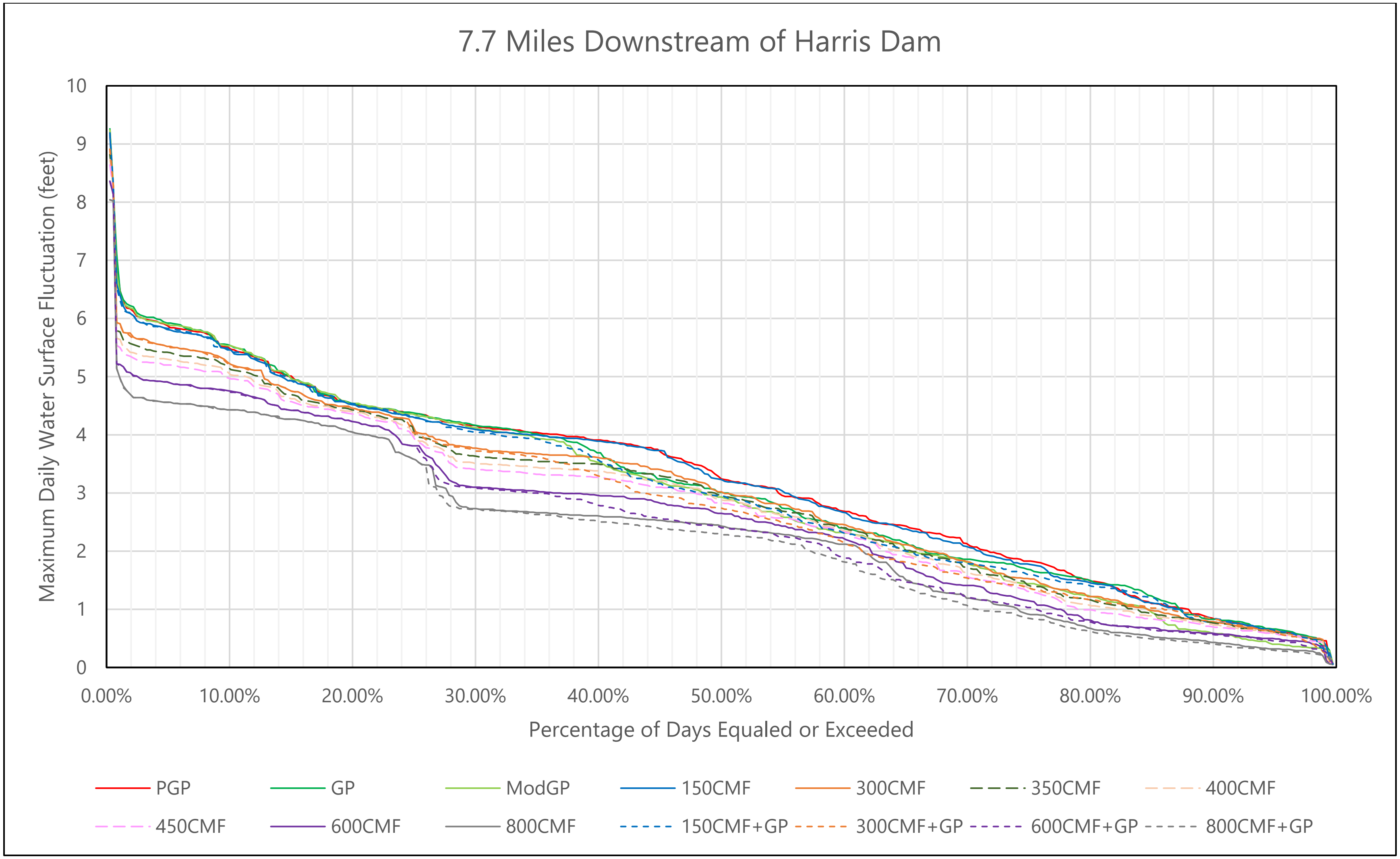

FIGURE 3–16 AVERAGE DAILY WATER SURFACE FLUCTUATION EXCEEDANCE CURVES FOR 7.7 MILES BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

TABLE 3-8 AVERAGE DAILY WATER SURFACE FLUCTUATION (IN FEET) EXCEEDANCE 20.6 MILES BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

Percentage of Days Equaled or Exceeded	Downstream Release Alternative													
	PGP	GP	ModGP	150CMF	300CMF	350CMF	400CMF	450CMF	600CMF	800CMF	150CMF +GP	300CMF +GP	600CMF +GP	800CMF +GP
1	7.67	6.71	6.77	6.63	6.57	6.54	6.52	6.51	6.46	6.37	6.68	6.59	6.47	6.37
5	5.35	4.88	4.84	4.87	4.8	4.78	4.75	4.71	4.6	4.47	4.84	4.76	4.58	4.45
10	4.64	4.48	4.44	4.55	4.41	4.38	4.34	4.3	4.23	4.19	4.43	4.4	4.23	4.19
20	3.94	3.87	3.86	3.9	3.85	3.81	3.81	3.81	3.77	3.66	3.84	3.81	3.77	3.66
30	3.52	3.38	3.37	3.47	3.32	3.29	3.3	3.25	3.17	3.06	3.38	3.29	3.09	2.99
40	3.02	2.98	2.94	3	2.94	2.91	2.91	2.9	2.81	2.69	2.95	2.91	2.73	2.65
50	2.74	2.64	2.61	2.73	2.63	2.61	2.6	2.59	2.5	2.4	2.63	2.56	2.42	2.33
60	2.47	2.4	2.37	2.45	2.41	2.41	2.38	2.38	2.32	2.2	2.37	2.33	2.21	2.12
70	1.94	1.87	1.77	1.97	1.92	1.93	1.94	1.94	1.91	1.85	1.86	1.87	1.71	1.66
80	0.91	0.81	0.76	0.9	0.83	0.82	0.79	0.74	0.63	0.6	0.8	0.74	0.64	0.59
90	0.47	0.48	0.42	0.45	0.43	0.45	0.45	0.43	0.35	0.21	0.4	0.4	0.33	0.26
95	0.26	0.3	0.24	0.25	0.26	0.3	0.31	0.32	0.26	0.14	0.28	0.27	0.23	0.18
99	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.1

Note: Table cells are shaded based a 3-color scale where green represents the lowest value, yellow is midpoint (50% value), and red is highest value in the table.

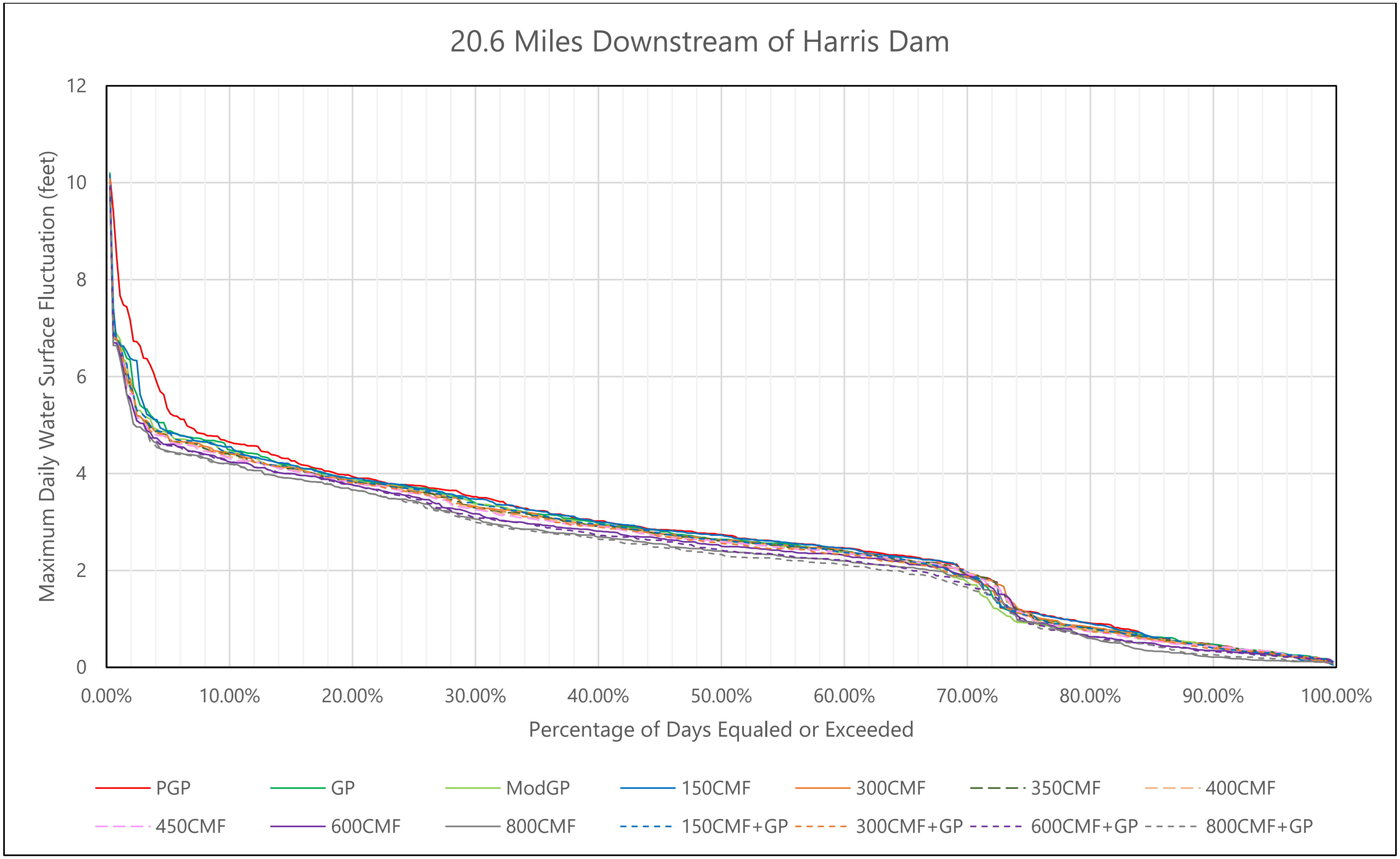

FIGURE 3–17 AVERAGE DAILY WATER SURFACE FLUCTUATION EXCEEDANCE CURVES FOR 20.6 MILES BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

TABLE 3-9 AVERAGE WATER SURFACE FLUCTUATION (IN FEET) EXCEEDANCE 36.6 MILES BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

Percentage of Days Equaled or Exceeded	Downstream Release Alternative													
	PGP	GP	ModGP	150CMF	300CMF	350CMF	400CMF	450CMF	600CMF	800CMF	150CMF +GP	300CMF +GP	600CMF +GP	800CMF +GP
1	4.18	4.14	4.18	4.51	4.47	4.45	4.42	4.38	4.33	4.2	4.18	4.31	4.18	4.08
5	3.29	3.26	3.24	3.23	3.22	3.21	3.24	3.24	3.23	3.11	3.24	3.22	3.23	3.12
10	3.05	3.09	3.02	3.05	3	2.99	2.99	2.98	2.94	2.87	3	3	2.93	2.86
20	2.62	2.66	2.62	2.64	2.63	2.62	2.6	2.6	2.58	2.53	2.62	2.61	2.58	2.53
30	2.37	2.37	2.3	2.38	2.4	2.39	2.34	2.33	2.29	2.22	2.33	2.37	2.21	2.17
40	2.05	2.08	2.02	2.08	2.04	2.03	2.02	2.02	1.96	1.93	2.06	2.02	1.95	1.89
50	1.7	1.7	1.67	1.73	1.75	1.76	1.76	1.76	1.75	1.72	1.71	1.72	1.71	1.68
60	1.42	1.42	1.41	1.44	1.47	1.48	1.49	1.5	1.51	1.5	1.41	1.44	1.45	1.41
70	1.14	1.14	1.12	1.15	1.14	1.14	1.13	1.13	1.11	1.06	1.12	1.12	1.07	1.02
80	0.59	0.6	0.61	0.65	0.69	0.67	0.64	0.65	0.6	0.62	0.64	0.62	0.57	0.56
90	0.24	0.23	0.22	0.26	0.26	0.26	0.24	0.24	0.23	0.24	0.24	0.26	0.24	0.25
95	0.13	0.10	0.09	0.11	0.11	0.10	0.09	0.09	0.10	0.11	0.12	0.12	0.13	0.13
99	0.06	0.06	0.06	0.06	0.05	0.05	0.04	0.04	0.05	0.05	0.06	0.06	0.07	0.07

Note: Table cells are shaded based a 3-color scale where green represents the lowest value, yellow is midpoint (50% value), and red is highest value in the table.

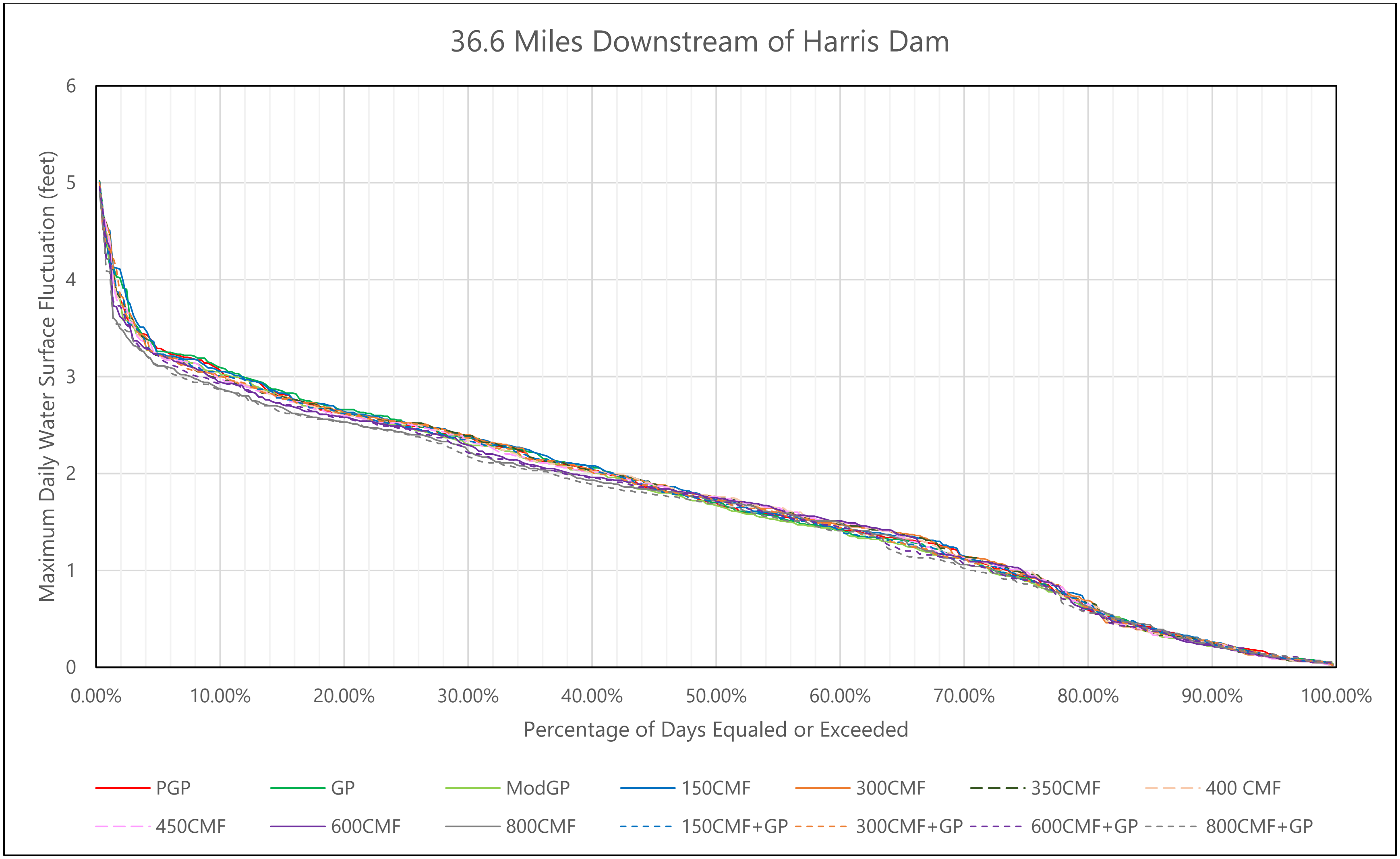

FIGURE 3–18 AVERAGE DAILY WATER SURFACE FLUCTUATION EXCEEDANCE CURVES FOR 36.6 MILES BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

3.5 Aquatic Resources

As indicated in the Study Plan, aquatic resources (aquatic habitat, water temperature, and fish entrainment) were assessed using the models developed for the Phase 1 Report.

3.5.1 Methods

Downstream Aquatic Habitat

Effects of downstream release alternatives on aquatic habitat in the Tallapoosa River downstream of Harris Dam were assessed using information developed in the Downstream Aquatic Habitat Study (Kleinschmidt 2021a). Specifically, each downstream release alternative was simulated using the HEC-RAS model, which generated an hourly time-series of wetted perimeter values at multiple river cross sections. The wetted perimeter data were then analyzed using the same methodology employed in the Downstream Aquatic Habitat Study to assess the amount and stability of wetted habitat.

Downstream Temperature

The effects of downstream release alternatives on water temperature in the tailrace, one mile, and seven miles downstream of Harris Dam were simulated using the water quality module of the HEC-RAS model. Specifically, water temperature data collected in 2019-2020 as part of the Downstream Aquatic Habitat Study were used to calibrate the model. Subsequently, simulations were run for each downstream release alternative for a duration of two weeks during a spring period (April), summer period (July), and fall period (September). The two-week periods were selected based on the availability of contiguous in-situ data from all three locations for the simulation window. The HEC-RAS model generated an hourly time-series of water temperature for each downstream release alternative. A winter period was not simulated since the reservoir is not thermally stratified during that time and water temperatures are typically uniform throughout the water column.

Fish Entrainment

The Desktop Fish Entrainment and Turbine Mortality Report (Kleinschmidt 2018b) estimated the rate of fish entrainment at Harris Dam under current operations using a database of fish entrainment information by the Electric Power Research Institute (EPRI

1992). Information used for the study were derived from specific studies on projects that are similar to Harris with regard to geographic location, station hydraulic capacity, station operation, and fish information (species, assemblage, water quality) and that had available entrainment data (Kleinschmidt 2018b). Estimated turbine-induced mortality rates were then applied to fish entrainment estimates to determine potential fish mortality.

Turbine-induced mortality rates can vary based on the volume or velocity of water passing through turbines. The effect of downstream release alternatives on fish entrainment at the Harris Project were assessed based on changes in volume and velocity of water passing the turbines.

3.5.2 RESULTS

Harris Reservoir

Due to the effects of downstream release alternatives on Harris Reservoir levels, aquatic resources in the reservoir were qualitatively assessed. The higher CMF alternatives (600CMF and 800CMF) result in lower average elevations in Harris Reservoir compared to GP, 150CMF, 300CMF, 350CMF, 400CMF, and 450CMF reducing the amount of littoral habitat for juvenile fish and mollusks. In the summer, lower reservoir elevations compared to existing operations (GP) could reduce retention time and cause less pronounced thermal stratification.

Fish Entrainment

Based on the assumption that the theoretical minimum flow unit would pull water from the existing penstock, the volume of water passing through the turbines would not differ among downstream release alternatives; therefore, fish entrainment is not expected to change under any of the downstream release alternatives. However, mortality of entrained fish could be affected depending on the design of the minimum flow unit (e.g., turbine speed, diameter, and number of runner blades).

Downstream Aquatic Habitat

With the exception of the PreGP alternative, all downstream release alternatives resulted in increases in wetted perimeter when compared with existing conditions (GP). The ModGP alternative resulted in the smallest percent increase in wetted perimeter over existing conditions (GP), ranging from 0.1 to 2.8 percent, and the 800CMF alternative resulted in the largest increase, ranging from 1.2 to 14.1 percent (Table 3-10). Increases in wetted perimeter over existing conditions (GP) generally diminished for each alternative with increasing distance from Harris Dam. It is notable that the addition of Green Plan pulses to the CMF alternatives did not result in substantial increases to wetted perimeter. Graphical depictions of wetted perimeter (habitat) duration are provided in Figures 3-19 through 3-29.

TABLE 3-10 COMPARISON OF PERCENT DIFFERENCE FROM EXISTING CONDITIONS (GP) IN AVERAGE WETTED PERIMETER BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

	Miles Below Harris Dam Habitat Type										
	0.2	1	2	4	7	10	14	19	23	38	43
Alternative	Riffle	Riffle	Riffle	Pool	Pool	Riffle	Run-Pool	Riffle-Run	Riffle	Riffle	Pool
PreGP	-1.2%	-0.5%	-2.2%	-0.2%	-2.0%	-0.3%	-0.1%	-0.6%	-0.5%	-0.1%	-0.1%
GP	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
ModGP	2.2%	0.6%	2.3%	0.2%	2.8%	0.5%	0.3%	0.6%	0.5%	0.5%	0.1%
150CMF	2.5%	0.7%	2.4%	0.2%	2.3%	0.5%	0.3%	0.7%	1.1%	0.6%	0.3%
300CMF	5.8%	2.2%	6.8%	0.5%	6.0%	1.1%	0.6%	2.4%	2.8%	1.3%	0.7%
350CMF	6.8%	2.4%	7.2%	0.6%	6.9%	1.3%	0.6%	3.0%	3.5%	1.5%	0.8%
400CMF	7.7%	2.6%	7.5%	0.7%	7.8%	1.4%	0.7%	3.7%	4.2%	1.7%	0.9%
450CMF	8.5%	2.7%	7.7%	0.7%	8.6%	1.5%	0.8%	4.5%	4.9%	1.8%	1.1%
600CMF	10.9%	3.2%	8.3%	1.0%	10.6%	1.9%	1.0%	7.1%	7.2%	2.2%	1.4%
800CMF	14.1%	4.0%	9.1%	1.2%	12.4%	2.4%	1.2%	10.9%	10.6%	2.8%	1.9%
150CMF+GP	3.0%	1.0%	3.4%	0.3%	3.5%	0.6%	0.3%	1.0%	1.0%	0.6%	0.2%
300CMF+GP	6.3%	2.4%	7.0%	0.5%	6.6%	1.2%	0.6%	2.7%	3.0%	1.3%	0.7%
600CMF+GP	11.1%	3.3%	8.4%	1.0%	10.8%	1.9%	1.0%	7.1%	7.4%	2.2%	1.4%
800CMF+GP	14.1%	4.1%	9.2%	1.2%	12.5%	2.4%	1.2%	10.8%	10.8%	2.8%	1.9%

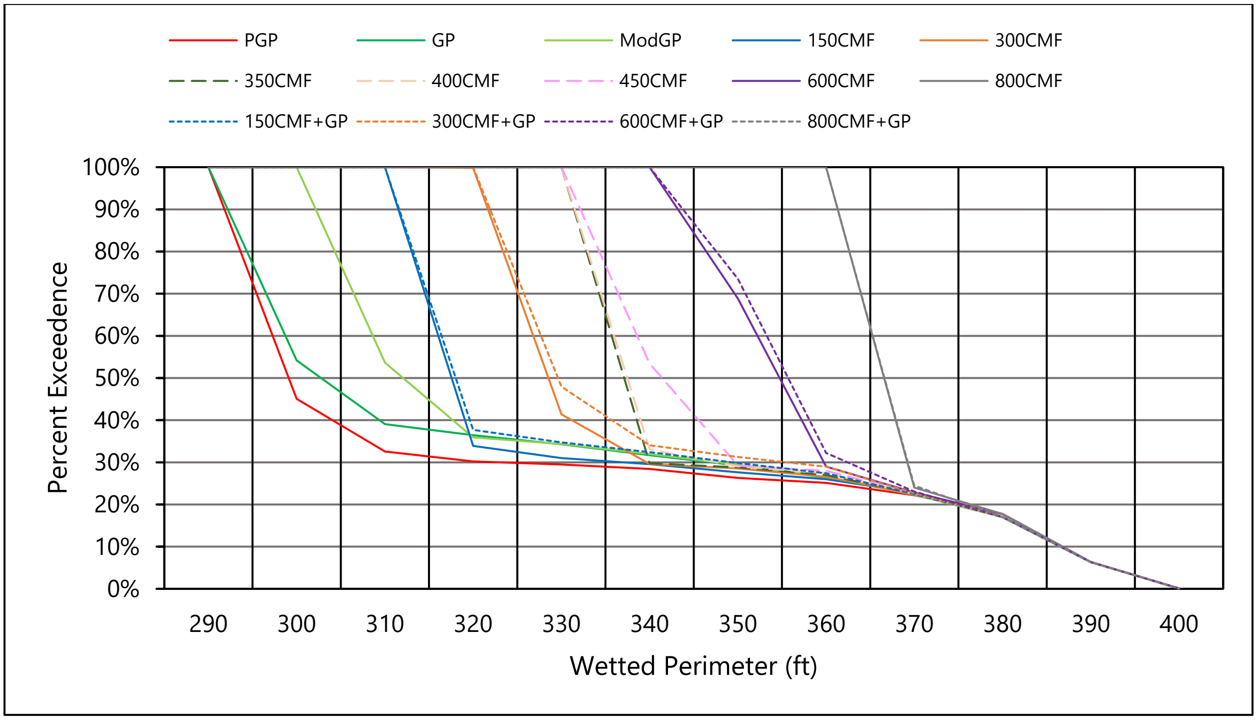

FIGURE 3–19 WETTED PERIMETER EXCEEDANCE CURVES FOR 0.2 MILES BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

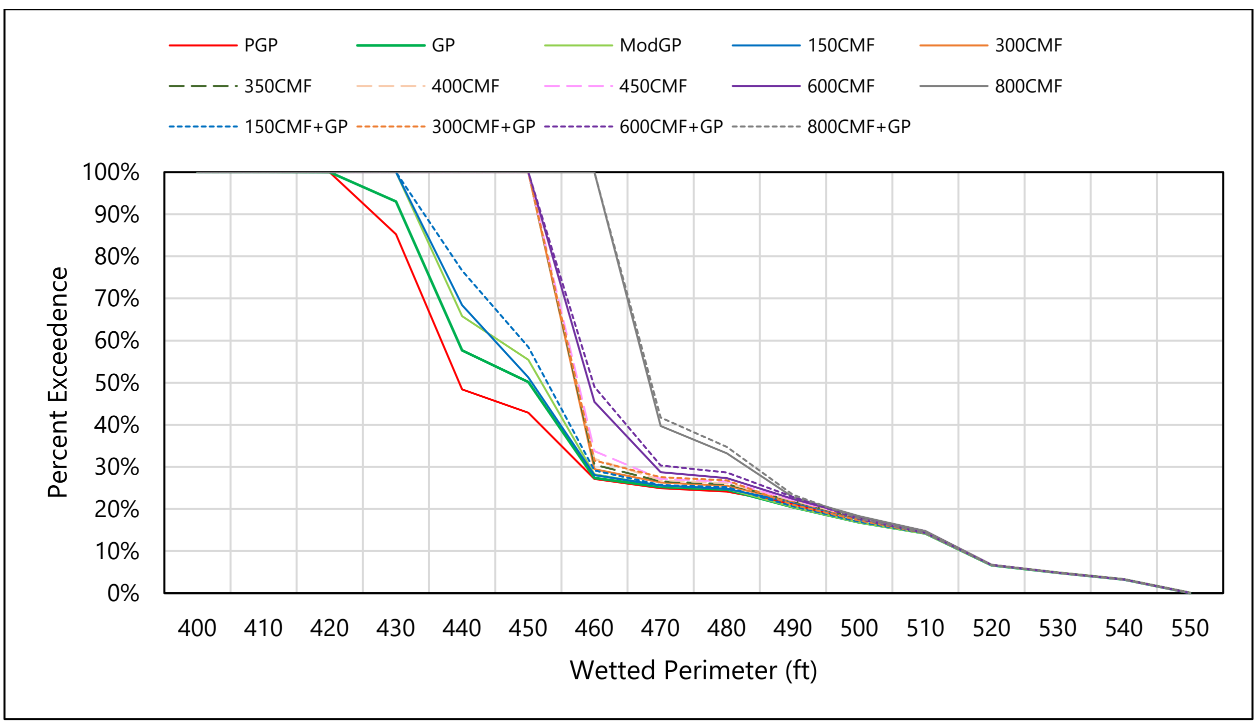

FIGURE 3–20 WETTED PERIMETER EXCEEDANCE CURVES FOR ONE MILE BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

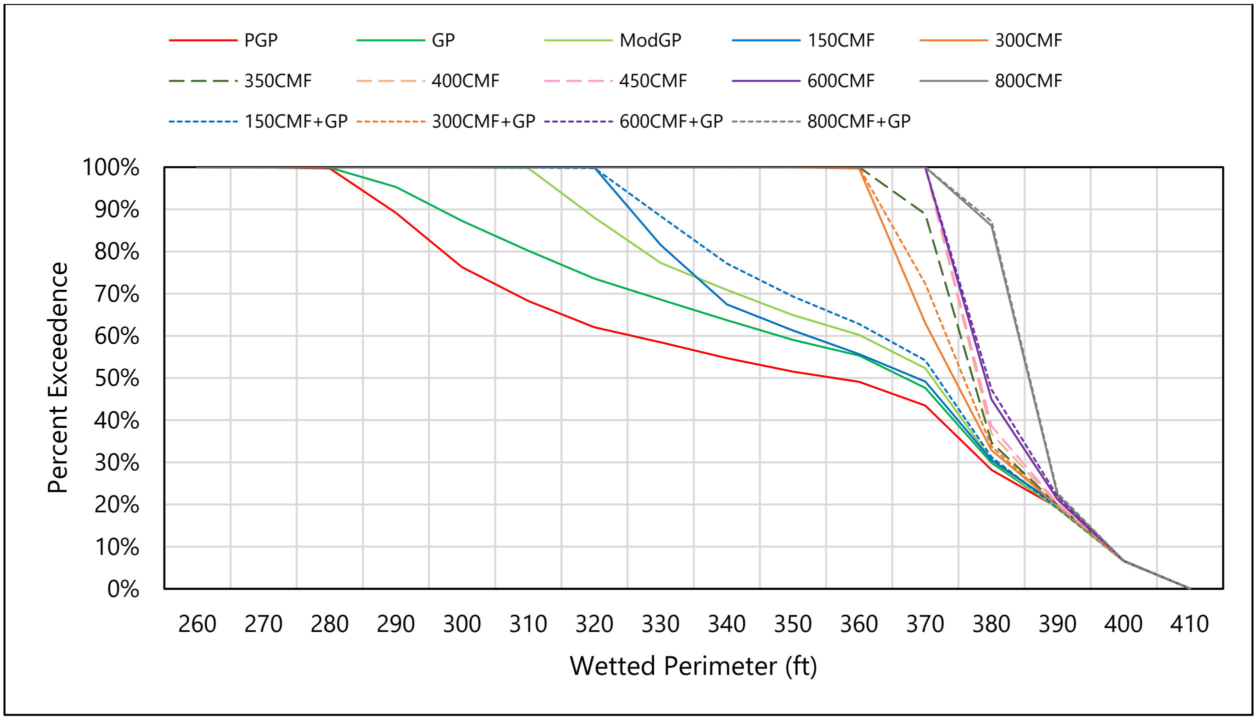

FIGURE 3–21 WETTED PERIMETER EXCEEDANCE CURVES FOR TWO MILES BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

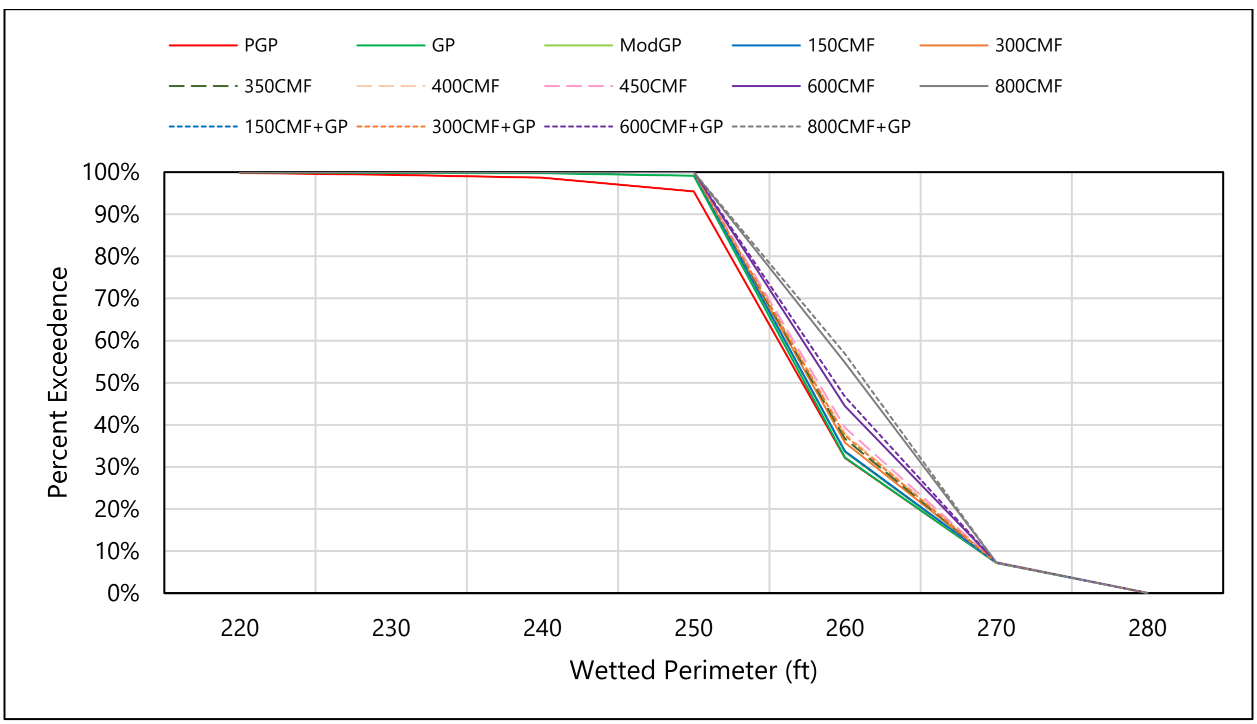

FIGURE 3–22 WETTED PERIMETER EXCEEDANCE CURVES FOR FOUR MILES BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

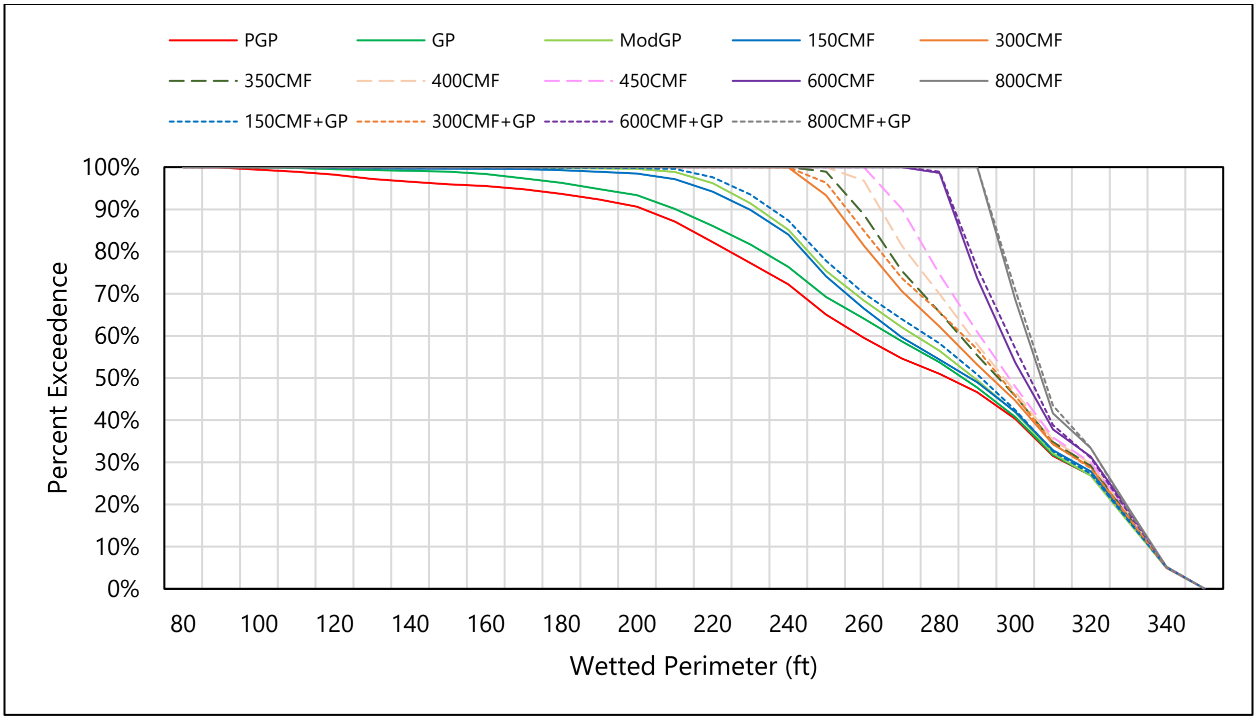

FIGURE 3–23 WETTED PERIMETER EXCEEDANCE CURVES FOR 7.5 MILES BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

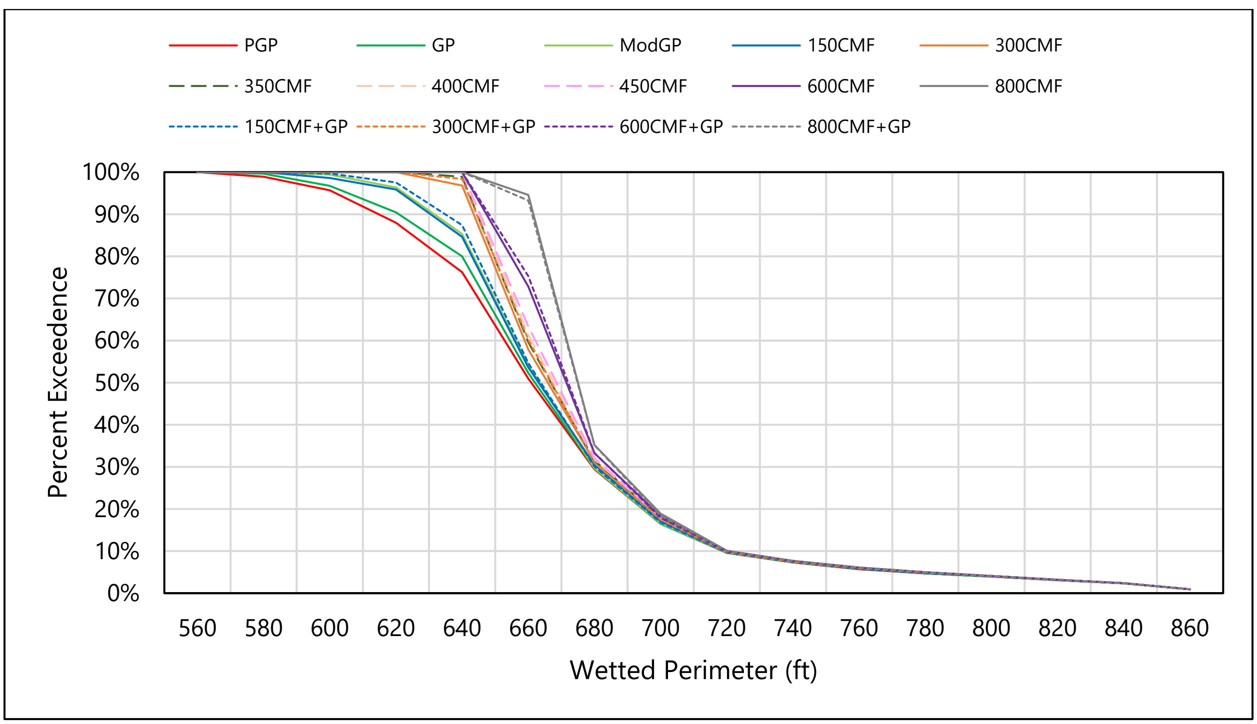

FIGURE 3–24 WETTED PERIMETER EXCEEDANCE CURVES FOR TEN MILES BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

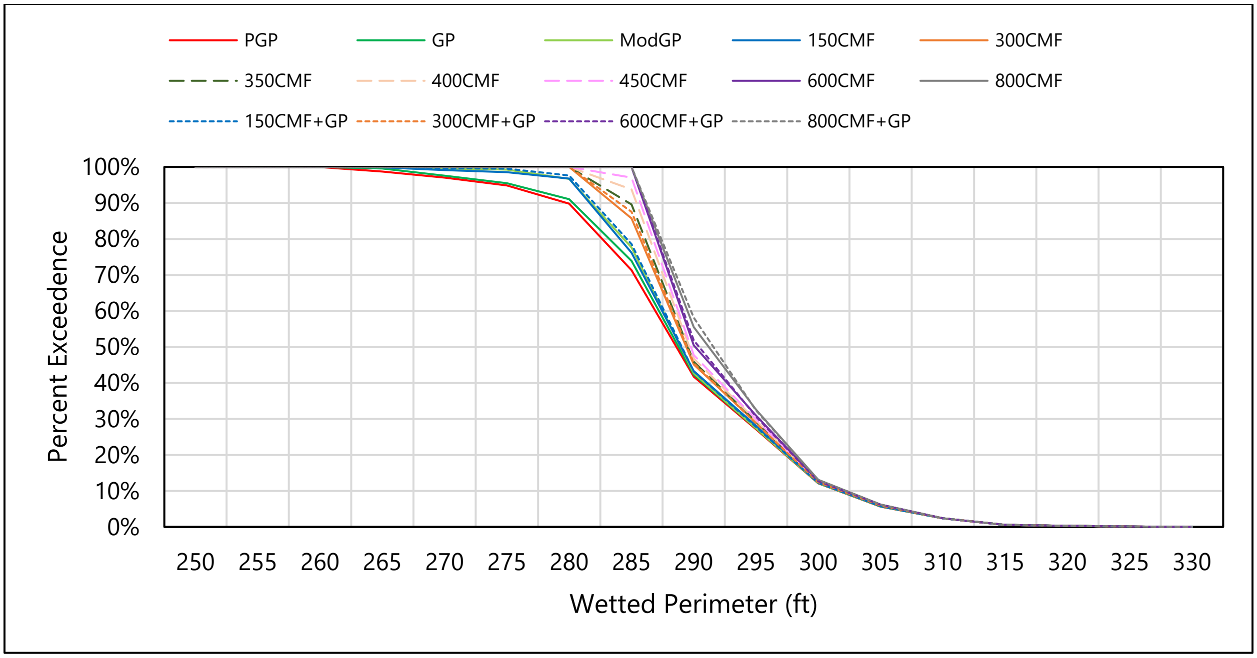

FIGURE 3–25 WETTED PERIMETER EXCEEDANCE CURVES FOR 14 MILES BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

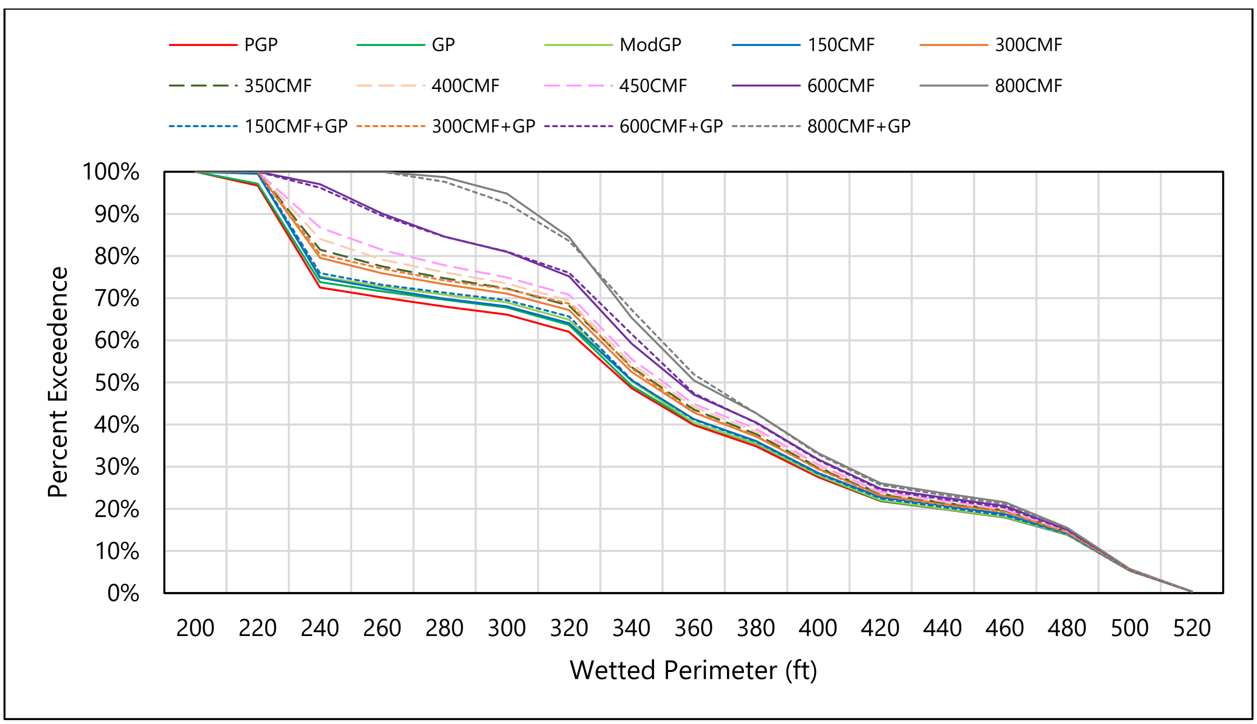

FIGURE 3–26 WETTED PERIMETER EXCEEDANCE CURVES FOR 19 MILES BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

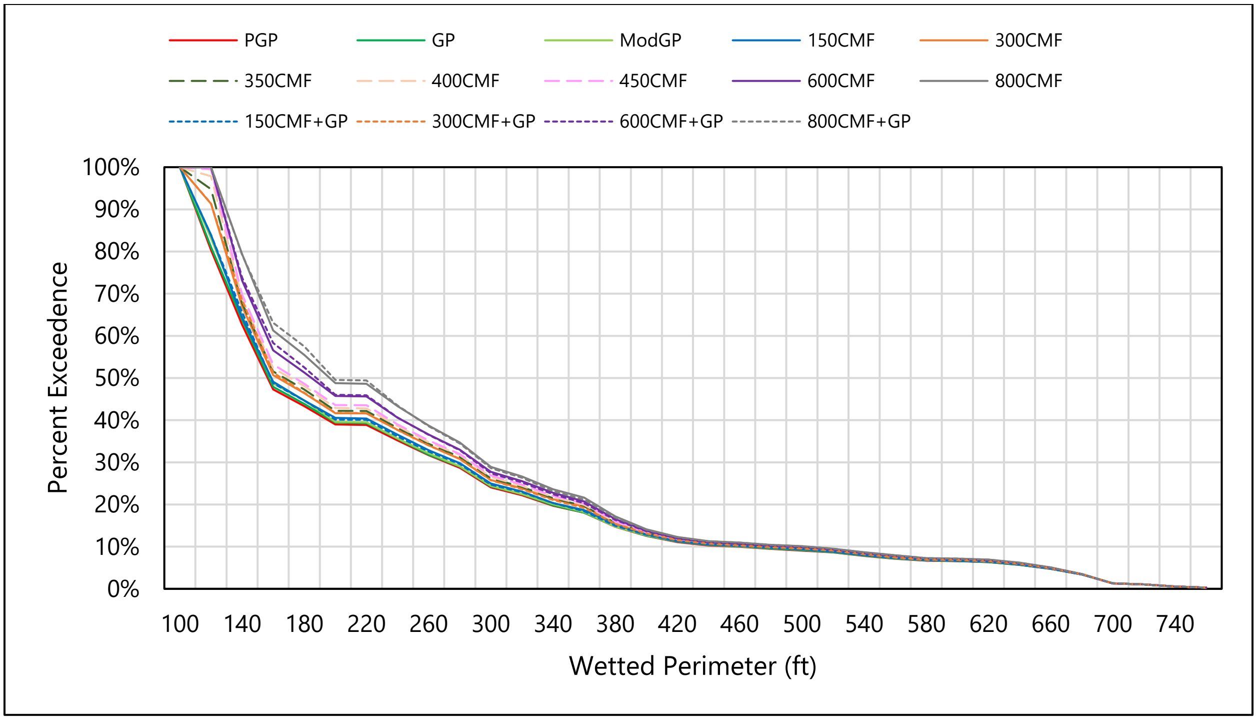

FIGURE 3–27 WETTED PERIMETER EXCEEDANCE CURVES FOR 23 MILES BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

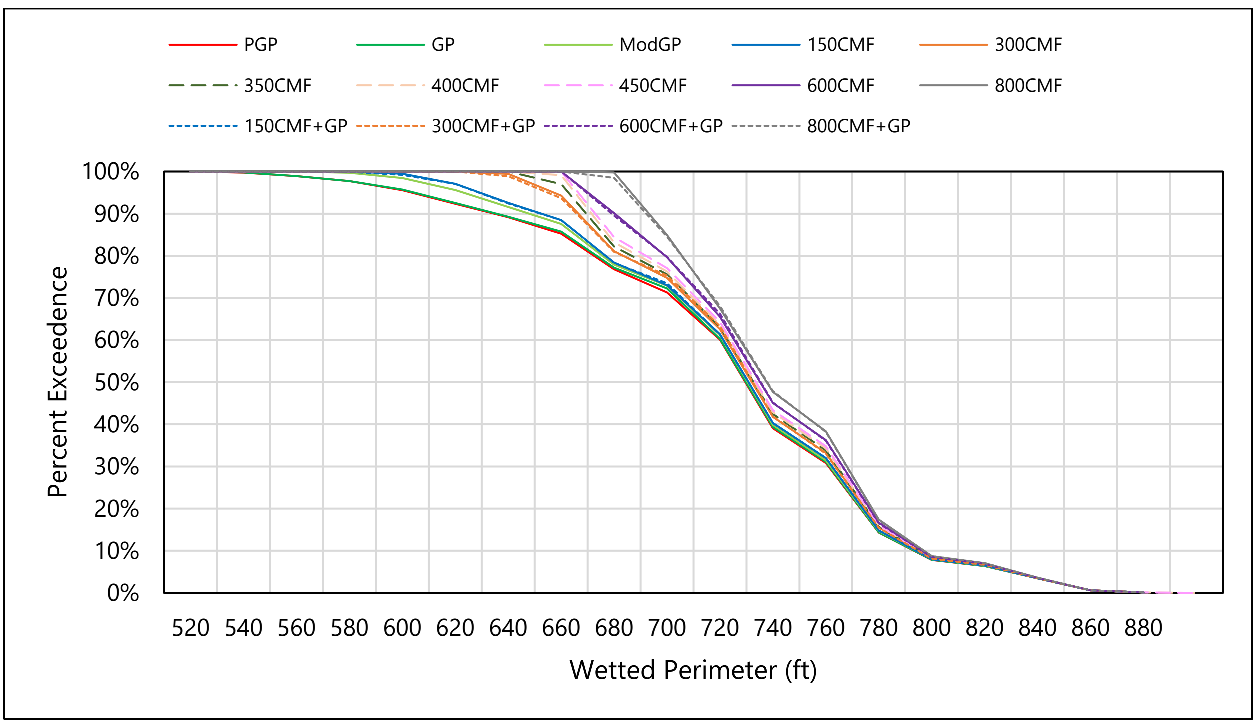

FIGURE 3–28 WETTED PERIMETER EXCEEDANCE CURVES FOR 38 MILES BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

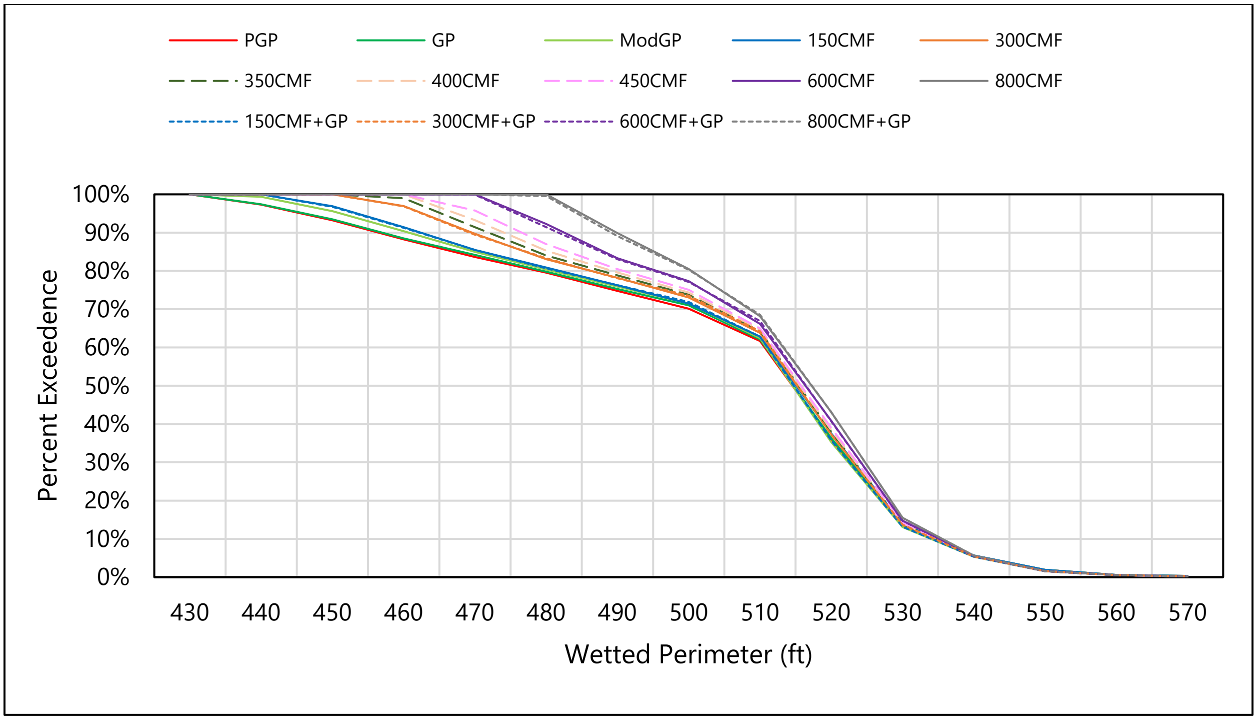

FIGURE 3–29 WETTED PERIMETER EXCEEDANCE CURVES FOR 43 MILES BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

Habitat stability was analyzed by comparing the average daily fluctuation of wetted perimeter (i.e., maximum minus minimum daily wetted perimeter) for each downstream release alternative. Based on the analysis, with the exception of PreGP, all release alternatives resulted in smaller daily wetted perimeter fluctuations (i.e., increased stability). The ModGP alternative resulted in the smallest percent decrease in wetted perimeter fluctuation over existing conditions (GP), ranging from 0 to -21 percent, and the 800CMF resulted in the largest percent decrease, ranging from 1 to -78 percent (Table 3-11). Decreases in wetted perimeter fluctuation over existing conditions (GP) generally diminished for each downstream release alternative with increasing distance from Harris Dam. It is notable that the addition of Green Plan pulses to the CMF alternatives resulted in only minor decreases in wetted perimeter fluctuation. Graphical depictions of wetted perimeter fluctuation are provided in Figure 3-30.

TABLE 3-11 COMPARISON OF PERCENT DIFFERENCE FROM EXISTING CONDITIONS (GP) IN DAILY WETTED PERIMETER FLUCTUATION BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

	Miles Below Harris Dam Habitat Type										
	0.2	1	2	4	7	10	14	19	23	38	43
Alternative	**Riffle**	**Riffle**	**Riffle**	**Pool**	**Pool**	**Riffle**	**Run-Pool**	**Riffle-Run**	**Riffle**	**Riffle**	**Pool**
PreGP	-1%	3%	5%	13%	16%	5%	4%	2%	0%	1%	1%
GP	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
ModGP	-15%	-7%	-21%	-9%	-19%	-7%	-9%	-2%	0%	-5%	-4%
150CMF	-20%	-7%	-31%	-7%	-11%	-3%	-5%	1%	1%	-3%	-2%
300CMF	-37%	-23%	-68%	-14%	-31%	-13%	-13%	0%	3%	-9%	-9%
350CMF	-42%	-24%	-72%	-17%	-35%	-15%	-15%	0%	3%	-10%	-11%
400CMF	-46%	-25%	-73%	-19%	-40%	-17%	-16%	0%	3%	-11%	-13%
450CMF	-50%	-26%	-74%	-21%	-44%	-18%	-18%	-1%	3%	-12%	-15%
600CMF	-61%	-29%	-78%	-28%	-56%	-22%	-23%	-5%	4%	-14%	-20%
800CMF	-77%	-32%	-82%	-35%	-64%	-26%	-28%	-16%	2%	-17%	-27%
150CMF+GP	-19%	-10%	-32%	-10%	-19%	-8%	-10%	-1%	1%	-5%	-5%
300CMF+GP	-37%	-25%	-70%	-18%	-35%	-16%	-16%	-3%	2%	-10%	-10%
600CMF+GP	-61%	-31%	-78%	-30%	-58%	-24%	-25%	-8%	2%	-15%	-21%
800CMF+GP	-78%	-34%	-82%	-37%	-66%	-28%	-29%	-17%	1%	-18%	-27%

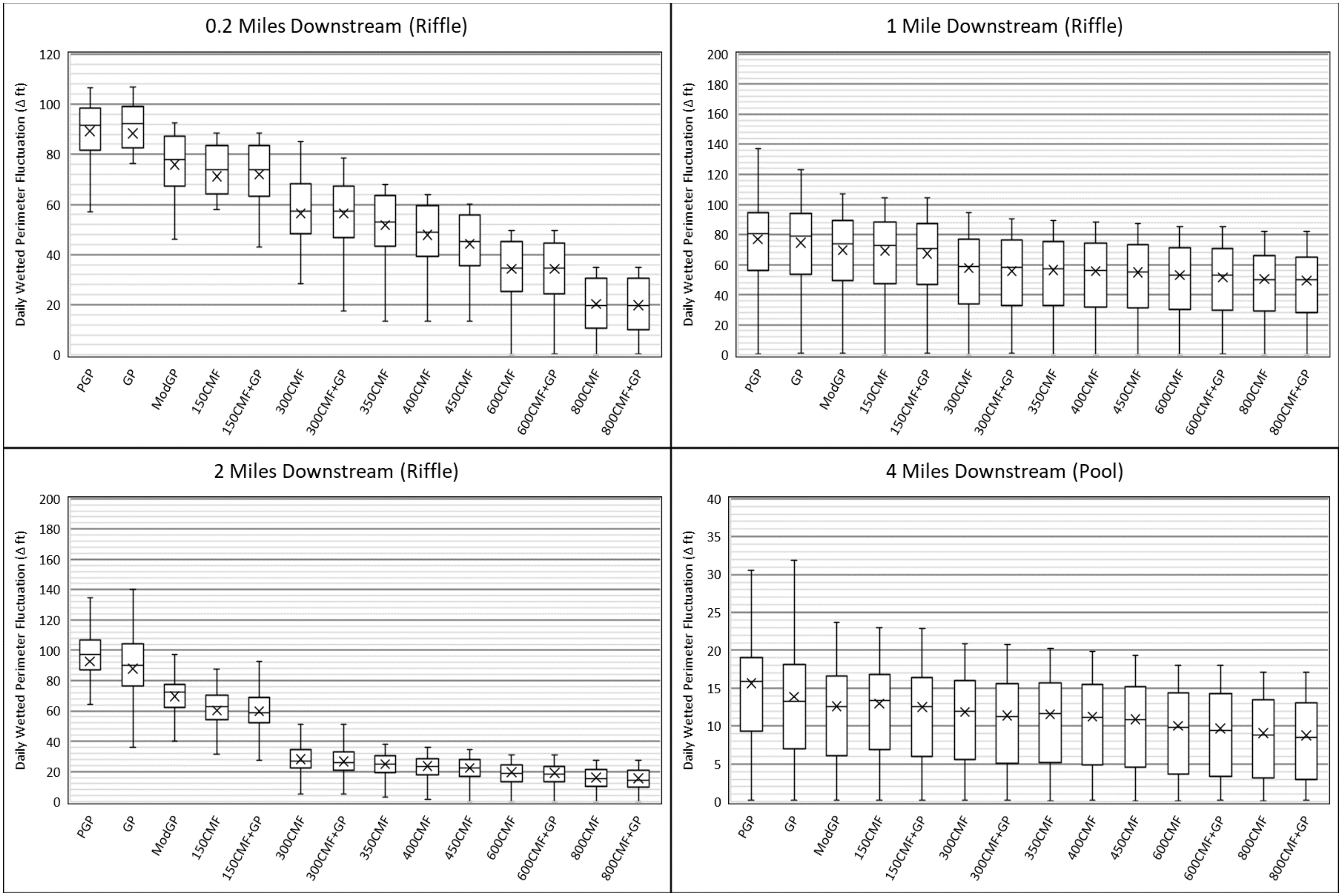

FIGURE 3–30 BOX PLOTS OF DAILY WETTED PERIMETER FLUCTUATION BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

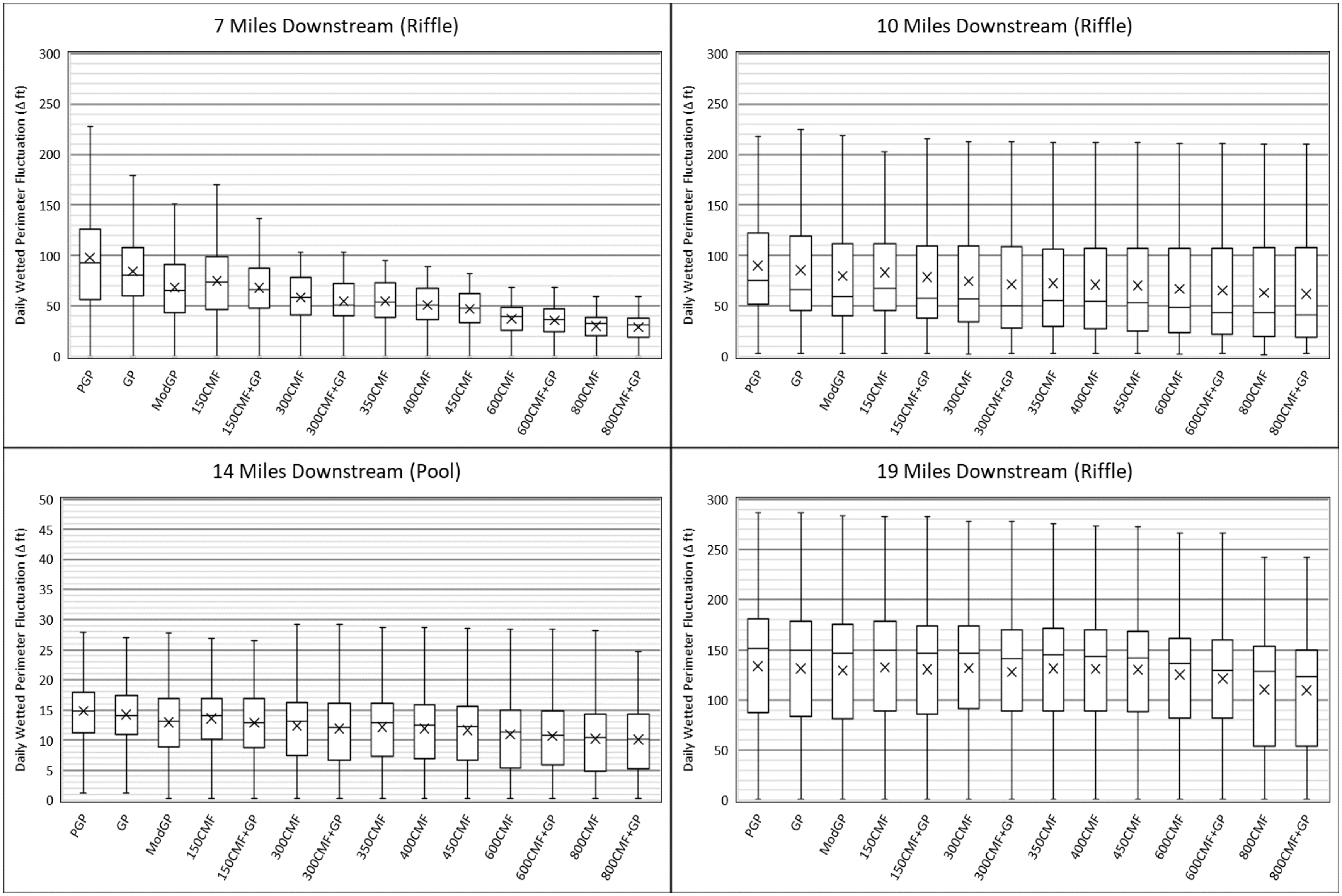

FIGURE 3-30 (CONTINUED)

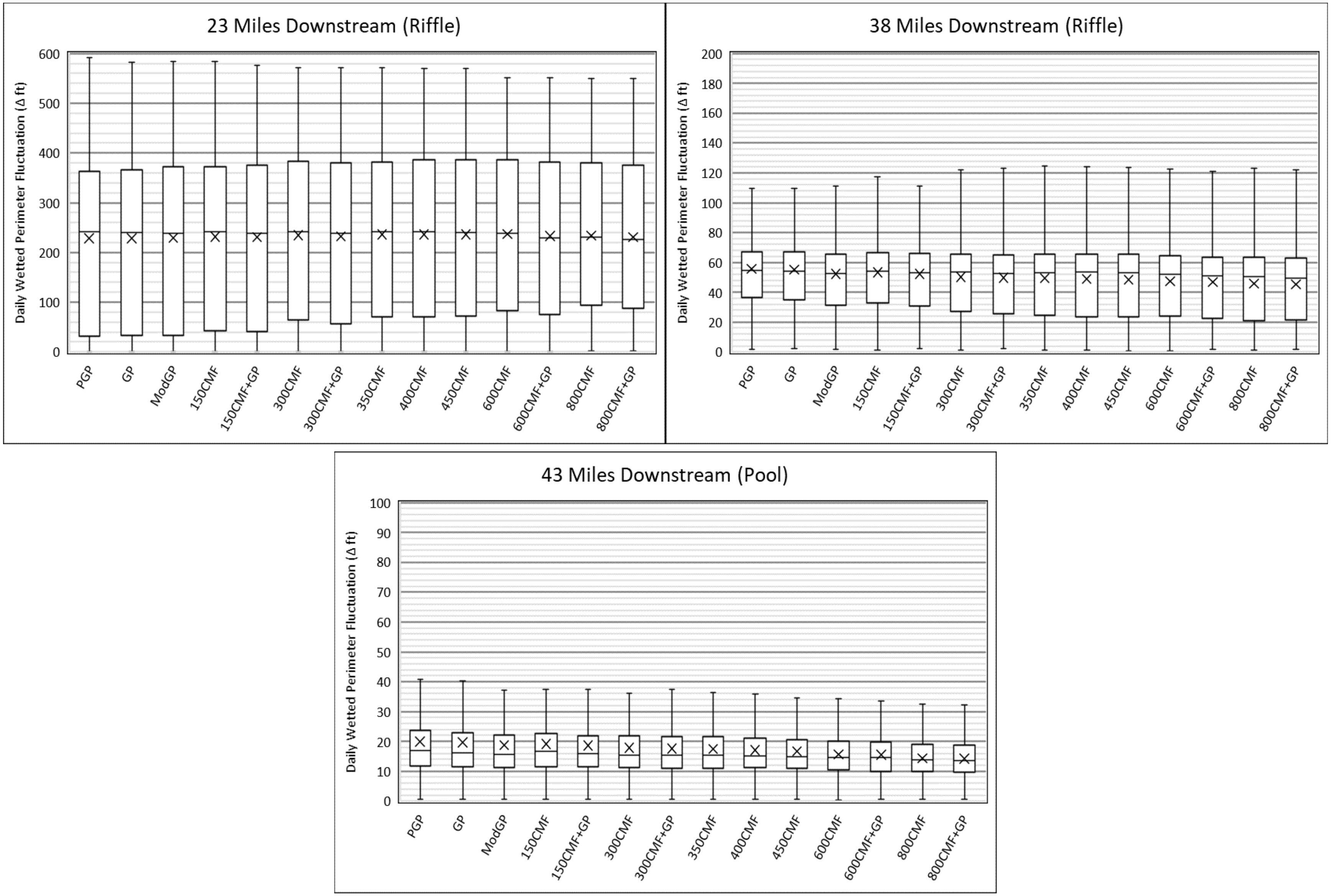

FIGURE 3-30 (CONTINUED)

Downstream Temperature

Results of the simulations using the water quality module of the HEC-RAS model revealed little difference in overall average water temperatures between each downstream release alternative. There were, however, noticeable differences in the magnitude of temperature fluctuations at the daily level (i.e., daily maximum minus daily minimum), especially near the dam. In the tailrace, average daily temperature fluctuations were 3.90 °C in the spring, 5.59 °C in the summer, and 4.60 °C in the fall under PreGP, compared to 1.88 °C, 1.79 °C, and 1.58 °C under 800CMF (Table 3-12). Maximum daily, average hourly, and maximum hourly water temperature fluctuations generally followed this same trend, both in the tailrace and one mile downstream of Harris Dam. Differences between all downstream release alternatives were relatively small when compared at a location seven miles downstream of Harris Dam (Figures 3-31 through 3-33).

TABLE 3-12 WATER TEMPERATURE STATISTICS (IN DEGREES CELSIUS) BELOW HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

		Spring					Summer					Fall				
	Alternative	Period Avg	Avg Daily Δ	Max Daily Δ	Avg Hourly Δ	Max Hourly Δ	Period Avg	Avg Daily Δ	Max Daily Δ	Avg Hourly Δ	Max Hourly Δ	Period Avg	Avg Daily Δ	Max Daily Δ	Avg Hourly Δ	Max Hourly Δ
Tailrace	PGP	16.95	3.90	6.79	0.35	5.90	24.76	5.59	6.89	0.52	4.10	25.72	4.60	5.78	0.398	2.63
	GP	16.95	3.88	6.79	0.35	5.90	23.94	4.32	5.23	0.54	3.90	25.39	3.61	4.40	0.39	2.99
	ModGP	16.98	3.85	6.79	0.36	5.90	24.12	4.00	4.88	0.54	4.25	25.68	3.51	4.48	0.39	2.19
	150CMF	17.02	2.89	4.88	0.27	3.98	23.79	3.27	4.08	0.40	2.81	25.63	3.09	4.01	0.28	1.99
	150CMF+GP	17.02	2.89	4.88	0.27	3.98	23.79	3.27	4.08	0.40	2.81	25.45	2.71	3.41	0.29	1.98
	300CMF	17.06	2.36	3.71	0.23	2.85	23.65	2.54	3.24	0.31	2.04	25.56	2.20	2.89	0.23	1.61
	300CMF+GP	17.06	2.36	3.71	0.23	2.85	23.65	2.54	3.24	0.31	2.04	25.47	2.13	2.72	0.25	1.57
	350CMF	17.07	2.25	3.47	0.22	2.68	23.62	2.39	3.06	0.29	1.88	25.55	2.00	2.28	0.22	1.59
	400CMF	17.08	2.18	3.30	0.22	2.57	23.60	2.27	2.91	0.27	1.75	25.53	1.90	2.13	0.22	1.58
	450CMF	17.09	2.11	3.15	0.22	2.47	23.58	2.16	2.78	0.26	1.64	25.52	1.81	2.03	0.22	1.57
	600CMF	17.11	1.97	2.90	0.00	2.26	23.52	1.93	2.48	0.23	1.39	25.50	1.68	2.15	0.22	1.56
	600CMF+GP	17.11	1.97	2.90	0.00	2.26	23.52	1.93	2.48	0.23	1.39	25.48	1.69	2.14	0.23	1.55
	800CMF	17.12	1.88	2.75	0.01	2.12	23.48	1.79	2.27	0.21	1.31	25.49	1.58	1.98	0.22	1.60
	800CMF+GP	17.12	1.88	2.75	0.01	2.12	23.48	1.79	2.27	0.21	1.31	25.48	1.58	1.97	0.22	1.60
1-mi Downstream	PGP	16.82	5.03	8.85	0.43	6.96	25.38	7.43	9.37	0.67	5.87	25.87	6.48	8.36	0.548	3.38
	GP	16.85	5.00	8.85	0.43	6.96	24.15	5.15	6.04	0.59	4.07	25.41	4.75	5.67	0.45	2.22
	ModGP	16.90	4.95	8.85	0.44	6.96	24.43	5.01	6.37	0.63	5.40	25.81	4.65	5.59	0.45	2.65
	150CMF	16.94	3.80	6.47	0.34	4.40	24.03	4.20	5.03	0.47	3.11	25.75	4.47	5.71	0.38	2.38
	150CMF+GP	16.94	3.80	6.47	0.34	4.40	24.03	4.20	5.03	0.47	3.11	25.48	3.44	4.06	0.32	1.64
	300CMF	17.02	2.90	4.78	0.27	2.82	23.88	3.28	4.05	0.36	2.24	25.65	2.98	3.72	0.26	1.63
	300CMF+GP	17.02	2.90	4.78	0.27	2.82	23.88	3.28	4.05	0.36	2.24	25.53	2.57	3.04	0.24	1.14
	350CMF	17.03	2.73	4.47	0.25	2.59	23.84	3.08	3.83	0.34	2.06	25.62	2.73	3.37	0.24	1.50
	400CMF	17.04	2.60	4.22	0.24	2.39	23.81	2.92	3.65	0.32	1.91	25.61	2.54	3.13	0.23	1.38

	Alternative	Spring					Summer					Fall				
		Period Avg	Avg Daily Δ	Max Daily Δ	Avg Hourly Δ	Max Hourly Δ	Period Avg	Avg Daily Δ	Max Daily Δ	Avg Hourly Δ	Max Hourly Δ	Period Avg	Avg Daily Δ	Max Daily Δ	Avg Hourly Δ	Max Hourly Δ
	450CMF	17.05	2.50	4.01	0.24	2.23	23.79	2.79	3.48	0.30	1.78	25.59	2.38	2.94	0.22	1.30
	600CMF	17.08	2.25	3.54	0.22	1.96	23.72	2.48	3.12	0.26	1.51	25.56	2.04	2.50	0.21	1.11
	600CMF+GP	17.08	2.25	3.54	0.22	1.96	23.72	2.48	3.12	0.26	1.51	25.54	1.92	2.24	0.20	0.94
	800CMF	17.10	2.07	3.18	0.21	1.76	23.65	2.24	2.81	0.23	1.30	25.54	1.79	2.17	0.20	0.97
	800CMF+GP	17.10	2.07	3.18	0.21	1.76	23.65	2.24	2.81	0.23	1.30	25.53	1.74	2.00	0.19	0.92
7-mi Downstream	PGP	16.78	3.67	5.31	0.29	2.65	26.98	3.80	5.17	0.32	0.91	26.48	2.96	4.19	0.255	0.79
	GP	16.78	3.67	5.31	0.29	2.65	25.80	4.19	5.31	0.33	1.89	26.66	2.84	3.64	0.24	0.78
	ModGP	16.79	3.70	5.31	0.29	2.65	25.80	4.18	5.31	0.34	1.78	26.67	2.52	3.31	0.22	0.66
	150CMF	16.78	3.64	5.07	0.29	2.51	25.62	4.05	5.12	0.32	1.79	26.41	2.92	4.11	0.25	0.76
	150CMF+GP	16.78	3.64	5.07	0.29	2.51	25.62	4.05	5.12	0.32	1.79	26.50	2.73	3.54	0.23	0.74
	300CMF	16.79	3.57	5.15	0.28	2.29	25.37	3.90	5.10	0.31	1.63	26.18	2.97	4.14	0.25	0.71
	300CMF+GP	16.79	3.57	5.15	0.28	2.29	25.37	3.90	5.10	0.31	1.63	26.28	2.67	3.53	0.23	0.68
	350CMF	16.80	3.53	5.05	0.28	2.24	25.30	3.86	5.10	0.30	1.58	26.14	2.99	4.14	0.26	0.70
	400CMF	16.80	3.50	4.98	0.28	2.18	25.23	3.83	5.10	0.30	1.54	26.10	3.02	4.14	0.26	0.70
	450CMF	16.81	3.46	4.92	0.27	2.12	25.28	3.81	5.10	0.30	1.49	26.06	3.03	4.11	0.26	
	600CMF	16.83	3.36	4.77	0.27	1.94	25.02	3.75	5.10	0.30	1.38	25.97	3.07	4.11	0.27	0.68
	600CMF+GP	16.83	3.36	4.77	0.27	1.94	25.02	3.75	5.10	0.30	1.38	26.07	2.83	3.70	0.24	0.65
	800CMF	16.86	3.23	4.60	0.25	1.77	24.86	3.66	5.10	0.29	1.27	25.89	3.05	3.99	0.26	0.71
	800CMF+GP	16.86	3.23	4.60	0.25	1.77	24.86	3.66	5.10	0.29	1.27	25.99	2.86	3.69	0.25	0.62

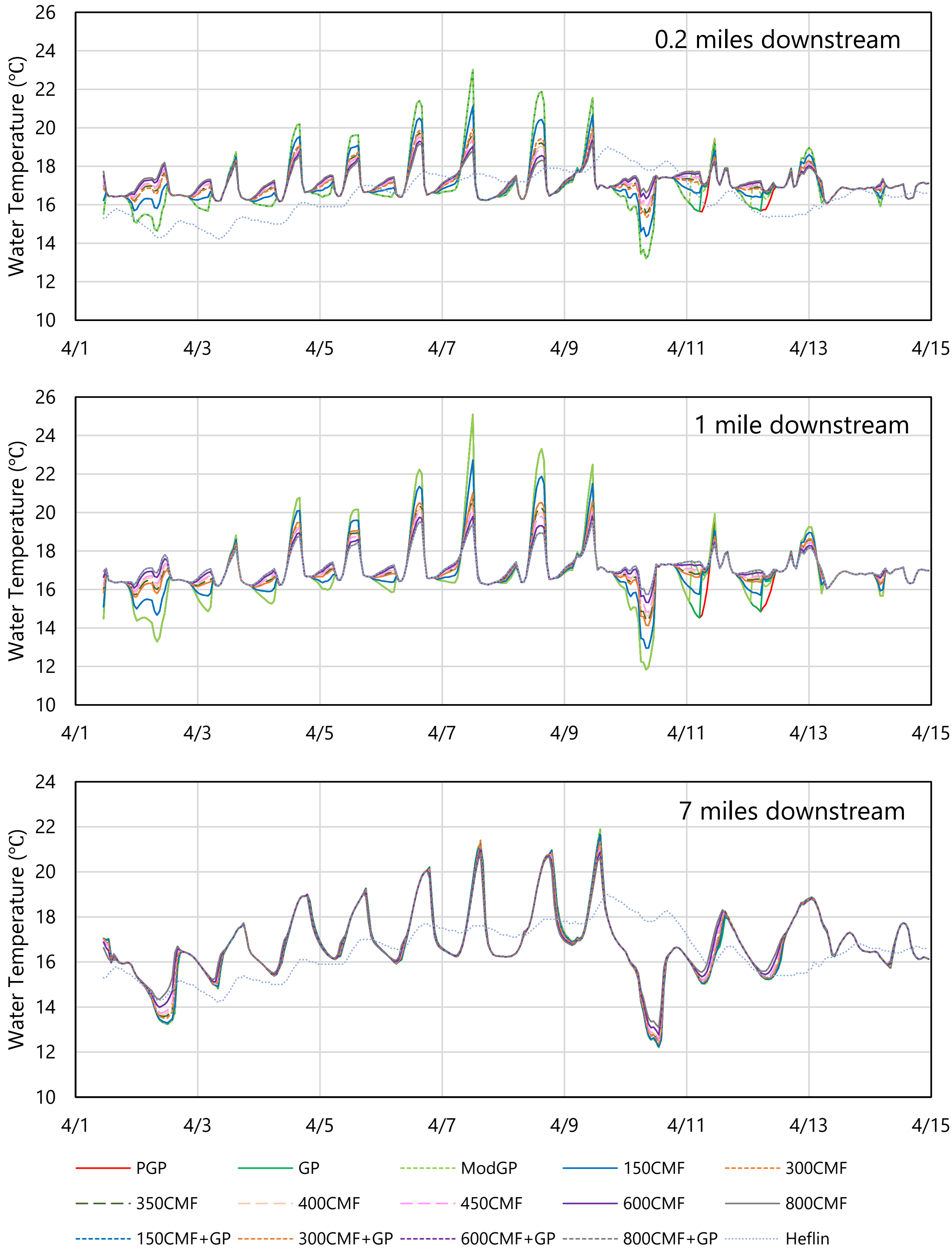

FIGURE 3–31 HOURLY WATER TEMPERATURE BELOW HARRIS DAM DURING SPRING PERIOD BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

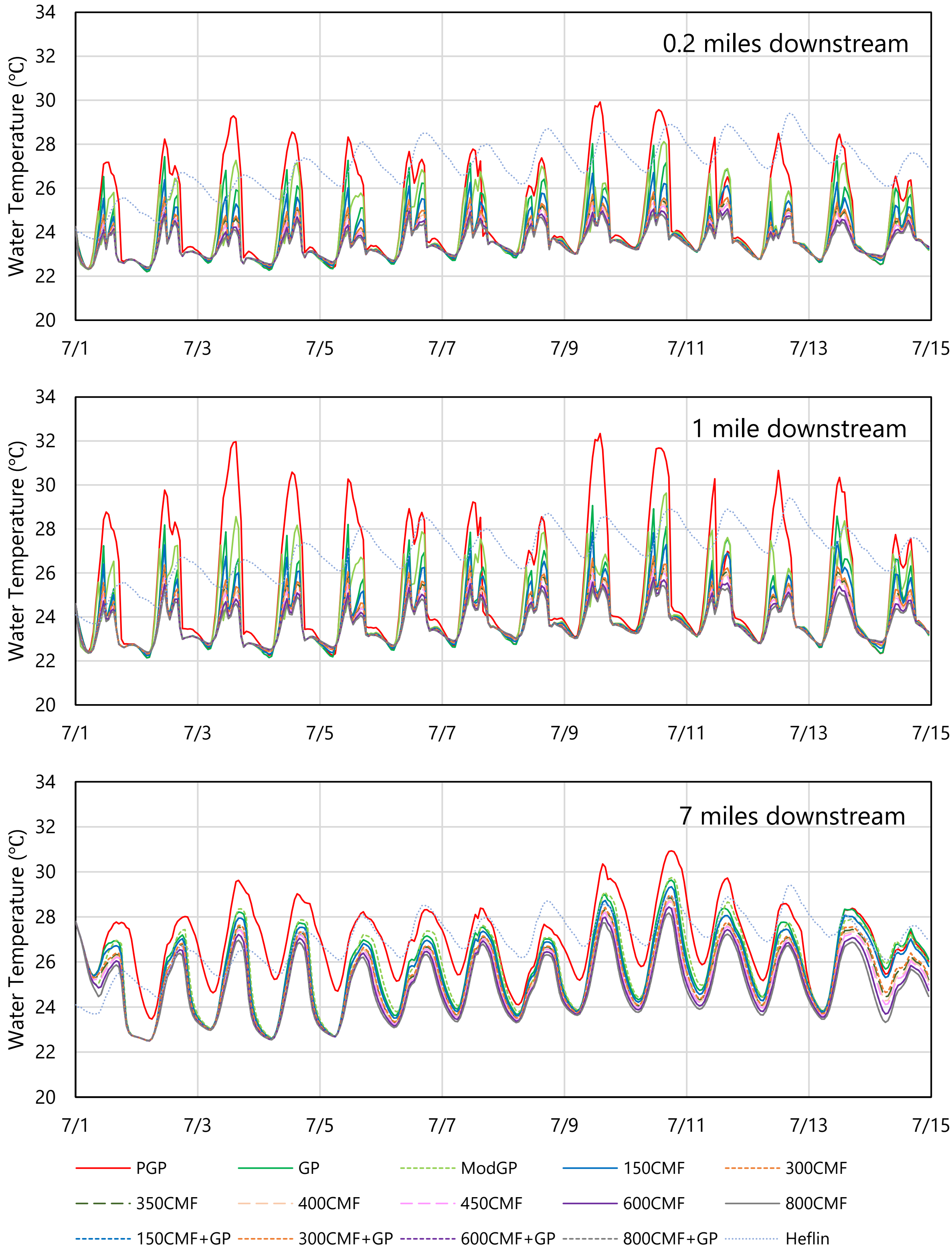

FIGURE 3–32 HOURLY WATER TEMPERATURE BELOW HARRIS DAM DURING SUMMER PERIOD BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

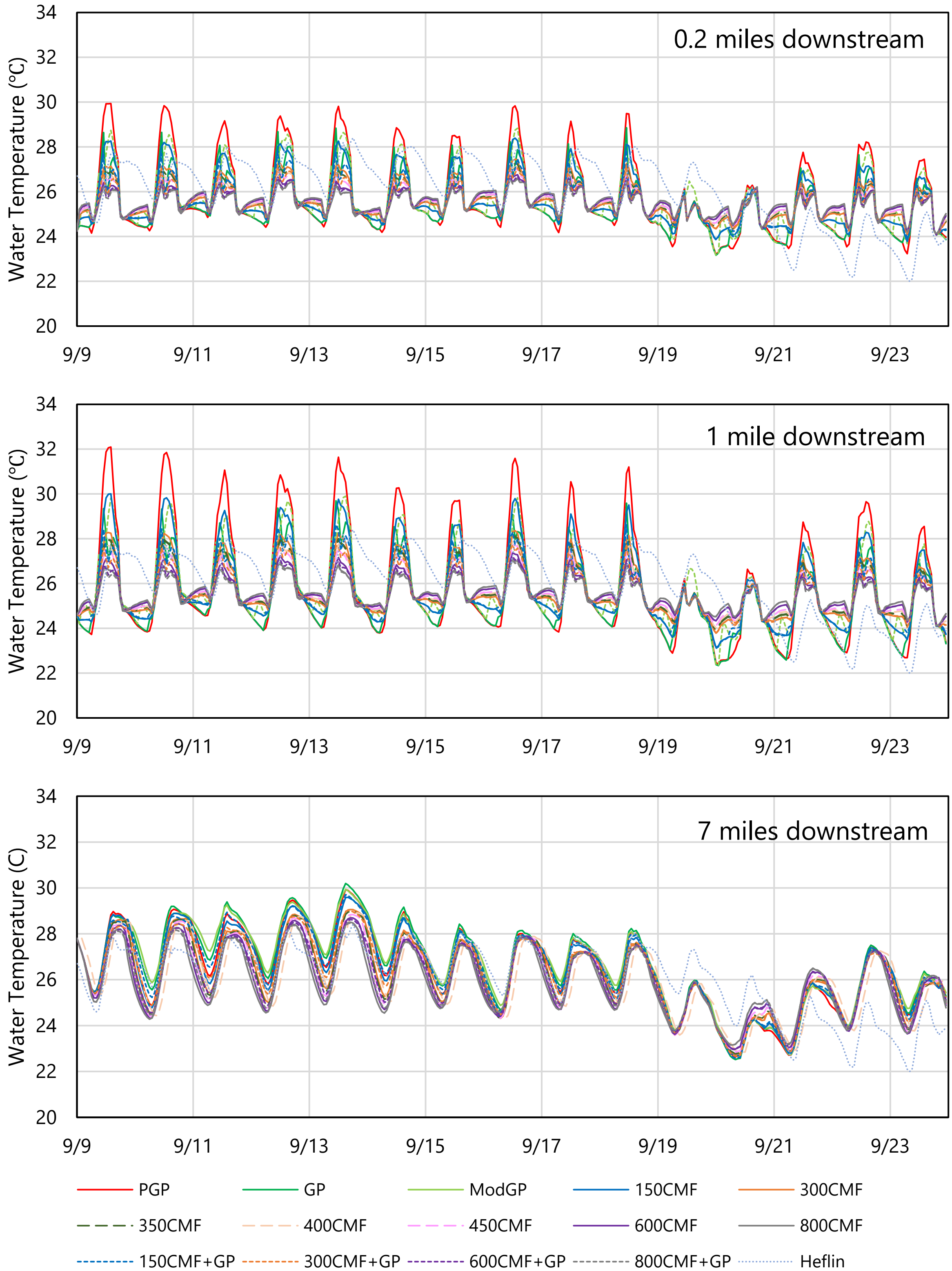

FIGURE 3–33 HOURLY WATER TEMPERATURE BELOW HARRIS DAM DURING FALL PERIOD BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

3.6 Wildlife, Terrestrial, and Endangered Species

As indicated in the Study Plan, the effects of downstream release alternatives on wildlife resources and threatened and endangered species were assessed using the models developed for the Phase 1 Report.

3.6.1 METHODS

Wildlife and Terrestrial Resources

Alabama Power used the outputs from the HEC-ResSim and HEC-RAS models to assess the effects of downstream release alternatives on wildlife and terrestrial resources.

Threatened and Endangered Species

Alabama Power used the Threatened and Endangered Species Study and outputs from the HEC-RAS model to assess the effects of downstream release alternatives on threatened and endangered species.

3.6.2 RESULTS

Harris Reservoir

Effects on wildlife and terrestrial resources around Harris Reservoir would be limited to the downstream release alternatives that result in lowering the elevation of Harris Reservoir below baseline conditions (GP). Figures 3-1 and 3-2 show that 600CMF, 600CMF+GP, 800CMF, and 800CMF+GP result in lowering the water surface elevation for all months of the year. These lower water elevations result in a net decrease in littoral habitat[13], decreasing the available habitat for amphibians, mussels, and other invertebrates that only persist in shallow water. Areas of Harris Reservoir that are permanently de-wetted due to lower water elevations throughout the year are expected to shift in habitat type. Permanently exposed areas would be dominated by mud flats, which may increase foraging sites for wading birds and small mammals. As mud flats dry due to constant sun exposure, these areas would naturally revegetate, increasing habitat for terrestrial species such as small mammals and birds.

[13] Littoral habitat is defined as the shoreline to 8.2 feet below low water (FGDC 2013).

<u>Tallapoosa River Downstream of Harris Dam</u>

Modifying the flow release from Harris Dam would affect the wetted perimeter and wetted perimeter fluctuation in the Tallapoosa River between Harris Dam and Horseshoe Bend. Changes in wetted perimeter and wetted perimeter fluctuation would affect the littoral habitat between Harris Dam and Horseshoe Bend. No other habitat type, such as upland habitats, are expected to be significantly affected by these changes. Thus, only littoral habitat was analyzed. The following sections outline the trends of each downstream release alternative and how the alternatives are expected to affect littoral habitat.

Wetted Perimeter

Littoral habitat is expected to increase at a similar percentage rate as the wetted perimeter. Greater amounts of wetted perimeter may result in marginal increases in availability of shallow breeding sites for early spring breeding amphibians (Appendix D).

Compared to current operations, all downstream release alternatives (excluding the PreGP alternative) would increase the daily wetted perimeter between Harris Dam and Horseshoe Bend (Table 3-10). Generally, as downstream flows increase, percent wetted perimeter increases. Thus, 150CMF and 150CMF+GP produce the least percent wetted perimeter increase, and 800CMF and 800CMF+GP produce the greatest percent wetted perimeter increase. The addition of Green Plan pulses to the CMF alternatives did not result in substantial increases to wetted perimeter.

Wetted Perimeter Fluctuation

Littoral habitat is expected to be positively affected by less fluctuation in wetted perimeter. A more stable wetted perimeter results in constant, less variable shallow breeding sites for early spring breeding amphibians (Appendix D). As water perimeter fluctuations decrease, littoral habitat viability increases.

Compared to existing conditions (GP), all release alternatives (excluding PreGP) would decrease the wetted perimeter fluctuation between Harris Dam and Horseshoe Bend. Generally, as the downstream release alternatives increase, percent wetted perimeter fluctuation decreases. The ModGP alternative resulted in the smallest percent decrease in wetted perimeter fluctuation over existing conditions (GP), ranging from 0 to -21 percent, and the 800CMF resulted in the largest percent decrease, ranging from 1 to -78 percent (Table 3-11).

Continuous minimum flows with GP pulses have a slightly greater percent decrease (generally two percent or less depending on the type of habitat) than the same flow without the addition of GP pulses. As flow releases increase, the percent difference between the continuous minimum flow with and without the addition of Green Plan pulses decreases, resulting in virtually identical percent wetted perimeter fluctuation results. The 800CMF and 800CMF+GP alternatives are virtually identical, providing the greatest percent increase in littoral habitat stability. The 150CMF alternative provides the least percent increase in littoral habitat stability, with the ModGP alternative falling between 150CMF and the slightly greater 150CMF+GP alternative.

All proposed downstream release alternatives are expected to have a positive effect on wildlife and terrestrial resources in the Tallapoosa River below Harris Dam. The 150CMF and 150CMF+GP alternatives would provide the least net increase in littoral habitat, and the 800CMF and 800CMF+GP alternatives would provide the most net increase in littoral habitat. Project operations that increase wetted perimeter and decrease wetted perimeter fluctuations would have a beneficial effect on wildlife and terrestrial resources downstream of Harris Dam.

Threatened and Endangered Species

No T&E species or critical habitats are present in the Tallapoosa River from Harris Dam through Horseshoe Bend; therefore, there would be no effects on T&E species from any of the downstream release alternatives.

3.7 Recreation

As indicated in the Study Plan, downstream recreation resources were assessed using the models developed for the Phase 1 Report. Effects on Harris Reservoir recreation (recreation access) were also evaluated due to potential changes in lake levels associated with the downstream release alternatives.

3.7.1 METHODS

Harris Reservoir

HEC-ResSim modeling was used to determine the impact of downstream release alternatives on average winter and summer pool elevation. The number of usable recreation structures on Harris Reservoir under each downstream release alternative, including private docks and public ramps, were then determined.

The two key components of determining the usability of a structure are: 1) water depth and 2) the location on the structure at which water depth is measured. Elevation data was gathered during winter pool using LIDAR, a remote sensing method that uses pulsed lasers to measure distances. The elevation data was overlain with aerial imagery of the area so that each pixel of the imagery had an elevation value.[14] Using the elevation data, imagery of the winter operating curve contours was developed (Figure 3-34). These data were used to determine at what elevation water reaches a structure.

FIGURE 3–34 EXAMPLE ELEVATION CONTOURS FOR EACH WINTER POOL ALTERNATIVE

Alabama Power keeps and maintains an inventory of recreation structures on Lake Harris by gathering GPS data near or at each recreation structure and classifying those structures by type (e.g., boathouses, floats, piers, wet slips, and boardwalks). GPS data were converted to a shapefile, which is a file type used to mark geographic locations and provide information on geographic features. Each GPS point, represented by a yellow

[14] The aerial imagery was captured in February 2015.

circle (marker), was then moved to a location on the structure where depth was measured to determine usability.

Depth was calculated using elevation data for each marker that was placed on or upland of the 785 feet msl contour (Figure 3-35). For example, a marker placed at 785.5 feet msl is at a depth of 0.5 feet at a lake surface elevation of 786 feet msl. Because LIDAR cannot penetrate the water's surface, the elevation of markers placed below the 785 feet msl contour (Figure 3-35) was estimated using the slope of the nearby bank to interpolate the slope under the lake's surface.

FIGURE 3–35 EXAMPLE OF POINTS USED TO DETERMINE DEPTH OF WATER
The image to the left shows a point on the upland side of a structure; depth was determined from the elevation contour. The image to the right shows a point where the slope of the bank was used to determine depth. The blue elevation contour is the 785 ft msl contour.

Structure Type

Different types of structures may become usable during different conditions; therefore, a single method of analysis could not be applied to all structure types. The amount of depth and location on the structure at which depth was measured was determined separately for each type of private structure (i.e., boathouses, floats, piers, wet slips, and boardwalks) and for public boat ramps.

<u>*Boathouses*</u>

Boathouses require a certain amount of water to moor a boat and may be oriented allowing boats to enter the structure either parallel or perpendicular to the bank.

Regardless of which direction these structures are oriented, a marker was placed at the edge of the structure nearest to the bank (back edge) (Figure 3-36). A depth of two feet at this marker was required to classify these structures as usable.

Floats

Floats are often used to moor boats and are not fixed to the lake bottom, but float on the water's surface. A depth of two feet at the back edge of the structure was required to classify these structures as usable (Figure 3-36); a two-foot depth is sufficient to moor a boat on most of the floats. Floats located in shallow areas that have a very gradual sloping lake bottom may not be usable using these standards, but a minimum of two feet at the back edge would keep the structure from resting on dry ground during the winter, preventing possible damage.

Piers

Piers are built in a variety of shapes and lengths and were therefore classified into three sub-categories and analyzed separately. "Platform" piers (Figure 3-36) look similar to floats and are characterized by a long walkway often ending in a square-shaped platform used to moor boats. A depth of two feet at the back edge of this platform was required to classify "platform" piers as usable.

Piers that have no definable platform on the end and therefore no obvious place to measure depth were classified as mooring and fishing piers. Mooring piers were defined as greater than 30 feet in length. The marker was moved 30 feet from the front edge of the pier to provide a sufficient amount of scope to moor a boat (Figure 3-36).

Fishing piers were defined as 30 feet or less in length. The marker was moved midway from the front edge of the pier (away from the bank) to ensure that anglers could fish off the front or could cast underneath the pier (Figure 3-36). A depth of two feet was required to classify the mooring and fishing piers as usable.

Wet Slips

Wet slips are similar to boathouses in purpose and appearance but are not enclosed with walls and a roof. Therefore, wet slips were analyzed similarly to boathouses, with a requirement of two feet of depth at the back edge of the structure regardless of the direction the structure is oriented (Figure 3-36). Wet slips with multiple slips were classified as usable when all slips are usable (Figure 3-36).

Boardwalks

Although boardwalks are not used for access to the reservoir, they are used by visitors to enjoy the scenery or access other structures. The objective analysis on boardwalks is to improve aesthetics during the winter months. A depth of one foot at the front edge of boardwalks was required to classify these structures as usable and to reduce the amount of dry ground around boardwalks (Figure 3-36).

Public Boat Ramps

The ADCNR builds the majority of public boat ramps on Harris Reservoir to be usable at low winter pool. Specifically, most boat ramps are constructed with a 15 percent grade as the bottom edge enters the water at the current winter operating curve of 785 feet msl. This means the bottom edge of the concrete boat ramp is at a depth of 4.5 feet. This standard allows boats up to 26 feet in length to be launched with minimal effort at low winter pool.

The ADCNR was consulted and aerial imagery of Harris Reservoir at winter pool was used to determine which ramps are usable at the current low winter pool. The remaining ramps were analyzed by placing the point at the bottom edge of the concrete ramp and were determined to be usable at a depth of 4.5 feet (Figure 3-36). The lowest elevation at which public ramps are usable was assessed to the nearest 0.5 foot. It is worth noting that a criteria of 4.5 feet of depth at the end of the ramp was applied to all ramps, regardless of the percent grade.

	
Boathouse	Float
	
Platform Pier	Mooring Pier
	
Fishing Pier	Boardwalk

Continued On Next Page


Wet Slips

Wet Slip with Multiple Slips

Public Boat Ramp

FIGURE 3–36 STRUCTURE TYPES AND THE POINTS AT WHICH USABILITY WAS DETERMINED

Field Assessment

Field confirmation was required for certain structures because: 1) some structures were constructed after the aerial imagery used for analysis was acquired (Figure 3-37) and 2) other structures were not clearly visible on the aerial imagery (i.e., structure is obscured by foliage or shadow on the imagery) (Figure 3-37). During July 2020, the location for depth analysis for these structures was confirmed in the field by acquiring a GPS reading at the physical location on the structure where depth at winter pool alternatives would be calculated. Field confirmation was also used to determine whether some structures were still operational or in use.

FIGURE 3–37 STRUCTURES BUILT AFTER IMAGERY WAS OBTAINED (LEFT) AND STRUCTURES COVERED BY FOLIAGE OR SHADOW (RIGHT)

__Tallapoosa River Downstream of Harris Dam__

In accordance with the FERC-approved Study Plan, two questions were addressed related to how recreation may be affected by a downstream release from Harris Dam: 1) determine how downstream releases affect boating in the Tallapoosa River, from Harris Dam to Horseshoe Bend by correlating data collected from Tallapoosa River users with flow information available for the day/time the user was on the water; and 2) use the HEC-RAS model to determine how downstream releases affect boatable flows.

The HEC-RAS model was used to assess the impact of downstream releases on boating recreation closer to Harris Dam. Specifically, the model was used to analyze variation in "boatable days" at Wadley and boating depth changes from Harris Dam to Malone (approximately 7 miles downstream of Harris Dam) for the downstream release alternatives. The HEC-RAS model was used to generate one year of hourly data for each of the 14 alternatives, using 2001 historical data as a baseline typical year, to be able to compare the different alternatives.

The HEC-RAS model was used to show changes to boatable days at the Wadley USGS gage (13.9 miles downstream of Harris Dam) for each downstream release alternative. For the analysis, "boatable days" were defined as days (both weekday and weekend) when flows measured at the Wadley gage were between 450 cfs and 2,000 cfs between sunrise and sunset. If at any time between sunrise and sunset the flow at Wadley falls below 450 cfs or rises above 2,000 cfs, the day is no longer considered boatable in this analysis.

In addition, using the HEC-RAS model results, Alabama Power examined the flow depth from Harris Dam to Malone by examining the minimum depth at ten cross sections for each of the downstream release alternatives (Figure 3-38). Minimum flow depth was calculated by subtracting the lowest water surface elevation, occurring at any point in the year, from the minimum channel elevation at each cross section.

Alabama Power further analyzed the ten cross sections between Harris Dam and Malone using the HEC-RAS model to assess changes to river navigability for each of the downstream release alternatives. Specifically, the water surface elevation at each of the cross sections for the downstream release alternative was compared to existing conditions (GP). September 9, 2001 was used in the model as a historical low-flow day, as there was minimal generation from Harris Dam and minimal contributing inflow from the watershed below Harris Dam.

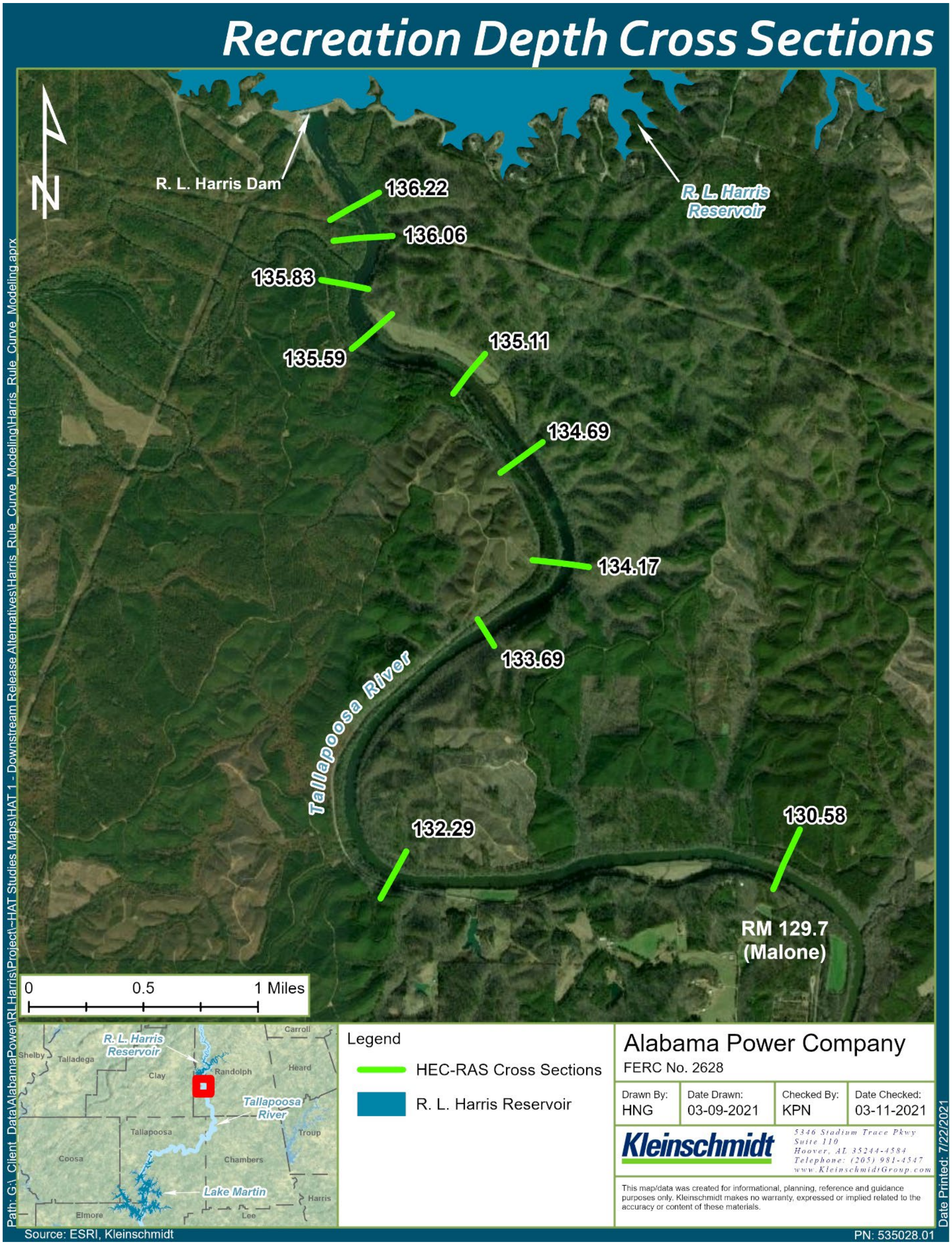

FIGURE 3–38 LOCATION OF CROSS SECTIONS FROM HARRIS DAM TO MALONE USED TO ASSESS WATER DEPTH AND NAVIGABILITY FOR BOATING RECREATION

3.7.2 RESULTS

Harris Reservoir

There were 2,282 private structures identified on Lake Harris; however, structures that appeared to be severely damaged, abandoned, unmaintained, or that were under construction were omitted from analysis. Omitting these structures resulted in 2,123 private recreation structures. Of these 2,123 structures, the elevation of the marker was estimated for 742 structures, and depths were obtained during the field assessment for 211 structures.

Table 3-13 shows the number of usable private structures at various lake elevations in 1-foot increments. The effects of PGP, 150CMF, 300CMF, 350CMF, 400CMF, 450CMF, and 150CMF+GP on lake recreations structure usability throughout the year are minimal, while other alternatives have the potential to reduce the usability of these structures in the summer months. The elevations at which public boat ramps become usable are summarized in Table 3-14.

TABLE 3-13 NUMBER OF PRIVATE RECREATION STRUCTURES ON HARRIS RESERVOIR THAT ARE USABLE AT SPECIFIED RESERVOIR ELEVATIONS

Lake Elevation (feet msl)	Number of Usable Private Structures	Percentage of Usable Private Structures
793	2123	100.0
792	1990	93.8
791	1786	84.1
790	1568	73.9
789	1327	62.5
788	1112	52.4
787	826	38.9
786	642	30.2
785	449	21.1
784	311	14.6
783	199	9.4
782	138	6.5
781	95	4.5
780	63	3.0
779	48	2.3
778	42	2.0
777	32	1.5
776	21	1.0
775	14	0.7
774	12	0.6
773	10	0.5
772	8	0.4
771	7	0.3
770	4	0.2

TABLE 3-14 PUBLIC BOAT RAMP USABILITY AT THE LOWEST POSSIBLE RESERVOIR ELEVATION

Boat Ramp	Lowest Reservoir Elevation Usable (feet msl)
Big Fox Creek	785.0
Crescent Crest	785.0
Foster's Bridge	785.0
Hwy 48 Bridge	785.0
Lee's Bridge	791.5
Little Fox Creek	790.0
Lonnie White*	787.5
Swagg**	790.0

*Lonnie White Boat Ramp is frequently used at current winter pool, but larger boats cannot launch and many boat trailers need to back off the edge of the ramp. ADCNR is currently extending the ramp so that it is fully usable by the drawdown of 2021.
**Swagg Boat Ramp ends right at the water's edge during current winter pool but is still in use by some recreators.

Tallapoosa River Downstream of Harris Dam

User Perceptions of Flow

Data from the Recreation Evaluation Report (Kleinschmidt 2020) indicated that 70 percent of all Tallapoosa River trips began at Horseshoe Bend (43.0 miles downstream of Harris Dam), 12.7 percent of trips began at the Germany's Ferry boat launch (33.3 miles downstream of Harris Dam), and 10.4 percent of trips began at Jaybird Landing (48.6 miles downstream of Harris Dam). Results from the Recreation Evaluation Report also showed that the majority of recreation users found all water levels acceptable (with river flows ranging from 499 to 6,110 cfs), and the recreation effort did not appear to be affected by flow. Most recreation users were not aware of the Tallapoosa River flow until they arrived to recreate; there was no significant relationship between satisfaction and water level (Kleinschmidt 2020).

Boatable Days

Spring and Fall have the most variation in number of boatable days, with the most annual boatable days occurring with the 300CMF+GP alternative (Table 3-15).

TABLE 3-15 NUMBER OF BOATABLE DAYS IN THE TALLAPOOSA RIVER BELOW HARRIS DAM BY SEASON

Alternative	Winter	Spring	Summer	Fall	Annual
PreGP	27	19	21	30	97
GP	30	18	23	29	100
ModGP	30	19	31	40	120
150CMF	29	19	24	37	109
300CMF	32	15	29	61	137
350CMF	32	12	28	65	137
400CMF	31	12	28	65	136
450CMF	30	11	28	65	134
600CMF	29	7	27	63	126
800CMF	27	4	25	61	117
150CMF+GP	34	17	28	43	122
300CMF+GP	35	16	31	63	145
600CMF+GP	30	11	28	63	132
800CMF+GP	26	6	28	62	122

Note: Boatable Days are defined as days (both weekday and weekend) when flows measured at the Wadley gage were between 450 cfs and 2,000 cfs between sunrise and sunset.

There was a slight difference in annual boatable days under existing conditions (GP) and Pre-Green Plan (PreGP) operations. The 150CMF alternative provided a nine percent increase in boatable days over baseline (GP), and the 300CMF and 350CMF alternatives provided a 37 percent increase over baseline. Table 3-16 shows the alternatives ranked by the number annual boatable days, with 300CMF+GP providing the most boatable days and PreGP providing the least.

TABLE 3-16 ANNUAL BOATABLE DAYS FOR EACH ALTERNATIVE

Alternative	Annual Boatable Days
300CMF+GP	145
300CMF	137
350CMF	137
400CMF	136
450CMF	134
600CMF+GP	132
600CMF	126
150CMF+GP	122
800CMF+GP	122
ModGP	120
800CMF	117
150CMF	109
GP	100
PGP	97

Flow Depth

The HEC-RAS flow depth analysis conducted between Harris Dam and Malone initially revealed that the minimum flow depth was not less than one foot with any of the downstream release alternatives. There were minimal differences in boating depth between PreGP, GP, and ModGP alternatives. Boating depth increased incrementally from 150CMF to 800CMF (Figure 3-39). However, adding Green Plan pulses to any of the CMF alternatives provided no appreciable difference in boating depth.

For the initial analysis, the minimum flow depth threshold of one foot was achieved if any portion of a cross section measured at least that depth. However, a one-foot threshold at any one given point on a cross section is not an accurate indicator of river navigability. Due to these limitations, an additional depth analysis was performed to compare the change in surface water elevations at particular cross sections.

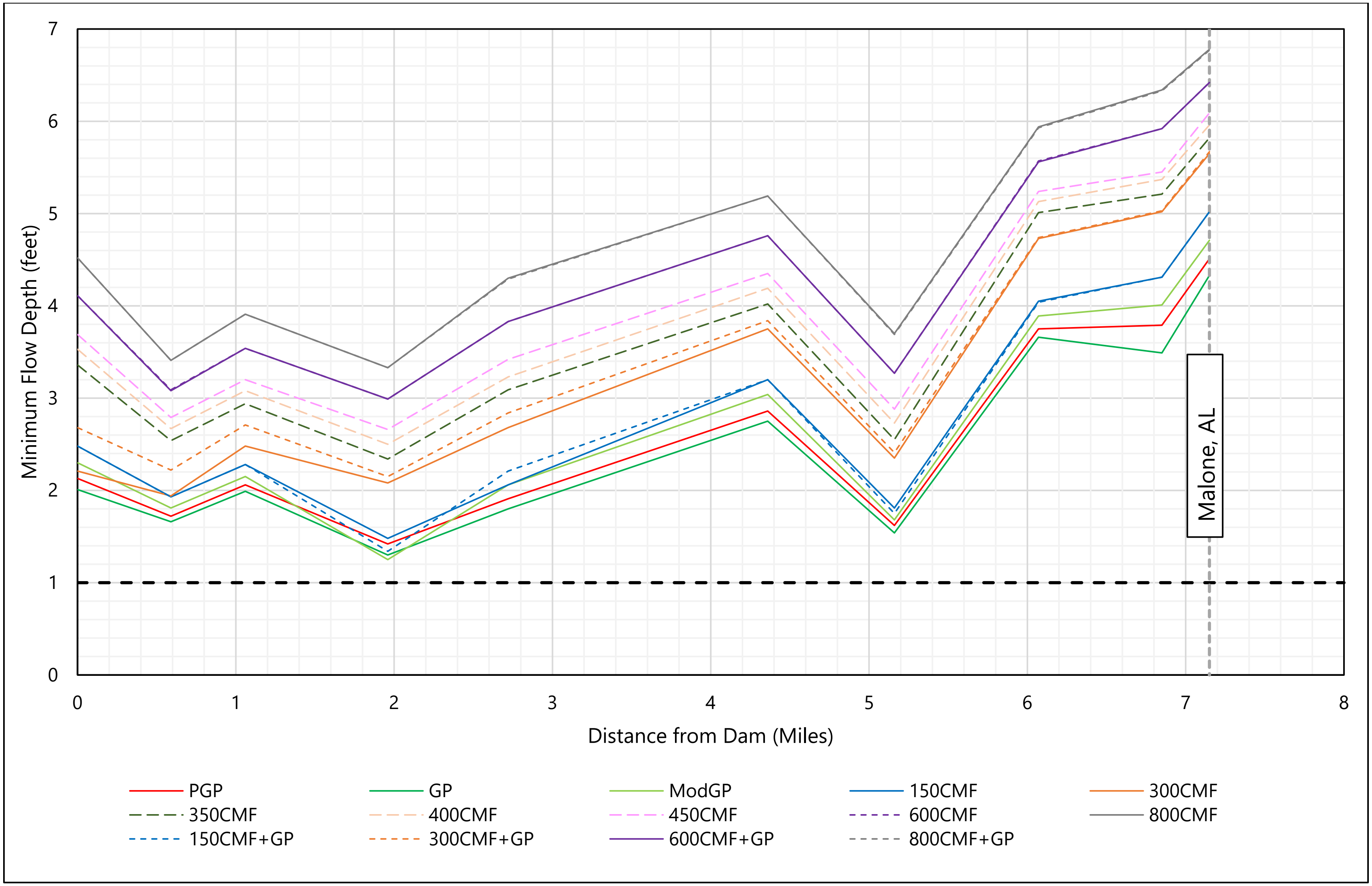

FIGURE 3–39 MINIMUM DEPTH (IN FEET) OF THE TALLAPOOSA RIVER FROM HARRIS DAM TO MALONE BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES

Navigability

The additional boating depth analysis was performed to depict a single low-flow period on a single day (September 9, 2001) at 10 cross sections between Harris Dam and Malone.

The 150CMF alternative increased water surface elevation in the immediate tailrace by slightly over 0.25 feet compared to existing conditions (GP), whereas the 300CMF alternative increased approximately 0.75 feet compared to baseline. The trend of an increase in boating depth continues for the 350CMF, 400CMF, 450CMF, 600CMF, and 800CMF alternatives. Adding Green Plan pulses to any of the CMF alternatives has no appreciable difference in boating depth. Additionally, pulsing could adversely affect recreation as it creates more unpredictable conditions for recreation users in the Tallapoosa River near Harris Dam. Results are presented in Table 3-17 and Figures 3-40 to 3-49.

TABLE 3-17 CHANGE IN WATER SURFACE ELEVATION (IN FEET) IN THE TALLAPOOSA RIVER DOWNSTREAM OF HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES COMPARED TO BASELINE (GP) USING DATA FROM SEPTEMBER 9, 2001

Alternative	Miles Below Harris Dam									
	0.4	0.6	0.8	1.0	1.5	2.0	2.5	3.0	4.4	6.0
GP	0	0	0	0	0	0	0	0	0	0
PreGP	0.08	0.07	0.08	0.06	0.07	0.07	0.08	0.1	0.04	-0.01
150CMF	0.28	0.28	0.33	0.29	0.31	0.3	0.36	0.48	0.28	0.19
150CMF+GP	0.28	0.28	0.33	0.29	0.31	0.3	0.36	0.48	0.28	0.22
ModGP	0.18	0.17	0.2	0.17	0.19	0.18	0.21	0.29	0.15	0.12
300CMF+GP	0.72	0.75	0.86	0.79	0.79	0.8	0.94	1.27	0.87	0.86
300CMF	0.72	0.75	0.86	0.79	0.79	0.8	0.94	1.27	0.87	0.86
350CMF	0.84	0.88	1.00	0.94	0.92	0.94	1.10	1.50	1.04	0.97
400CMF	0.97	1.02	1.13	1.07	1.05	1.06	1.26	1.71	1.20	1.09
450CMF	1.09	1.13	1.25	1.21	1.17	1.18	1.40	1.91	1.36	1.20
600CMF+GP	1.38	1.43	1.57	1.54	1.48	1.49	1.76	2.42	1.74	1.5
600CMF	1.38	1.43	1.57	1.54	1.48	1.49	1.76	2.42	1.74	1.5
800CMF+GP	1.69	1.75	1.92	1.91	1.81	1.83	2.16	2.97	2.18	1.87
800CMF	1.69	1.75	1.92	1.91	1.81	1.83	2.16	2.97	2.18	1.87

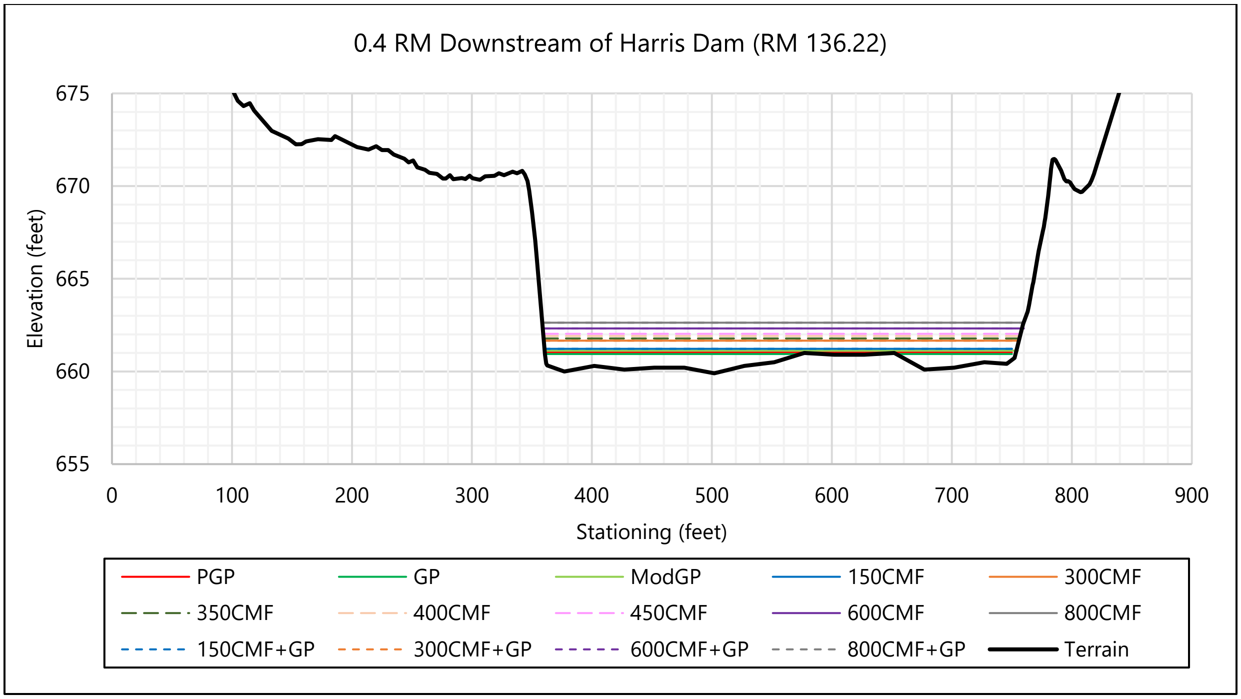

FIGURE 3–40 CROSS SECTION OF WATER SURFACE ELEVATION (IN FEET) 0.4 MILES DOWNSTREAM OF HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES USING DATA FROM SEPTEMBER 9, 2001

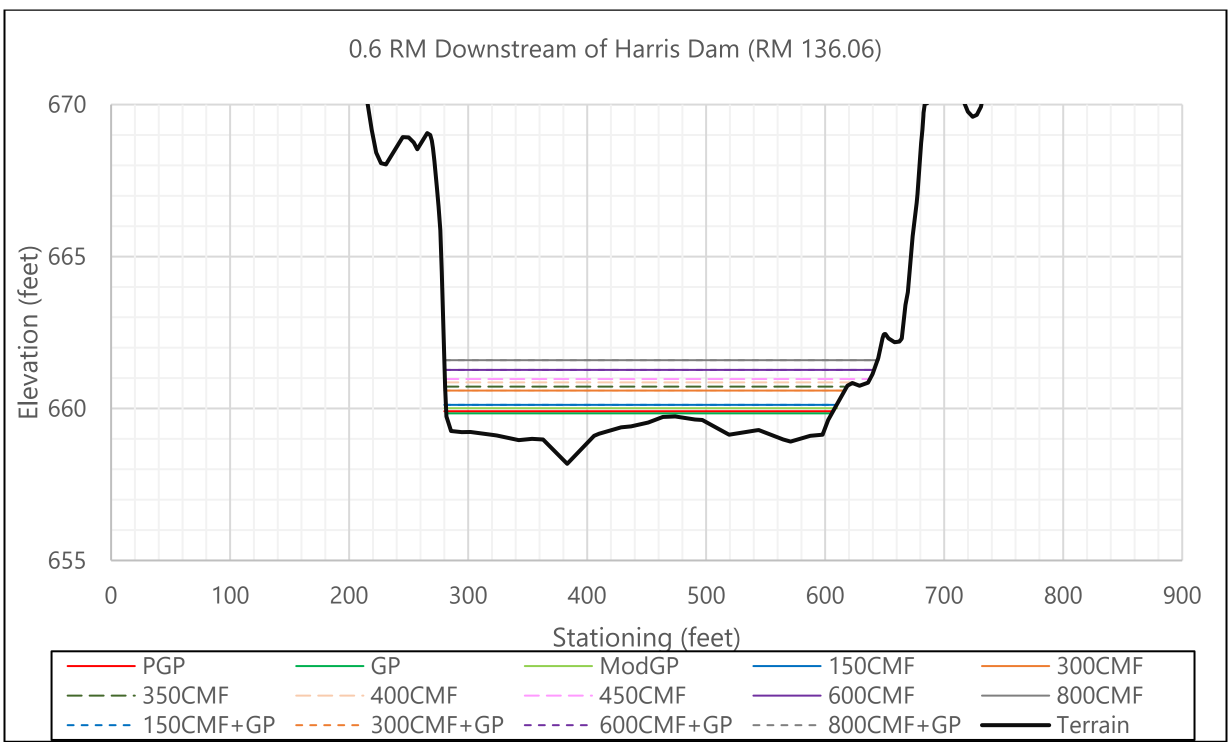

FIGURE 3–41 CROSS SECTION OF WATER SURFACE ELEVATION (IN FEET) 0.6 MILES DOWNSTREAM OF HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES USING DATA FROM SEPTEMBER 9, 2001

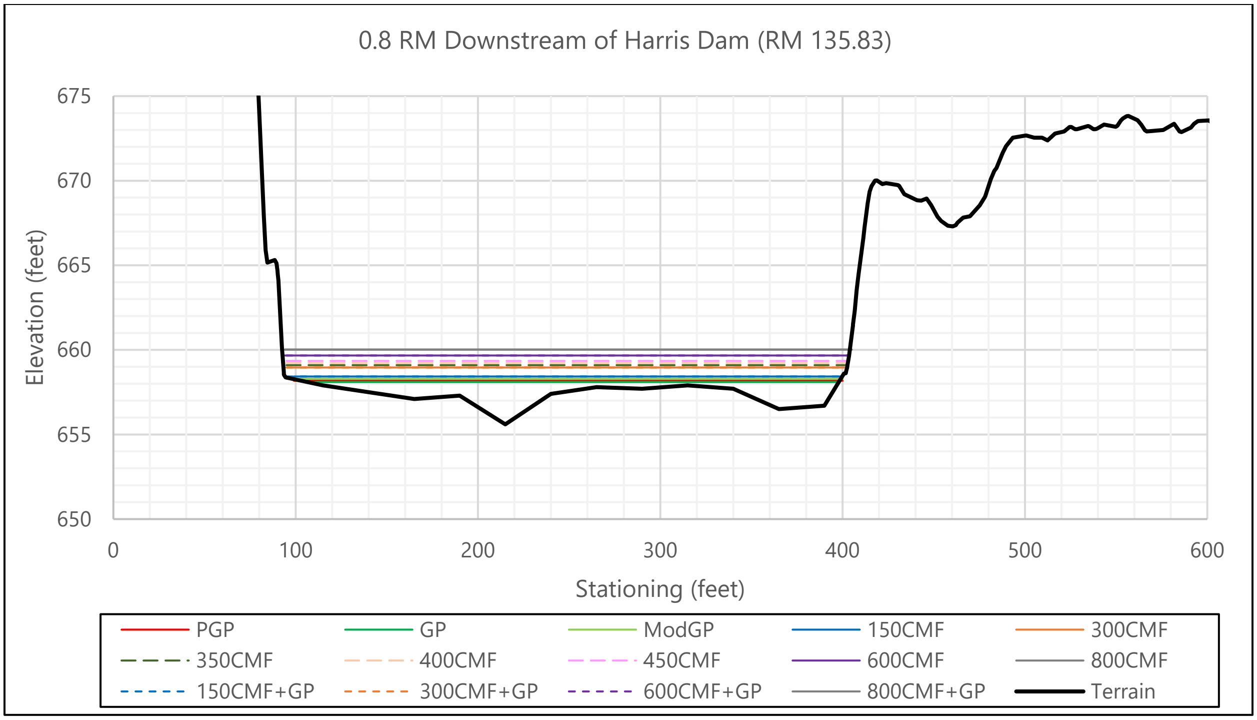

FIGURE 3–42 CROSS SECTION OF WATER SURFACE ELEVATION (IN FEET) 0.8 MILES DOWNSTREAM OF HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES USING DATA FROM SEPTEMBER 9, 2001

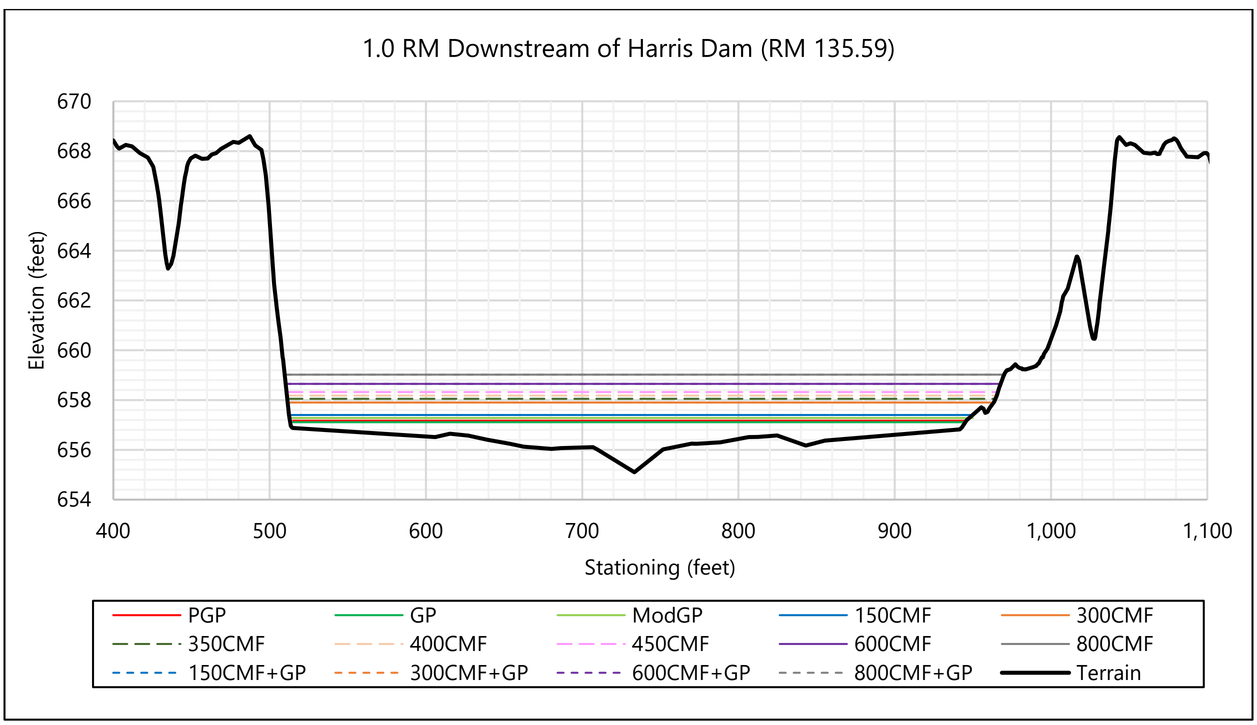

FIGURE 3–43 CROSS SECTION OF WATER SURFACE ELEVATION (IN FEET) ONE MILE DOWNSTREAM OF HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES USING DATA FROM SEPTEMBER 9, 2001

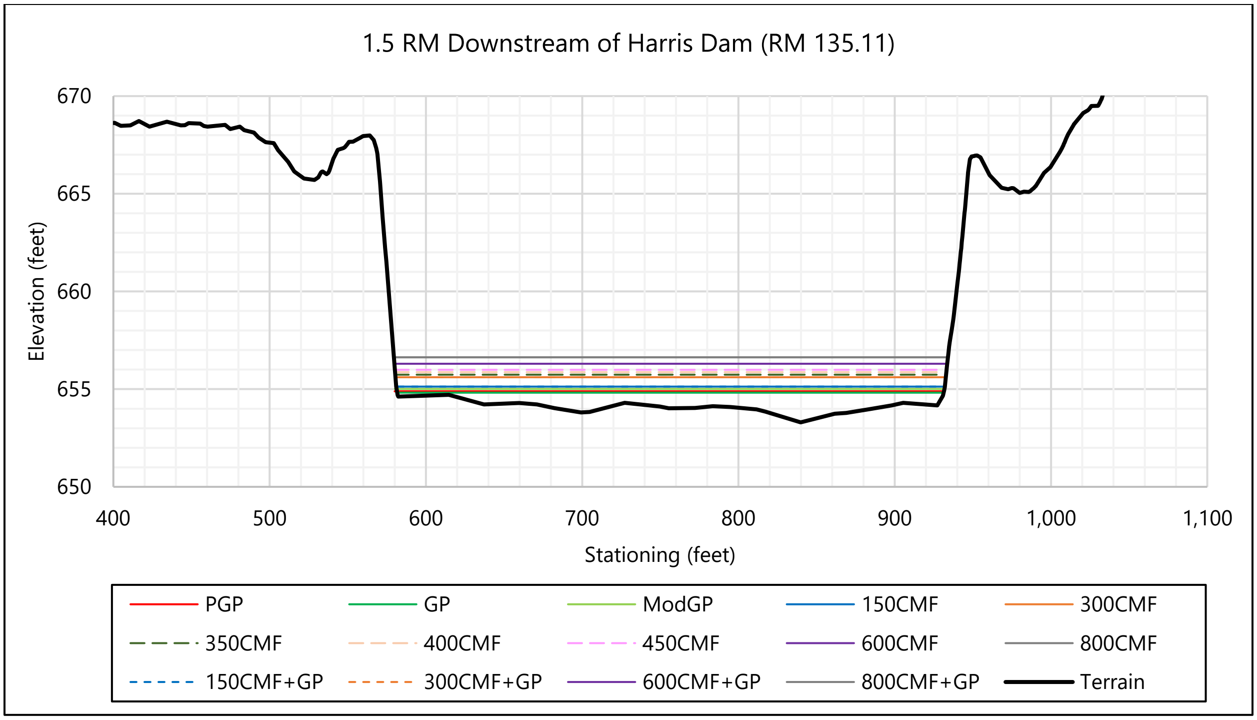

FIGURE 3–44 CROSS SECTION OF WATER SURFACE ELEVATION (IN FEET) 1.5 MILES DOWNSTREAM OF HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES USING DATA FROM SEPTEMBER 9, 2001

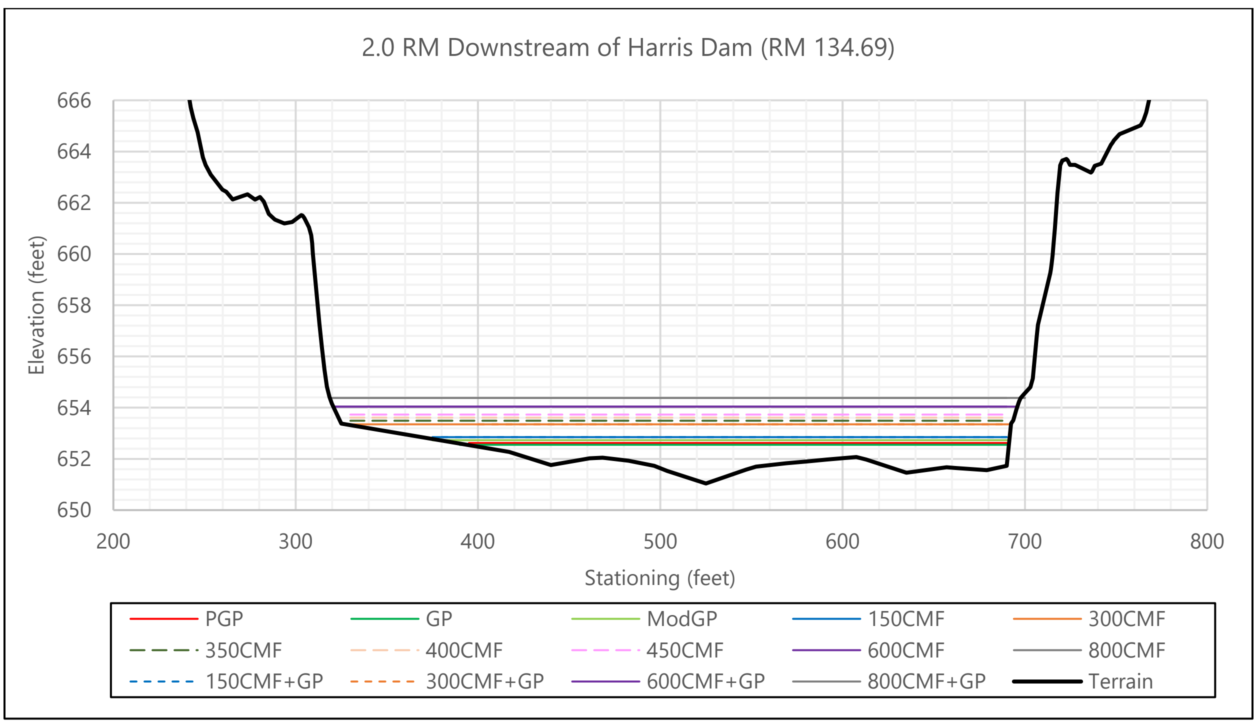

FIGURE 3–45 CROSS SECTION OF WATER SURFACE ELEVATION (IN FEET) TWO MILES DOWNSTREAM OF HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES USING DATA FROM SEPTEMBER 9, 2001

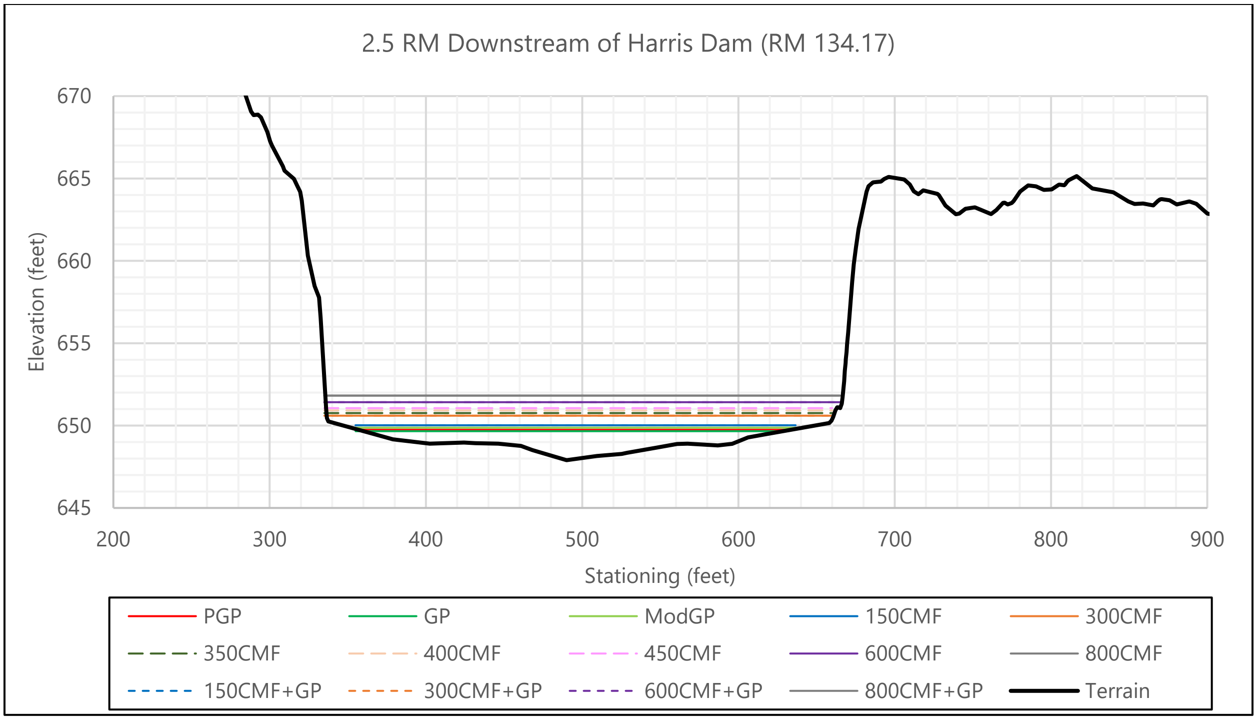

FIGURE 3–46 CROSS SECTION OF WATER SURFACE ELEVATION (IN FEET) 2.5 MILES DOWNSTREAM OF HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES USING DATA FROM SEPTEMBER 9, 2001

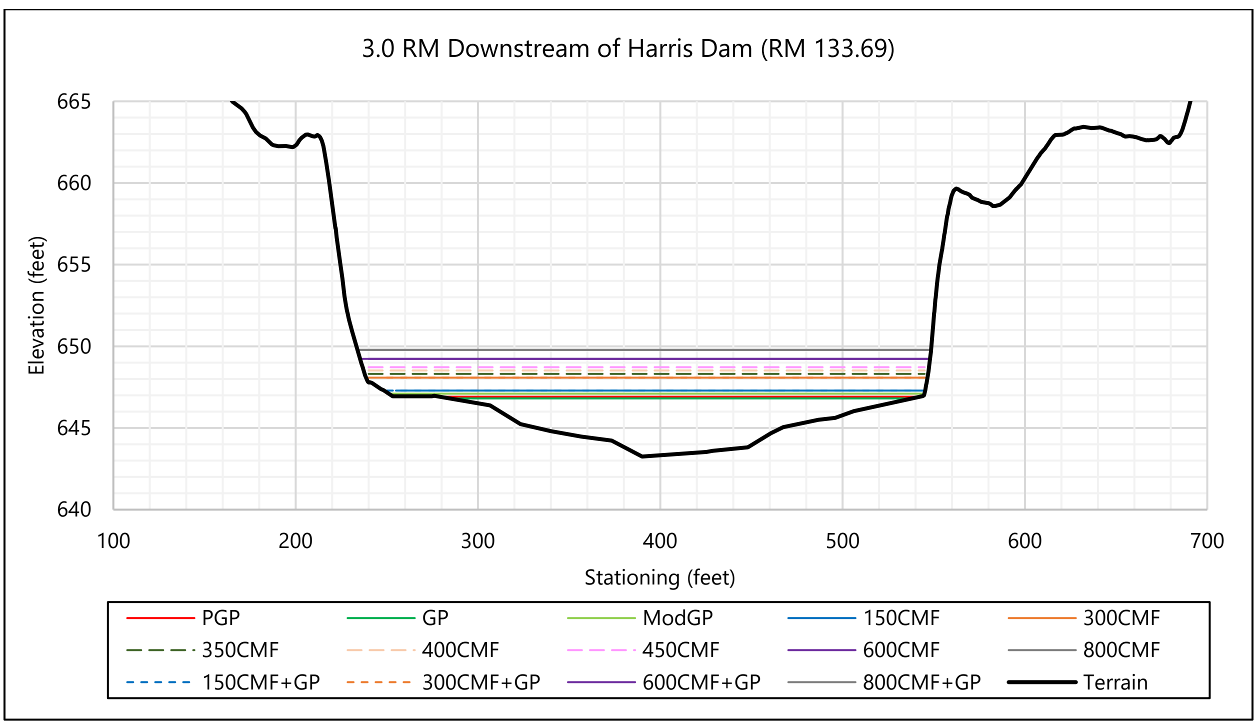

FIGURE 3–47 CROSS SECTION OF WATER SURFACE ELEVATION (IN FEET) 3.0 MILES DOWNSTREAM OF HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES USING DATA FROM SEPTEMBER 9, 2001

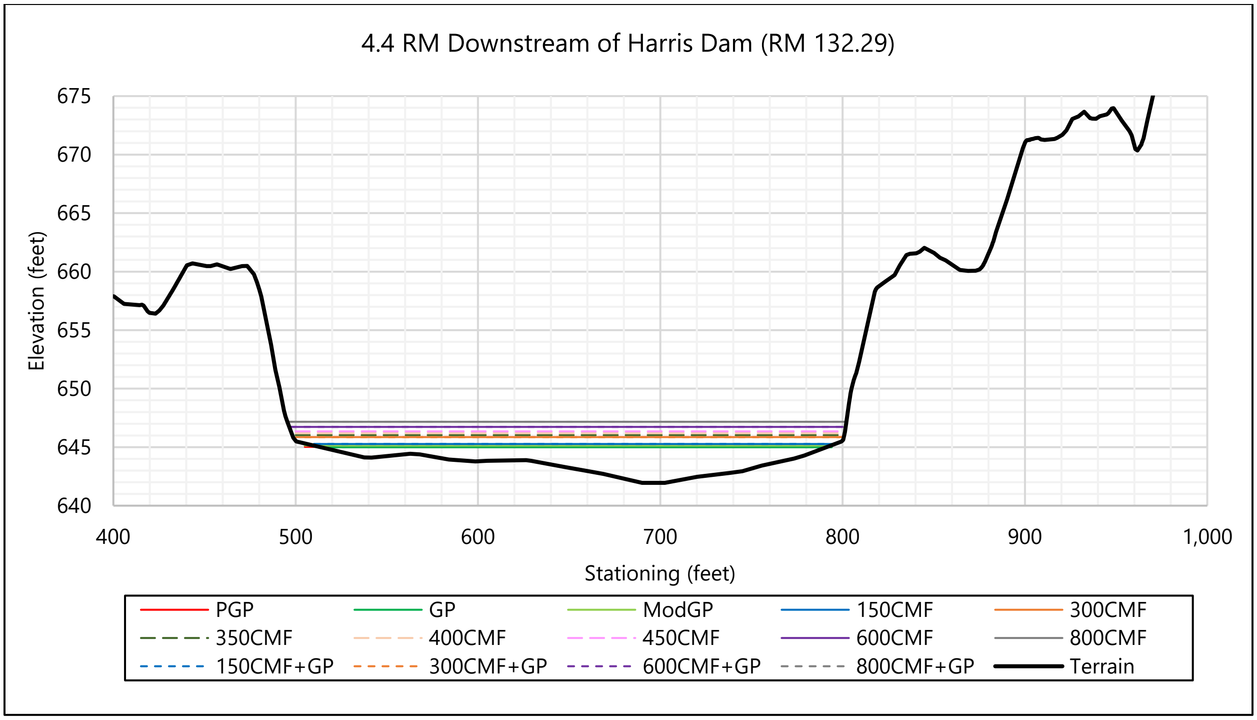

FIGURE 3–48 CROSS SECTION OF WATER SURFACE ELEVATION (IN FEET) 4.4 MILES DOWNSTREAM OF HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES USING DATA FROM SEPTEMBER 9, 2001

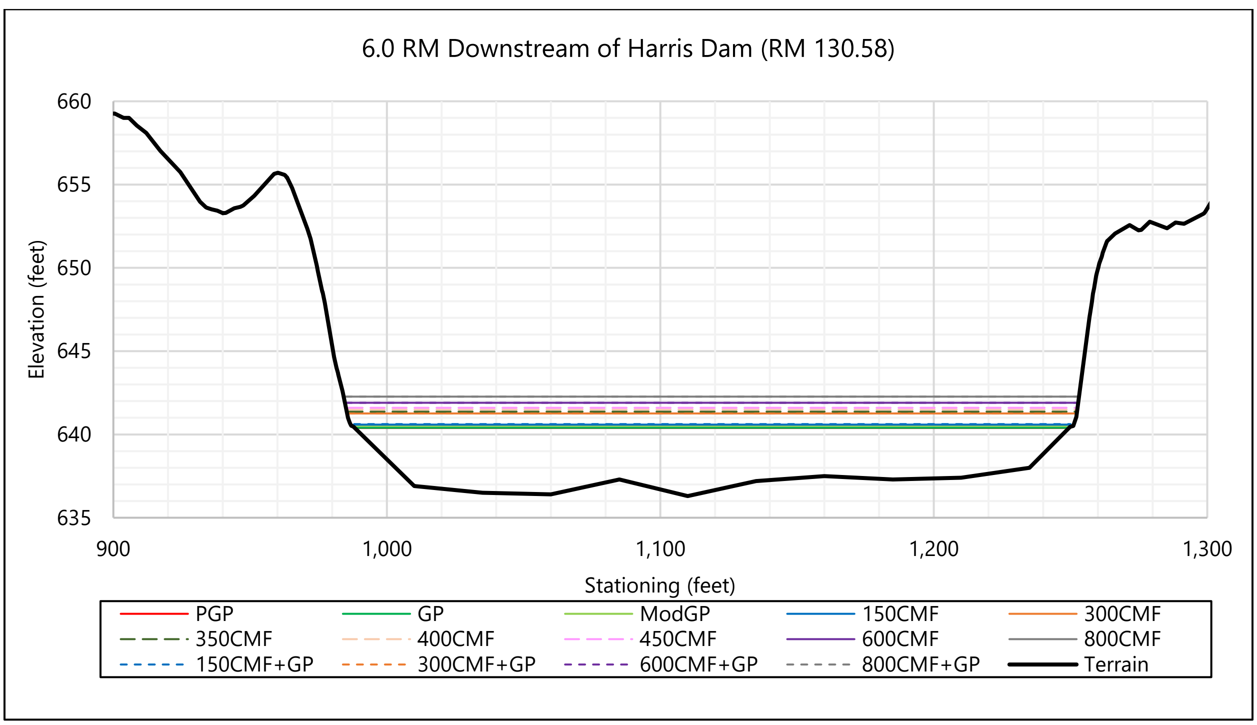

FIGURE 3–49 CROSS SECTION OF WATER SURFACE ELEVATION (IN FEET) SIX MILES DOWNSTREAM OF HARRIS DAM BASED ON HEC-RAS MODEL OF DOWNSTREAM RELEASE ALTERNATIVES USING DATA FROM SEPTEMBER 9, 2001

3.8 Cultural

As indicated in the Study Plan, cultural resources were assessed using existing information and the models developed for the Phase 1 Report.

3.8.1 METHODS

Existing information (elevation data [LIDAR], aerial imagery, and topographic data), the HEC-RAS model, and expert opinions were used to evaluate cultural resources that may be impacted by downstream release alternatives and to qualitatively determine the effects of downstream release alternatives on specific cultural resources. A primary point of interest is the Miller Bridge Piers and Abutments.

Alabama Power worked with The University of Alabama, Office of Archeological Research (OAR) to identify 19 cultural resources in the Tallapoosa River downstream of Harris Dam through Horseshoe Bend[15]. In addition, Alabama Power and OAR reviewed any possible effects to 96 archaeological sites on Harris Reservoir[16] as a result of changes to releases downstream of Harris Dam.

Of the 19 resources in the Tallapoosa River, six are recommended eligible for listing or listed in the National Register of Historic Places (NRHP), four are recommended ineligible, and nine are undetermined as regards their NRHP eligibility. The recommendations for these resources were not taken into consideration when assessing potential effects from the downstream release alternatives as most were documented more than 40 years ago and their current disposition is unknown.

OAR used the flow stage data provided by the HEC-RAS model and LIDAR to produce a three-foot digital elevation model (DEM). OAR then used the DEM to determine cultural resources that are subject to inundation and the downstream alternative releases where fluctuation, wave action, and flowage had the potential to remove sediment and result in various forms of adverse effect. The prime factors considered were inundation time for

[15] One of the 19 downstream sites is located within the Harris Project Boundary, however, many of these resources are on private property and not within Alabama Power's administrative area of control.

[16] The Harris Pre-Application Document (PAD) identified 327 cultural resources in and around Lake Harris. Harris Action Team (HAT) 6 worked together to identify 96 cultural resources that may be eligible for listing in the National Register of Historic Places (NRHP) and may be affected by Harris Project operations.

cultural resources and fluctuations caused by water levels increasing and decreasing across a cultural resource's minimum elevation. The average of inundation time periods for all downstream release alternatives was used to compare each alternative. While this does not take into account all fluctuations of exposure and inundation, flow velocity, or the variability in the sensitivity of different parts of cultural resources sites, it does serve as a baseline from which to assess which proposed downstream release alternative is more or less likely to result in effects to a particular site's boundary.

Inundation of cultural resources below Harris Dam is considered differently than those above the dam. Cultural resources inundated within the reservoir do not experience the same effects as those along the river channel below the dam where the flow velocity of the river is greater. In the reservoir, inundation can serve as a protective measure for sites, removing them from some potential effects by recreational activity, looting, erosion from exposure, wave action, and fluctuating water levels. However, below the dam, inundation more often results in scouring and removal of overlying protective vegetation and sediments.

It must also be noted that Miller Bridge Piers and Abutments represent an unusual cultural resource. Miller Bridge Piers and Abutments were built in 1908 and was once the longest covered bridge in the United States at 600 feet in length. It has become recognized as a significant cultural resource associated with Horseshoe Bend Military Park and, as such, the National Park Service requested specific consideration be taken to the effects of changes to downstream flow. The remnants of the bridge include abutments on the left and right banks of the Tallapoosa River, as well as four stone and masonry piers within the river that are constantly affected by the flow of the river as the piers stand on the riverbed. The Miller Bridge Piers and Abutments (which is continuously inundated) is included in the downstream release alternatives analysis and, as a result, its inclusion moves the data towards greater periods of time that the cultural resources below Harris Dam are inundated (OAR Personal Communication December 2020).

3.8.2 RESULTS

Harris Reservoir

Changing downstream releases may affect Alabama Power's ability to maintain water elevations in Harris Reservoir. Neither the PreGP 150CMF, 300CMF, 350CMF, 400CMF, 450CMF, or the 150 CMF +GP alternatives would affect Harris Reservoir elevations on average. Therefore, the 96 cultural resources identified in and around Lake Harris, would not be affected by these alternatives. The remaining downstream release alternatives that were analyzed (600CMF, 800CMF, 300CMF+GP, 600CMF+GP, 800CMF+GP) impact Harris Reservoir elevations, which will expose the 96 cultural resources in and around Harris Reservoir to additional reservoir fluctuations, wind erosion, and vandalism. These flows, however, may negatively impact reservoir recreation; therefore, impacts from recreation on cultural resources may be less under these alternatives.

Tallapoosa River Downstream of Harris Dam

Appendix E (filed as privileged) includes a spreadsheet showing modeled elevation data for each of the 19 cultural resources sites downstream of Harris Dam to Horseshoe Bend and associated maps. The elevation data shows each site under the analyzed flow scenarios and the minimum/maximum site elevation. These elevations were used to show the percent of time each site is underwater with each of the different flows.[17] The 19 cultural resources sites on the Tallapoosa River downstream of Harris Dam are inundated 49.4 percent of the time under existing conditions (GP). A summary of the inundation of cultural resources for each downstream release alternative is provided in Table 3-18 (OAR Personal Communication December 2020). This table shows that under the PreGP, 150CMF, 300CMF, 350CMF, 400CMF, and 450CMF alternatives, 11 of the cultural resources were inundated for a similar amount of time compared to baseline (GP). However, eight sites are inundated for different amounts of time compared to baseline. Further, the +GP alternatives inundated five of the nineteen sites for a greater percentage of time. The 600CMF and 800CMF alternatives inundate all 19 sites for a greater percent of time. An increased amount of time that some of the cultural resources are inundated compared to existing conditions (GP) means they are subject to increased scouring and removal of overlying protective vegetation and sediments.

[17] This information was included with the Preliminary Licensing Proposal in response to a request by FERC staff in the Updated Study Report Meeting and is being included here as it is applicable to this analysis.

TABLE 3-18 NUMBER OF CULTURAL RESOURCE IN THE TALLAPOOSA RIVER BETWEEN HARRIS DAM AND HORSESHOE BEND NATIONAL MILITARY PARK AFFECTED DIFFERENTLY BY DOWNSTREAM RELEASE ALTERNATIVES COMPARED TO GREEN PLAN OPERATIONS

Alternative	Number of Cultural Resources Sites Affected Differently Than Baseline (GP)[1]	Percent of Time Inundated Compared to Baseline (GP)[2]
PreGP	8	-0.2%
ModGP	0	0.0%
150CMF	8	0.2%
300CMF	8	1.9%
350CMF	8	2.1%
400CMF	8	2.7%
450CMF	8	3.1%
600CMF	19	4.1%
800CMF	19	4.2%
150CMF+GP	5	0.4%
300CMF+GP	5	2.4%
600CMF+GP	5	4.0%
800CMF+GP	5	4.3%

[1] 19 sites that may be affected by downstream release alternatives were identified in the Tallapoosa River below Harris Dam.

[2] The 19 cultural resources sites on the Tallapoosa River downstream of Harris Dam are inundated 49.4 percent of the time under baseline conditions (GP).

4.0 SUMMARY

This report presents the Phase 2 analyses of the downstream release alternatives. In the preceding section, effects on resources were analyzed using the Phase 1 modeling results along with other FERC-approved relicensing study results; both quantitative and qualitative results were presented.

The effects of the downstream release alternatives on all resources are summarized in Table 4-1.

TABLE 4-1 SUMMARY OF EFFECTS OF DOWNSTREAM RELEASE ALTERNATIVES

Resource	PreGP	ModGP	150CMF	300CMF	350CMF	400CMF	450CMF	600CMF	800CMF	150CMF+GP	300CMF+GP	600CMF+GP	800CMF+GP
Harris Reservoir Elevations	=	=	=	=	=	=	=	-	-	=	-	-	-
Hydro Generation	+	-	-	-	-	-	-	-	-	-	-	-	-
Flood Control	=	=	=	=	=	=	=	=	=	=	=	=	=
Navigation	=	=	=	=	=	=	=	=	=	=	=	=	=
Drought Operations	=	=	=	=	=	=	=	=	=	=	=	=	=
Martin Project Conditional Fall Extension	+	=	+	+	+	+	+	-	-	-	-	-	-
Water Quality – Harris Reservoir	=	=	=	=	=	=	=	-	-	=	-	-	-
Water Quality – Tallapoosa River	=	=	=	=	=	=	=	=	=	=	=	=	=
Water Use – Harris Reservoir	=	=	=	=	=	=	=	=	-	=	=	-	-
Water Use – Tallapoosa River	=	=	=	=	=	=	=	=	=	=	=	=	=
Erosion – Harris Reservoir	=	=	=	=	=	=	=	=	=	=	=	=	=
Erosion – Tallapoosa River	-	+	+	+	+	+	+	+	+	+	+	+	+
Aquatic Resources – Harris Reservoir	=	=	=	=	=	=	=	-	-	=	-	-	-
Aquatic Resources – Fish Entrainment	=	=	=	=	=	=	=	=	=	=	=	=	=
Downstream Aquatic Habitat – Tallapoosa River	-	+	+	+	+	+	+	+	+	+	+	+	+
Downstream Temperature Fluctuation – Tallapoosa River	-	+	+	+	+	+	+	+	+	+	+	+	+

Resource	PreGP	ModGP	150CMF	300CMF	350CMF	400CMF	450CMF	600CMF	800CMF	150CMF+GP	300CMF+GP	600CMF+GP	800CMF+GP
Wildlife – Harris Reservoir	=	=	=	=	=	=	=	-	-	=	-	-	-
Wildlife – Tallapoosa River	-	+	+	+	+	+	+	+	+	+	+	+	+
T&E Species – Harris Reservoir	=	=	=	=	=	=	=	=	=	=	=	=	=
T&E Species – Tallapoosa River	=	=	=	=	=	=	=	=	=	=	=	=	=
Recreation – Harris Reservoir	=	=	=	=	=	=	=	-	-	=	-	-	-
Recreation – Tallapoosa River	-	+	+	+	+	+	+	+	+	+	+	+	+
Cultural Resources – Harris Reservoir	=	=	=	=	=	=	=	-	-	=	-	-	-
Cultural Resources – Tallapoosa River	+	=	-	-	-	-	-	-	-	-	-	-	-

=: No Effect

+ Beneficial Effect

-: Adverse Effect

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APPENDIX A

ACRONYMS AND ABBREVIATIONS

Acronyms and Abbreviations

A

A&I	Agricultural and Industrial
ACFWRU	Alabama Cooperative Fish and Wildlife Research Unit
ACF	Apalachicola-Chattahoochee-Flint (River Basin)
ACT	Alabama-Coosa-Tallapoosa (River Basin)
ADCNR	Alabama Department of Conservation and Natural Resources
ADECA	Alabama Department of Economic and Community Affairs
ADEM	Alabama Department of Environmental Management
ADROP	Alabama-ACT Drought Response Operations Plan
AHC	Alabama Historical Commission
Alabama Power	Alabama Power Company
AMP	Adaptive Management Plan
ALNHP	Alabama Natural Heritage Program
APE	Area of Potential Effects
ARA	Alabama Rivers Alliance
ASSF	Alabama State Site File
ATV	All-Terrain Vehicle
AWIC	Alabama Water Improvement Commission
AWW	Alabama Water Watch

B

BA	Biological Assessment
B.A.S.S.	Bass Anglers Sportsmen Society
BCC	Birds of Conservation Concern
BLM	U.S. Bureau of Land Management
BOD	Biological Oxygen Demand

C

°C	Degrees Celsius or Centrigrade
CEII	Critical Energy Infrastructure Information
CFR	Code of Federal Regulation
cfs	Cubic Feet per Second
cfu	Colony Forming Unit
CLEAR	Community Livability for the East Alabama Region
CPUE	Catch-per-unit-effort
CWA	Clean Water Act

D

DEM	Digital Elevation Model
DIL	Drought Intensity Level
DO	Dissolved Oxygen
dsf	day-second-feet

E

EAP	Emergency Action Plan
ECOS	Environmental Conservation Online System
EFDC	Environmental Fluid Dynamics Code
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act

F

°F	Degrees Fahrenheit
ft	Feet
F&W	Fish and Wildlife
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FNU	Formazin Nephelometric Unit
FOIA	Freedom of Information Act
FPA	Federal Power Act

G

GCN	Greatest Conservation Need
GIS	Geographic Information System
GNSS	Global Navigation Satellite System
GPS	Global Positioning Systems
GSA	Geological Survey of Alabama

H

Harris Project	R.L. Harris Hydroelectric Project
HAT	Harris Action Team
HEC	Hydrologic Engineering Center
HEC-DSSVue	HEC-Data Storage System and Viewer
HEC-FFA	HEC-Flood Frequency Analysis
HEC-RAS	HEC-River Analysis System
HEC-ResSim	HEC-Reservoir System Simulation Model
HEC-SSP	HEC-Statistical Software Package

HDSS	High Definition Stream Survey
hp	Horsepower
HPMP	Historic Properties Management Plan
HPUE	Harvest-per-unit-effort
HSB	Horseshoe Bend National Military Park

I

IBI	Index of Biological Integrity
IDP	Inadvertent Discovery Plan
IIC	Intercompany Interchange Contract
IVM	Integrated Vegetation Management
ILP	Integrated Licensing Process
IPaC	Information Planning and Conservation
ISR	Initial Study Report

J

JTU	Jackson Turbidity Units

K

kV	Kilovolt
kva	Kilovolt-amp
kHz	Kilohertz

L

LIDAR	Light Detection and Ranging
LWF	Limited Warm-water Fishery
LWPOA	Lake Wedowee Property Owners' Association

M

m	Meter
m^3	Cubic Meter
M&I	Municipal and Industrial
mg/L	Milligrams per liter
ml	Milliliter
mgd	Million Gallons per Day
µg/L	Microgram per liter
µs/cm	Microsiemens per centimeter
mi^2	Square Miles
MOU	Memorandum of Understanding

MPN	Most Probable Number
MRLC	Multi-Resolution Land Characteristics
msl	Mean Sea Level
MW	Megawatt
MWh	Megawatt Hour

N

n	Number of Samples
NEPA	National Environmental Policy Act
NGO	Non-governmental Organization
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NTU	Nephelometric Turbidity Unit
NWI	National Wetlands Inventory

O

OAR	Office of Archaeological Resources
OAW	Outstanding Alabama Water
ORV	Off-road Vehicle
OWR	Office of Water Resources

P

PA	Programmatic Agreement
PAD	Pre-Application Document
PDF	Portable Document Format
pH	Potential of Hydrogen
PID	Preliminary Information Document
PLP	Preliminary Licensing Proposal
Project	R.L. Harris Hydroelectric Project
PUB	Palustrine Unconsolidated Bottom
PURPA	Public Utility Regulatory Policies Act
PWC	Personal Watercraft
PWS	Public Water Supply

Q

QA/QC	Quality Assurance/Quality Control

R

RM	River Mile
RTE	Rare, Threatened and Endangered
RV	Recreational Vehicle

S

S	Swimming
SCORP	State Comprehensive Outdoor Recreation Plan
SCP	Shoreline Compliance Program
SD1	Scoping Document 1
SH	Shellfish Harvesting
SHPO	State Historic Preservation Office
Skyline WMA	James D. Martin-Skyline Wildlife Management Area
SMP	Shoreline Management Plan
SU	Standard Units

T

T&E	Threatened and Endangered
TCP	Traditional Cultural Properties
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
TRB	Tallapoosa River Basin
TSI	Trophic State Index
TSS	Total Suspended Soils
TVA	Tennessee Valley Authority

U

USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service

W

WCM	Water Control Manual
WMA	Wildlife Management Area
WMP	Wildlife Management Plan
WQC	Water Quality Certification

APPENDIX B

GREEN PLAN RELEASE CRITERIA

R L HARRIS RELEASE CRITERIA – *Effective March 1, 2005*

1. Daily Release Schedule
    a. The required Daily Volume Release will be at least 75% of the prior day's flow at the USGS Heflin Gauge.
    b. In the event that the Heflin Gauge is not in service, the required Daily Volume Release will be at least one-fourth of the previous day's inflow into R L Harris Reservoir.
    c. The Daily Volume Release will not to be below 100 DSF.
    d. Operations to ensure that flows at Wadley remain above the 45 cfs minimum mark shall continue.
    e. The required Daily Volume Release will be suspended if R L Harris is engaged in flood control operations.
    f. The required Daily Volume Release will be suspended if it jeopardizes the ability to fill R L Harris.
2. Hourly Release Schedule
    a. If less than two machine hours are scheduled for a given day, then the generation will be scheduled as follows:
        i. One-fourth of the generation will be scheduled at 6 AM.
        ii. One-fourth of the generation will be scheduled at 12 Noon.
        iii. One-half of the generation will be scheduled for the peak load.
        iv. If the peak load is during the morning, one-fourth of the generation will be scheduled at 6 PM.
    b. If two to four machine hours are scheduled for a given day, then generation will be scheduled as follows:
        i. Thirty minutes of generation will be scheduled at 6 AM.
        ii. Thirty minutes of generation will be scheduled at 12 Noon.
        iii. The remaining generation will be scheduled for the peak load.
        iv. If the peak load is during the morning, thirty minutes of the generation will be scheduled at 6 PM.
3. Two Unit Operation
    a. On the average, there will be more than 30 minutes between the start times between the two units.
    b. Two units may come online with less than 30 minute difference in their start times if there is a system emergency need.
4. Spawning Windows

    Spring and Fall spawning windows will scheduled as conditions permit. The operational criteria during spawning windows will supersede the above criteria.

R L Harris Release Criteria – *Effective March 1, 2005*

1. Daily Release Schedule

    a. The required Daily Volume Release will be at least 75% of the prior day's flow at the USGS Heflin Gauge.

    b. In the event that the Heflin Gauge is not in service, the required Daily Volume Release will be at least one-fourth of the previous day's inflow into R L Harris Reservoir.

    c. The Daily Volume Release will not to be below 100 DSF.

    d. Operations to ensure that flows at Wadley remain above the 45 cfs minimum mark shall continue.

    e. The required Daily Volume Release will be suspended if R L Harris is engaged in flood control operations.

    f. The required Daily Volume Release will be suspended if it jeopardizes the ability to fill R L Harris.

Drought 2007-2008 R L Harris Release Criteria

a. If the flows at Wadley are at or above 100 cfs, there will be one pulse per day, which will result in a Daily Volume Release of approximately 50 DSF.

b. The flows at Wadley will not be lower than the flows at Heflin.

R L HARRIS MINIMUM FLOW PROCEDURE

STEP 1: CREATE SCHEDULE BASED ON PRIOR DAY'S HEFLIN FLOW

Prior Day's Heflin Flow (DSF)	Generation At 6 AM	Generation At 12 Noon	Generation As System Needs	Total Machine Time	R L Harris Total Disch (DSF)
0 < HEFLIN Q < 150	10 MIN	10 MIN	10 MIN	30 MIN	133
150 < HEFLIN Q < 300	15 MIN	15 MIN	30 MIN	1 HR	267
300 < HEFLIN Q < 600	30 MIN	30 MIN	1 HR	2 HRS	533
600 < HEFLIN Q < 900	30 MIN	30 MIN	2 HRS	3 HRS	800
900 < HEFLIN Q	30 MIN	30 MIN	3 HRS	4 HRS	1,067

STEP 2: ADD ADDITIONAL PEAK GENERATION AS NEEDED

STEP 3: ADJUST SCHEDULE IF NECESSARY

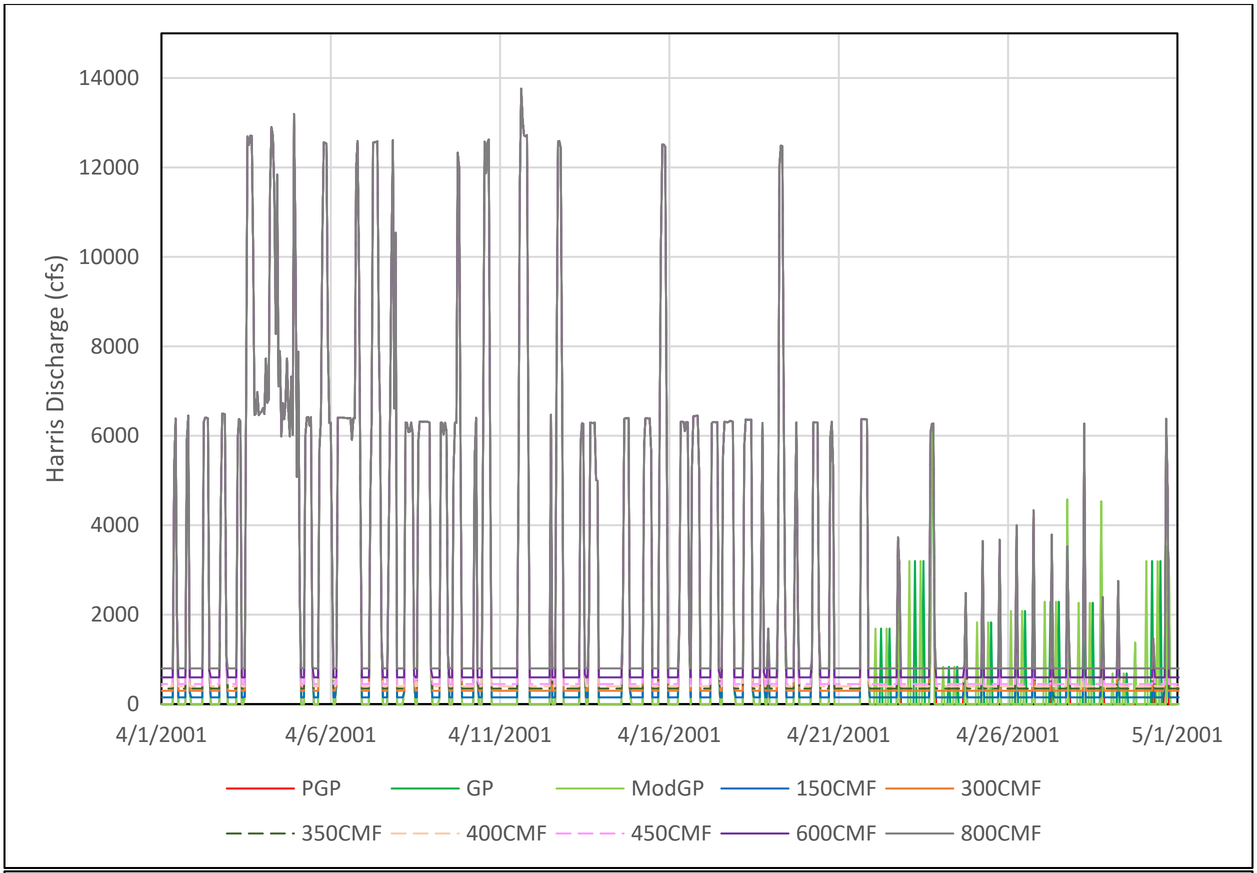
TOTAL SCH GENERATION	Generation At 6 AM	Generation At 12 Noon	Generation As System Needs	Total Machine Time	R L Harris Total Disch (DSF)
IF GENERATION = 1 MACH HR	15 MIN	15 MIN	30 MIN	1 HR	267
IF GENERATION = 2 MACH HRS	30 MIN	30 MIN	1 HR	2 HRS	533
IF GENERATION = 3 MACH HRS	30 MIN	30 MIN	2 HRS	3 HRS	800
IF GENERATION = 4 MACH HRS	30 MIN	30 MIN	3 HRS	4 HRS	1,067
IF GENERATION = 5+ MACH HRS			ALL		

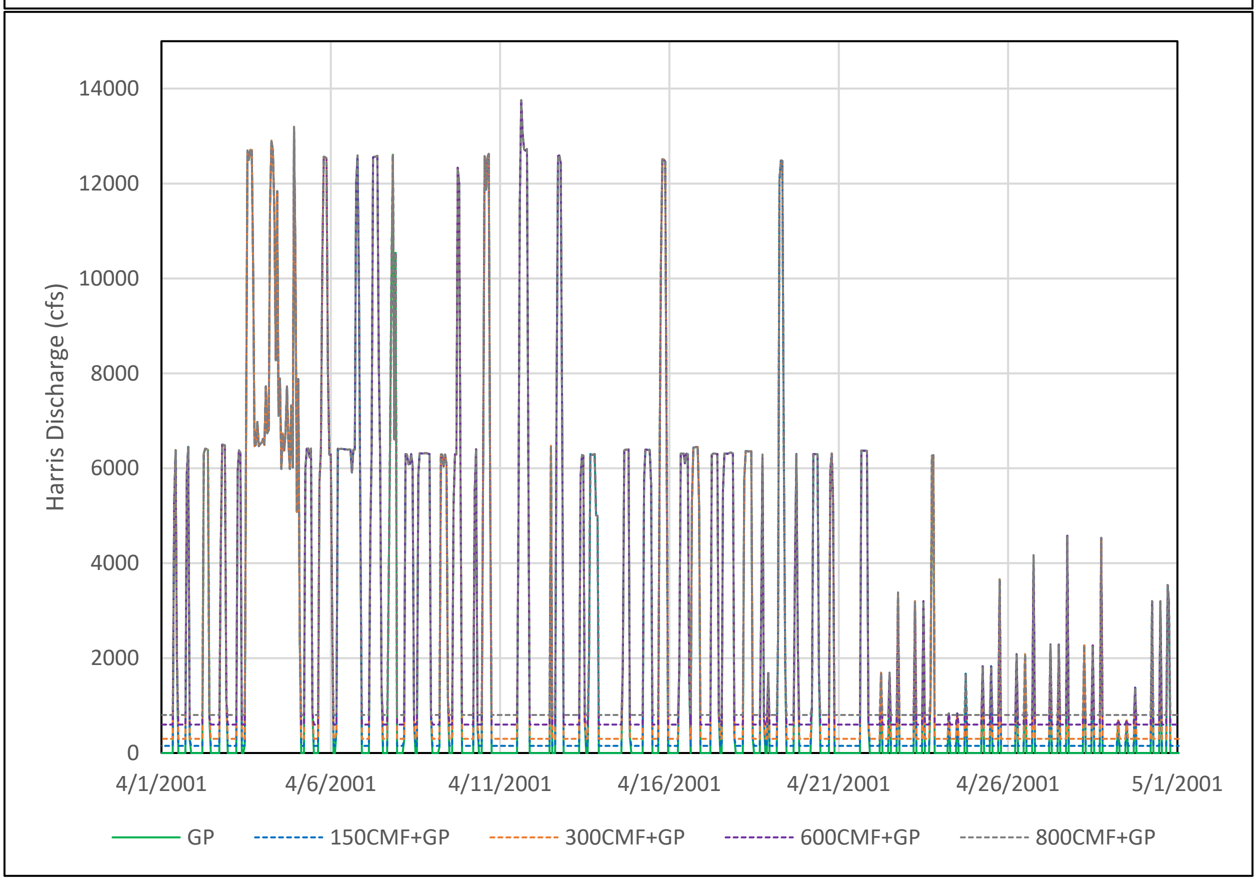
NOTES

1. SCHEDULING OF GENERATION DOES NOT PRECLUDE THE ADDITION OF GENERATION AT ANY TIME.
2. ALL START TIMES ARE APPROXIMATE.
3. WHEN PULSING, IF THE SYSTEM DOES NOT DICTATE GENERATION DURING THE PM, A PULSE WILL BE SCHEDULED AT 6 PM.
4. R L HARRIS MIN FLOW PROCEDURE WILL BE SUSPENDED DURING ANY OF THE FOLLOWING CONDITIONS:
    - A) TALLAPOOSA RIVER HAS BEEN PLACED UNDER FLOOD CONTROL OPERATIONS.
    - B) FISH SPAWNING OPERATIONS HAVE BEEN SCHEDULED.
    - C) APC HAS DECLARED THAT CONDITIONS EXIST THAT THREATEN THE SPRING FILLING OF R L HARRIS RESERVOIR.

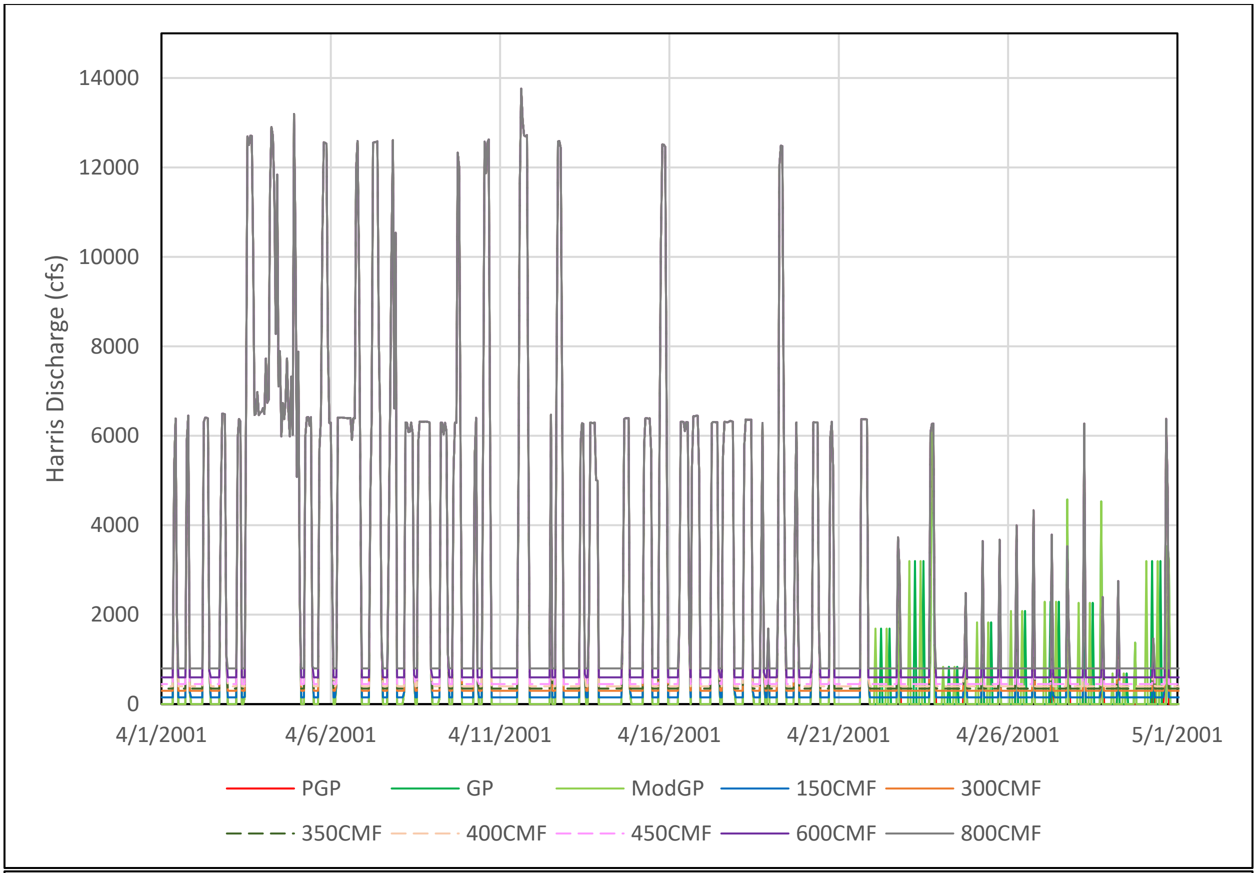
APPENDIX C

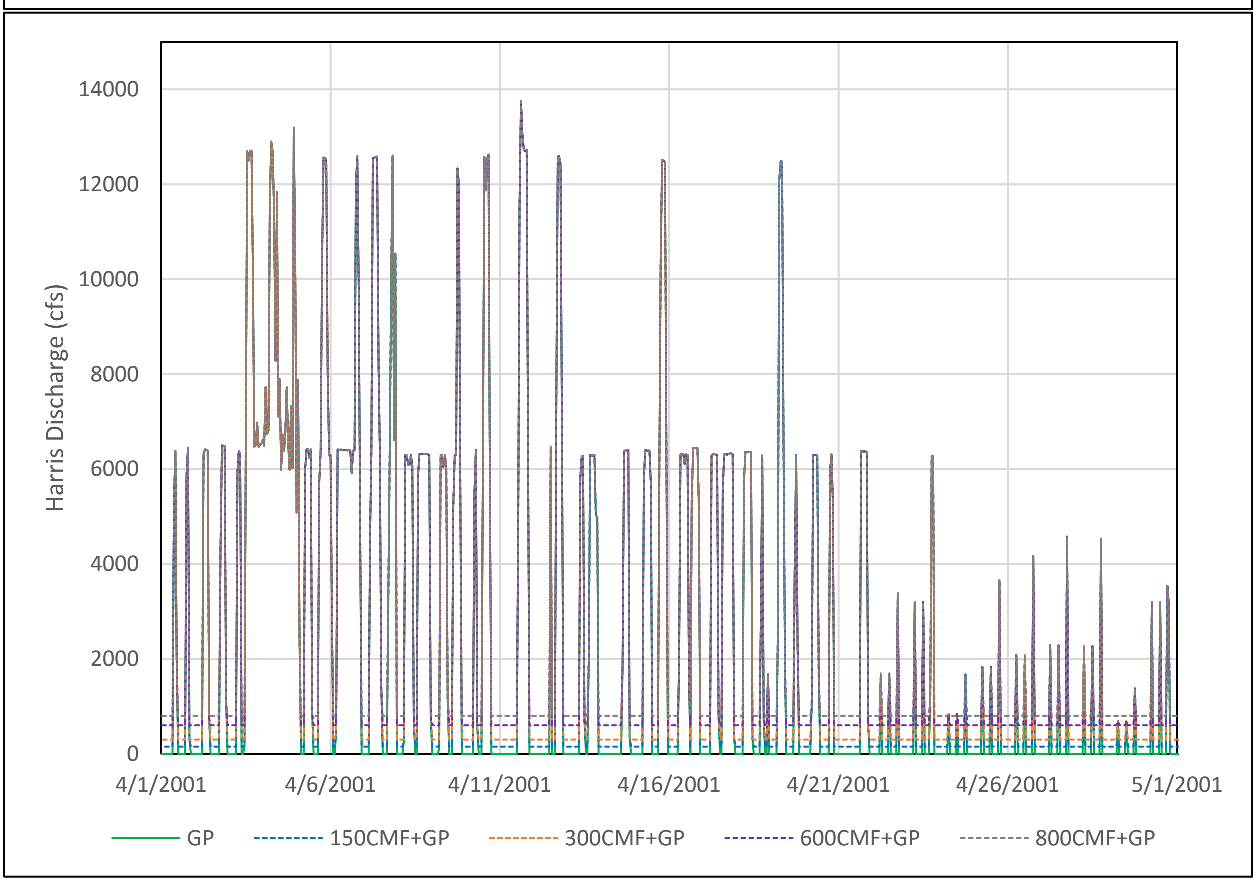
MONTHLY HYDROGRAPHS OF DOWNSTREAM RELEASE ALTERNATIVES



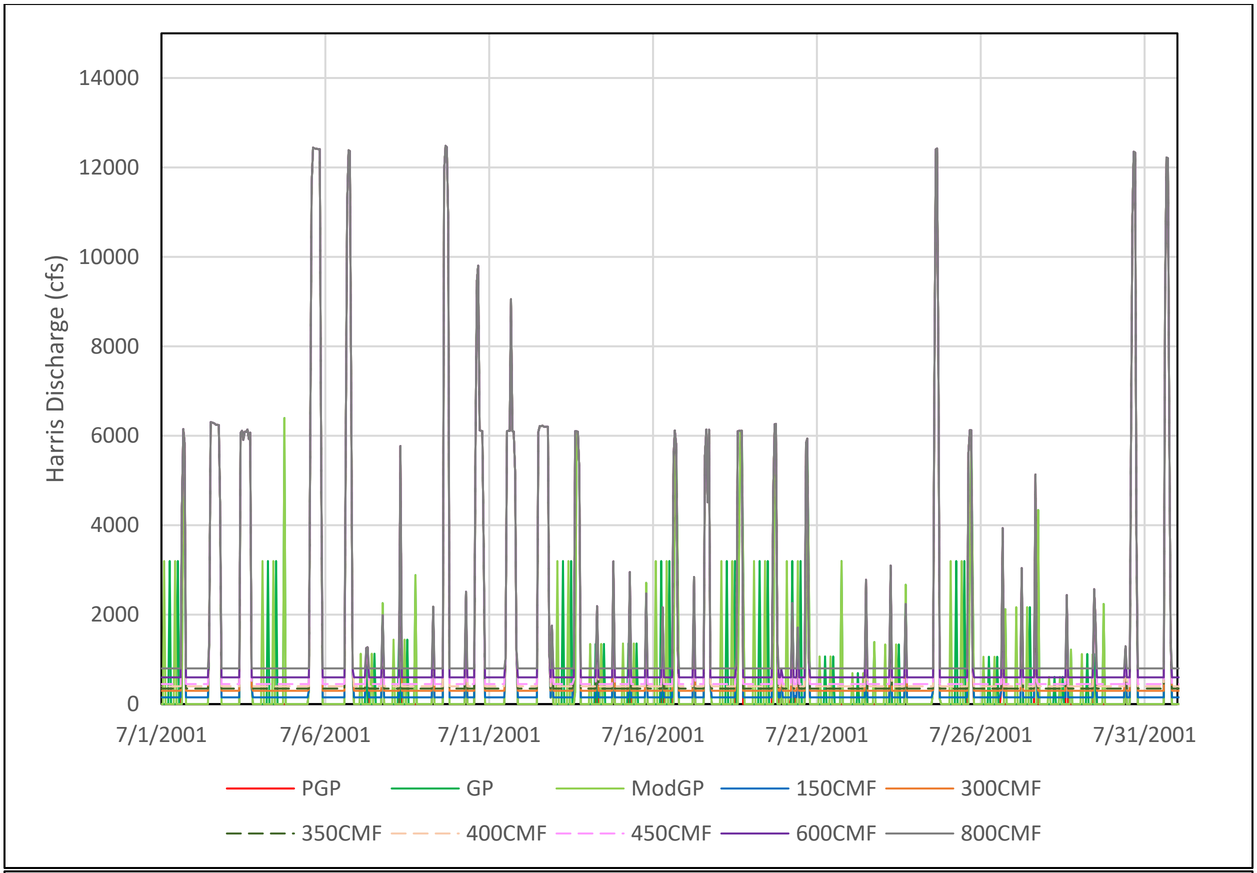


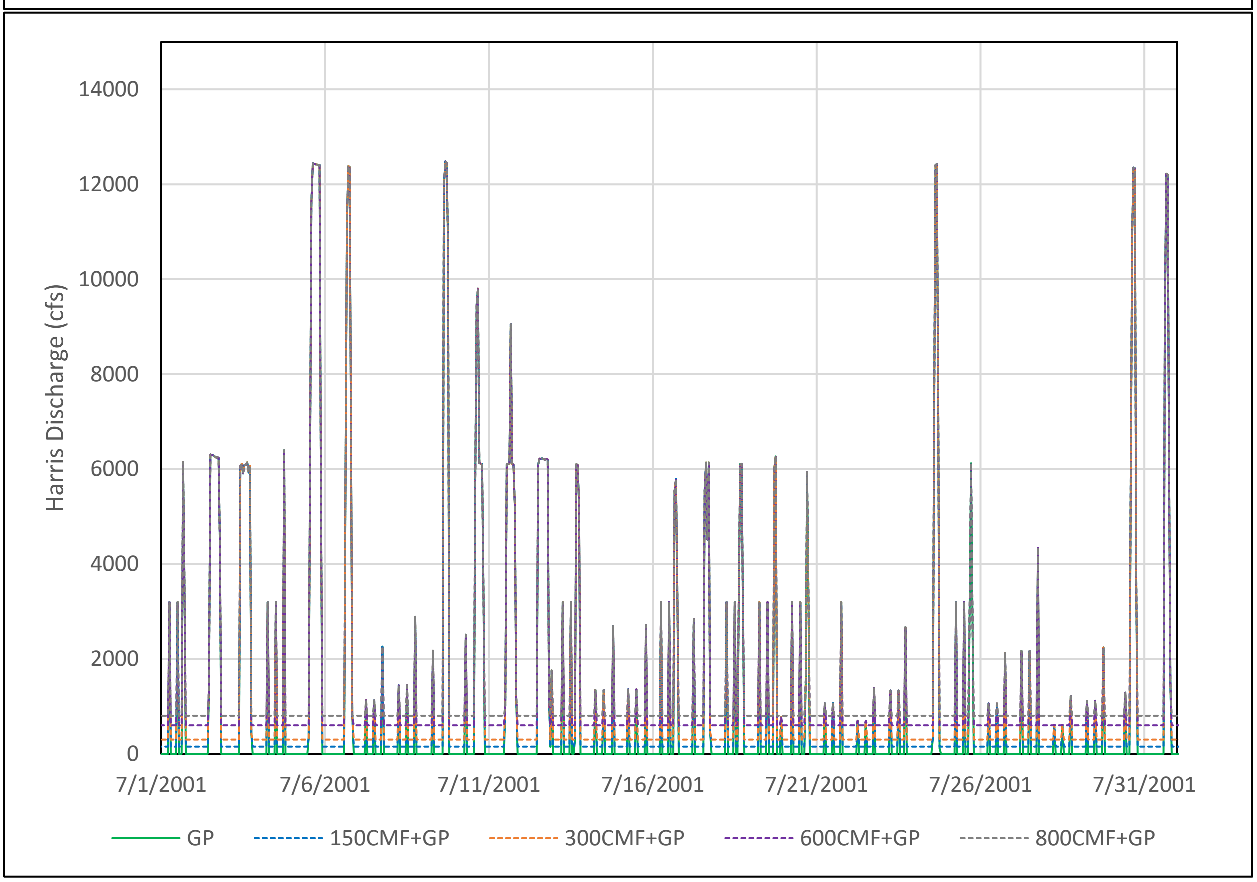
January Harris Dam Discharges



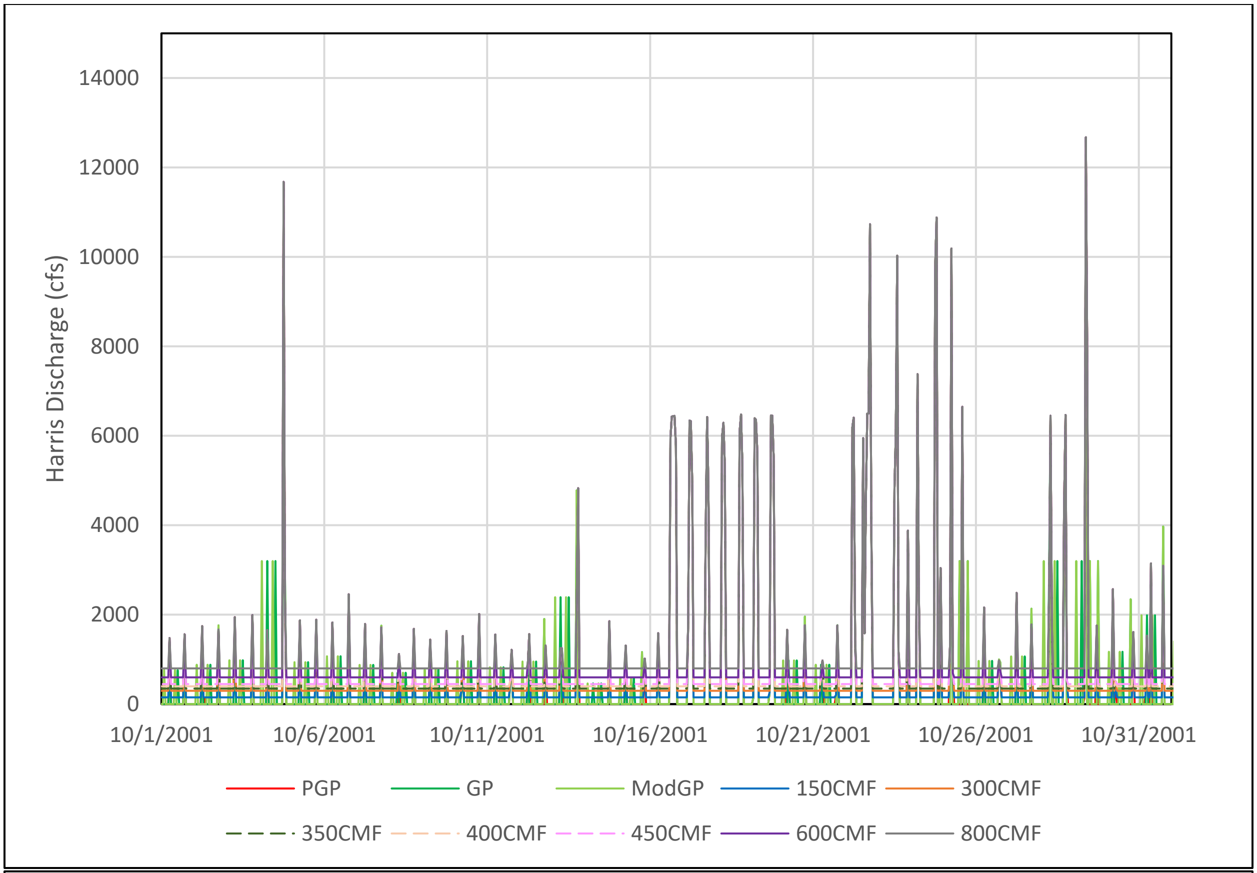


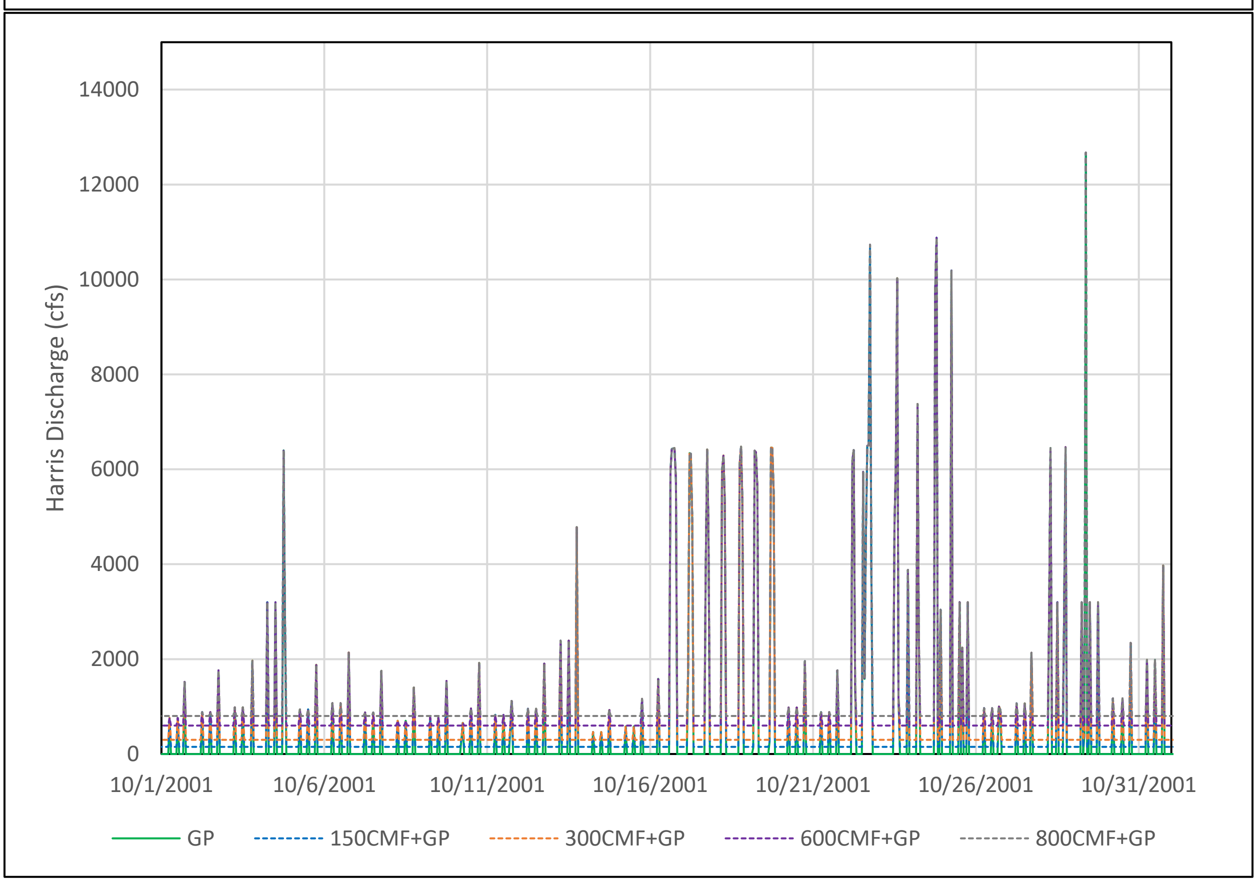
April Harris Dam Discharges





July Harris Dam Discharges





October Harris Dam Discharges

APPENDIX D

AMPHIBIAN SPECIES POTENTIALLY OCCURRING IN THE HARRIS PROJECT VICINITY

Family	Common Name	Scientific Name	Abundance in Project Area	Habitat
Bufonidae	American Toad	*Bufo americanus*	Common	Upland forests, suburban areas
Bufonidae	Fowler's Toad	*Bufo woodhousii*	Common	Sandy areas around shores of lakes, or in river valleys
Hylidae	Northern Cricket Frog	*Acris crepitans*	Common	Creekbanks, lakeshores, and mudflats
Hylidae	Cope's Gray Treefrog	*Hyla chrysoscelis*	Common	Small trees or shrubs, typically over standing water; on ground or at water's edge during breeding season
Hylidae	Green Treefrog	*Hyla cinerea*	Moderately common	Permanent aquatic habitats
Hylidae	Mountain Chorus Frog	*Pseudacris brachyphona*	Moderately common	Forested areas in most of northern Alabama
Hylidae	Northern Spring Peeper	*Pseudacris crucifer*	Common	Ponds, pools, and swamps
Hylidae	Upland Chorus Frog	*Pseudacris triseriata feriarum*	Moderately common	Grassy swales, moist woodlands, river-bottom swamps, and environs of ponds, bogs, and marshes
Microhylidae	Eastern Narrow-mouthed Toad	*Gastrophyrne carolinensis*	Common	Variety of habitats providing suitable cover and moisture, including under logs and or leaf litter
Pelobatidae	Eastern Spadefoot Toad	*Scaphiopus holbrooki*	Moderately	Forested areas of sandy or loose soil
Ranidae	Bullfrog	*Rana catesbeiana*	Common	Permanent aquatic habitats
Ranidae	Bronze Frog	*Rana clamitans spp.*	Moderately common	Rocks, stumps, limestone crevices of stream environs, bayheads and swamps
Ranidae	Wood Frog	*Rana sylvatica*	Uncommon	Moist wooded areas
Ranidae	Southern Leopard Frog	*Rana pipiens sphenocephala*	Moderately common, believed to be declining	All types of aquatic to slightly brackish habitats
Ambystomatidae	Spotted Salamander	*Ambystoma maculatum*	Moderately common, believed to be declining	Bottomland hardwoods, woodland pools
Ambystomatidae	Marbled Salamander	*Ambystoma opacum*	Common	Bottomland hardwoods, woodland pools
Plethodontidae	Spotted Dusky Salamander	*Desmongnathus conanti*	Common	Damp habitats, seepage areas

Family	Common Name	Scientific Name	Abundance in Project Area	Habitat
Plethodontidae	Southern Two-lined Salamander	*Eurycea cirrigera*	Common	Shaded aquatic habitats
Plethodontidae	Three-lined Salamander	*Eurycea guttolineata*	Common	Shaded aquatic habitats, forested floodplains
Plethodontidae	Webster's Salamander	*Plethodon websteri*	Moderately common	Damp deciduous forest
Plethodontidae	Northern Slimy Salamander	*Plethodon glutinosus*	Common	Wide variety of habitats
Plethodontidae	Northern Red Salamander	*Pseudotriton ruber*	Common	Aquatic margins in forested areas
Salamandridae	Eastern Newt	*Notophthalmus viridescens louisianensis*	Moderately common	Terrestrial or aquatic habitats, depending on life stage
Salamandridae	Central Newt	*Notophthalmus viridescens*	Moderately common	Terrestrial or aquatic habitats, depending on life stage

Source: Mirarchi 2004, Causey 2006 as cited in Alabama Power 2018

APPENDIX E

MODELED ELEVATION DATA FOR EACH OF THE 19 CULTURAL RESOURCES SITES DOWNSTREAM OF HARRIS DAM TO HORSESHOE BEND WITH ASSOCIATED MAPS (PRIVILEGED)

Note: Data filed separately as privileged in Microsoft Excel Spreadsheet format.

APPENDIX F

STAKEHOLDER COMMENT TABLE

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response
Lake Wedowee Property Owners Association (LWPOA) Note: footnotes included in the original letter have been omitted from this table	05/19/2021 20210519-5060	The LWPOA will strenuously object to any change in reservoir/dam operations and downstream releases that would cause reservoir levels to drop below their current licensed levels of 793' msl in summer and 785' msl in winter, except for variations caused by drought. After reviewing both referenced study reports the Association can identify little good that would accrue to any stakeholders for any reason that would come from lowering reservoir levels from those currently licensed. a. Changes in release methods and timing that do not affect lake levels, such as continuous minimum flows or modifying the current "Green Plan" are of limited concern to the LWPOA and should be based on the maximum good the maximum number of stakeholders. b. Based on our review of the study reports, in scenarios where CMF or CMF+Green Plan releases approach or exceed 300 cfs total, reservoir levels would drop below currently licensed levels during various months and for greater periods of time than in accordance with present operating rules (Section 3.1.2, pp 9-18, DRA). c. According to Section 3.7.1, Table 3-14, pg 74 of the DRA, no public boat ramps would be available for use six months each year (November to April) should the winter pool fall below 785' msl. d. LWPOA asks that Alabama Power and FERC carefully consider the negative effects on thousands of lakefront property owners of increasing downstream releases in any way that will lower summer or winter pool levels. While economic analysis is not part of the draft reports, common sense dictates that lowering lake levels would have a negative impact on property values, county property tax receipts, and recreational opportunities that generate significant income for local businesses.	As indicated in the Preliminary Licensing Proposal, Alabama Power is proposing to design, install, operate, and maintain a minimum flow unit to provide a continuous minimum flow (CMF) in the Tallapoosa River below Harris Dam. The HEC-ResSim model indicated that this CMF would have negligible effects on average reservoir elevations throughout the year compared to the Green Plan (baseline). In addition, Alabama Power proposes to develop low-inflow and drought operations procedures for the minimum flow unit in consultation with resource agencies following unit installation and performance testing. Any such procedures would not be inconsistent with ADROP. Drought operations procedures for the minimum flow unit would be developed so that reservoir elevations would not be lower than would occur under baseline operating conditions
LWPOA		The Lake Wedowee Property Owners Association supports the tenet that everyone has equal rights to Tallapoosa River waters, and desires to be a good neighbor to the entire basin community. Based on the data in the referenced study reports, the Association asks for nothing that would substantially harm any other stakeholder group with whom it shares the Tallapoosa River system.	Comment noted.

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response
Alabama Department of Conservation and Natural Resources (ADCNR) Note: footnotes included in the original letter have been omitted from this table	05/26/2021 20210527-5024	ADCNR has consistently stated and provided published peer reviewed references that support recommendations for downstream flows to mimic a natural flow regime with an adaptive management of flows that follows state dissolved oxygen guidelines and provides natural temperature regimes, at all times for the sustained long term benefit and conservation of aquatic species (See ADCNR, P-2628-005 FERC ¶ 20181002-5006). ADCNR remains concerned that temperature and discharge of the turbine releases has documented negative impacts on aquatic resources in the Tallapoosa River below Harris Dam." (See ADCNR, P-2628-005 FERC ¶ 20181002-5006). Licensee has stated it will examine options for temperature mitigation technologies once it has been determined that water temperature is a problem (page 26 of Initial Study Report Meeting Summary (May 12, 2020), (See P-2628-005 FERC ¶ 20200512-5083). In our ADCNR, NOI, PAD, Scoping Document 1, and Study Plans for the R. L. Harris Hydroelectric Project comments we stated, "We request that when evaluating impacts on downstream water quality (including water temperature) due to project operations, that methods to mitigate the unnatural water temperature variability be fully assessed. Over the past 40 years, several different technologies have been developed and used to improve flows and water temperatures below hydropeaking dams, nationally and internationally. We recommend that Alabama Power evaluate these technologies to determine feasibility for the Harris Project. The following technologies are not an exhaustive list but are examples of technologies utilized at other hydropower projects: house turbine unit, temperature control devices, trunnions, deep-water aeration or pumps, surface pumps, draft tube mixer, submerged weirs or curtains, and sluice gates. ADCNR is not advocating for any particular method, but merely stating that all options should be investigated by Alabama Power to determine the best option for the Harris Project." (See ADCNR, P-2628-005 FERC ¶ 20181002- 5006). We recommend an analysis of how different technology options in collaboration with the Downstream Release Alternatives and Operating Curve Change could provide modifications in regard to timing, duration, rate of change, frequency and magnitude of water temperatures at varying distances from the dam to most closely align with unregulated temperature (Newell and Heflin gauges) regimes at all times and throughout the year.	Alabama Power's analysis of the long-term record of water temperatures below Harris, comparisons with recent water temperature records from unregulated sites upstream of Harris, and the results of Auburn's review of fish temperature requirements contained in the Aquatic Resources Study Report support that there is not a strong case for making a temperature modification at the Harris Project. Further, study results indicated that the flow modifications included in Alabama Power's license proposal would have a beneficial effect on aquatic resources by providing a reduction in daily and sub-daily water temperature fluctuations.

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response
ADCNR		On April 2, 2021, ADCNR provided the licensee with comments regarding the Auburn Report. We are currently awaiting a response to these comments and are concerned with temperature and aquatic resource information details that may be input into the model from reports prior to our comments being fully addressed. Allan Creamer with FERC at HAT 3 meeting notes from March 31, “expressed concern about models that do not have good data going into them.” ADCNR agrees that accurate and reliable data modeling requires inputs to be accurate and reliable. Below sub bulleted are comments regarding temperature overview statements provided by the licensee on page 27 of the PowerPoint presentation from the USR meeting on April 27, 2021. These comments concern the licensee’s USR meeting summary statement that, “there does not appear to be a strong case for making a temperature modification”, and issues to address when inputting temperature data into the Downstream Release alternative models:	See below for responses to sub-bulleted comments.
ADCNR		On page 26 of the Downstream Release Alternative Draft Phase 2 Report, water quality data utilized for modeling seems to be limited in years (2017-2020) and does not include winter months, drought years or years with high variation as indicated in the larger temperature data sets. For example, PAD, Volume 1, Appendix E, pages 17-18, Figures 3- 8, 3-9 and 3-10 include histograms of daily water temperature range for three sites below Harris Dam from 2005 through 2017. These figures indicate daily temperature ranges (the difference between the minimum and maximum temperatures) occurring as high as 15°C in the Tailrace, 10°C in Malone and 15°C in Wadley, with numerous instances of daily water temperature ranges above 5°C (Note that in the Auburn Report the Auburn PI’s goal was to test extreme fluctuations seen downstream of Harris Dam. In order to test extreme fluctuations in temperature the Auburn PI’s selected 5° C decreases for the study). If only temperature data from 2017-2020 was included, variation may be misrepresented especially for periods of high variation indicate in the Auburn Report. From 2000-2018, Auburn Report, Figures 2.2 pages 120-129, illustrate highlighted high variation years of interest including 2000, 2002, 2003, 2008, 2009 and 2015. ADCNR had previously requested in comments that this Auburn Report temperature data be presented in similar form to the boxplots and histograms in the Aquatic Resources Study Report for the water level logger data for the May 1, 2019 through April 30, 2020 providing the number of temperature change events not just percentages, noting that it only takes one extreme temperature change to cause a detrimental aquatic species event.	As indicated in Section 3.2.1 of the Downstream Release Alternatives Phase 2 Report, a variety of data sources were used to qualitatively describe potential effects on dissolved oxygen in the tailrace that may occur due to a change in downstream releases. However, there appears to be some confusion on the paragraph on page 26 of the draft report, as it pertains to the downstream release alternatives analysis, so the paragraph was removed from the final report. Effects of the downstream release alternatives on temperature, including methods and data used, are included in Section 3.5 of the Downstream Release Alternatives Phase 2 Report.

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response
ADCNR		Include if model input data presented in the Downstream Release Alternative Draft Phase 2 Report utilized the continuous monitoring data or generation only temperature and DO data. With so many temperature gages and sites in the various studies and the vast difference in time ranges the data spans, it is crucial to specify which data was input into the model and why. It is important to note that Auburn Report temperature evaluation methodology (page 12), highly reduced variation in its analyses. It also excluded winter temperature data and had numerous gaps of missing data during known high variation periods. It is of note that although temperature data as presented in the Auburn Report, reduced variation in analyses, the data still indicate numerous daily and hourly temperature changes outside of temperature measurements examined for the two unregulated upstream control sites (Newell and Heflin). When comparing temperature data from two unregulated sites to regulated sites, all regulated sites had higher daily and hourly temperature variation throughout the year. Tailrace temperatures were higher in the winter at all sites compared to unregulated sites. Seasonal temperature shifts indicate warmer mean temperatures in the tailrace later in the fall season when compared to unregulated sites. In addition, warmer temperatures in the tailrace during the winter and cooler temperatures in the summer when compared to unregulated sites. Model input data should span a larger time period (include high variation years) and should include winter temperature data.	As indicated in Section 3.2.1 of the Downstream Release Alternatives Phase 2 Report, a variety of data sources were used to qualitatively describe potential effects on dissolved oxygen in the tailrace that may occur due to a change in downstream releases. However, there appears to be some confusion on the paragraph on page 26 of the draft report, as it pertains to the downstream release alternatives analysis, so the paragraph was removed from the final report. The data used to analyze downstream release alternatives on water temperature are described in Section 3.5.1 of the Downstream Release Alternatives Phase 2 Report.
ADCNR		On page 26 of the Downstream Release Alternative Draft Phase 2 Report, ADCNR wants to ensure that the water quality data utilized for modeling is not limited in downstream distance locations input into the model. Temperature data only includes input from the first 7 miles and makes statements indicating flow and temperature effects are limited to this stretch of the river only. Average wetted perimeter results Table 3-1 and 3-11 of the Downstream Release Alternative Draft Phase 2 Report and temperature data presented in Auburn Report show regulated release impacts throughout the tailrace but diminishing in magnitude with distance from the dam.	As indicated in Section 3.2.1 of the Downstream Release Alternatives Phase 2 Report, a variety of data sources were used to qualitatively describe potential effects on dissolved oxygen in the tailrace that may occur due to a change in downstream releases. However, there appears to be some confusion on the paragraph on page 26 of the draft report, as it pertains to the downstream release alternatives analysis, so the paragraph was removed from the final report.
ADCNR		On page 26, of the Downstream Release Alternatives Draft Phase 2 Report, include or reference the additional potential contributing factors provided on page 49 of the Water Quality Study Report regarding the dissolved oxygen levels in 2017. In addition to evaluating potential causes of the 2017 low dissolved oxygen events, changes and improvements that can be made to detect, adjust and improve operations to prevent another 2017 event from occurring again should be considered and evaluated for the sustained benefit of downstream aquatic resources. It is important to note when presenting dissolved oxygen or temperature that it only takes a single incident of depleted dissolved oxygen or extreme temperature change to cause a detrimental aquatic species event. If drought conditions are potentially impacting dissolved oxygen levels in drought years and in following	As indicated in Section 3.2.1 of the Downstream Release Alternatives Phase 2 Report, a variety of data sources were used to qualitatively describe potential effects on dissolved oxygen in the tailrace that may occur due to a change in downstream releases. However, there appears to be some confusion on the paragraph on page 26 of the draft report, as it pertains to the downstream release alternatives analysis, so the paragraph was removed from the final report.

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response
		years as stated on page 26 Downstream Release Alternatives Draft Phase 2 Report and as stated by licensee at the Harris Relicensing Harris Action Team (HAT) 1 Meetings April 1, 2021 that downstream temperature "deltas decrease with a CMF due to having more water in the channel as it prevents the water from getting shallower and experiencing thermal heating", then drought cutback releases currently at 85 cfs should be re-evaluated and analyzed. In addition, when re-evaluating and analyzing drought cutback releases, an emphasis should be placed on maintaining a minimum flow for the channel geomorphology of the Tallapoosa River downstream of Harris Dam to prevent direct solar radiation in shallow river sections from excessive heating. These flows should follow state dissolved oxygen guidelines and provides natural temperature regimes, at all times (during generation and non-generation). Temperature results presented in the Aquatic Resources Study Report indicate that the current channel geomorphology at flows below a certain threshold may be warming tailrace sections and increasing deltas to rates outside of control unregulated site (Newall, Heflin) ranges. The concept illustrated in the Aquatic Resources Study Report on page 56 to point out effects of low flows on measurements of water temperature fluctuation, also may be indicative that a low stable flow of 150 cfs in the example may not be suitable at providing riffle velocity and depths able to prevent direct solar radiation from excessive heating. Sufficient releases throughout the year especially late summer and early fall are required to prevent excessive heating of this nature in channels historically supporting higher mean annual flows. Table 5, pages 147 and 148 of Feaster and Lee (2017) an evaluation of the Tallapoosa River flows at Wadley, AL (Preregulation and Regulation) is provided and analyzed. Lowest average flows and duration of daily flow from April 1924 to March 1982 (Pre-regulation), indicated the river channel at Wadley was exposed to flows that equaled or exceeded 528 cfs 90 percent and 387 cfs 95 percent of the period and equaled or exceeded 7,820 cfs 5 percent of the time. These flows are drastically different than what the channel has been subjected to Post-regulation, especially in regard to low flows and the period of time the channel is exposed to low flows. During the Regulated period analyzed from April 1983 to March 2014, the Tallapoosa River at Wadley, AL river channel was exposed to flows that equaled or exceeded 220 cfs 90 percent and 170 cfs 95 percent of the period and equaled or exceeded 8,080 cfs 5 percent of the time. Focusing on lowest average flow for indicated number of consecutive days (7) at the site, pre regulation had recurrence interval of 10 years for flows below 170 cfs, during post regulation there was a recurrence interval of 5 years for flows below 170 cfs. Determining the change in water surface elevation and flow from the different downstream release alternatives in the Tallapoosa River downstream of Harris Dam and their effects on solar radiation heating (water temperature) for the channel	Alabama Power will meet state water quality standards in accordance with a Section 401 Water Quality Certificate.

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response
		geomorphology is a key component to consider when determining drought cutbacks and potential flow alternatives.	
ADCNR		In the Aquatic Resources Study Report, Newell temperature data was provided but not statistically analyzed. In the Auburn Report, unregulated Heflin data was provided but not statistically analyzed. Include statements clarifying how three years of temperature data was unable to be statistically analyzed. If the data was unable to be compared to the full regulated site data, a separate analysis could be completed for the same available time periods allowing for statistical evaluation comparisons. Regardless of the variables associated with the Heflin or Newell sites, temperature was the main metric of interest in the study, and there is no reason not to conduct analyses at the Heflin site or Newell site. Certain statements made, such as air hitting loggers at Heflin, and the suspect data at Malone and Wadley where water temperature consistently exceeds air temperature could potentially be further examined with statistical analyses of the data from both sites. For example, during the March 5, 2021 meeting (See Attachment 1, pages 1204-1206, P-2628- 005 FERC ¶ 20210412-5745). Auburn indicated that the Heflin water temperature data during winter was suspect. If data at Newell was analyzed, the researchers could distinguish whether the changes were due to logger malfunction, or the logger being exposed to air. In limited comparisons of unregulated and regulated temperature data included in the Auburn Report, it appears that the Heflin data included December to March months while the regulated site data excluded these December to March time periods. These time periods should either be fully analyzed for regulated sites as well or removed from the unregulated site data for equivalent comparison. ADCNR recommends fully evaluating all time periods, especially with indications that warmer water temperatures, compared to unregulated sites and downstream regulated sites, are being released into the tailwater during winter months.	This comment was addressed in Alabama Power's response provided to ADCNR on June 4, 2021 and filed with FERC on June 15, 2021 (Accession No. 20210615-5110). This comment and response is repeated on the comment table associated with the Auburn Report.
ADCNR		In the Auburn Report, explain how high temperature variation for a specific time period could be detected in the Tailrace and Wadley, but not at Malone (for example months 9-12 Figure 2.2, year 2015). As noted in our draft Aquatic Resources comments, if temperature data is unavailable for a specific site during a time period when other sites indicate high temperature variation, provide a caveat recognizing these specific key data range gaps with an explanation for the absence. For example, Tailrace 2000 Temperature Range is unavailable for 10-12-month data, but Malone and Wadley both indicate high temperature variation during this same time period. Unavailable temperature data gaps, during key high temperature variation events, have the potential to significantly reduce analyses of temperature changes and impacts occurring in the regulated reach. These limitations to the overall conclusions of temperature analyses should be included and discussed.	This comment was addressed in Alabama Power's response provided to ADCNR on June 4, 2021 and filed with FERC on June 15, 2021 (Accession No. 20210615-5110). This comment and response is repeated on the comment table associated with the Auburn Report.

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response
ADCNR		On page 12 of the Auburn Report it states, "Hourly data points were used to generate hourly and daily averages, minimum, and maximum temperatures through the year. This eliminated some variation but allowed for a consistent comparison of temperatures across years." Analyzing the temperature data in a way that "eliminates variation" in a study aimed at targeting the amount of "temperature variation" conflicts with the overall purpose. It is important to make sure that minimums and maximums that occur in the tailrace are not averaged or reduced. Provide Tables in addition to Figures similar to draft Water Quality Study Report Tables 4-9 and 4-10 for each year and site. In the draft Water Quality Study Report Tables 4-9 and 4-10 indicate that maximum temperature ranges reaching 29.35° C during generation and 35.60° C from the continuous downstream monitor for the 2019 monitoring period. Although the 2019 temperature data is not included in the Tailrace figures provided in Figure 2.2A of the Auburn Report, the maximum temperatures displayed do not seem to correlate with previous years. Explain how maximum temperature ranges from the continuous downstream monitor for 2019 are higher than the Auburn Report temperature range maximums included in Figure 2.2A for the tailrace. If they are at different gage locations or using different instrumentation, explain how they could differentiate so much in their temperature readings.	This comment was addressed in Alabama Power's response provided to ADCNR on June 4, 2021 and filed with FERC on June 15, 2021 (Accession No. 20210615-5110). This comment and response is repeated on the comment table associated with the Auburn Report.
ADCNR		On page 42 of the Downstream Release Alternative Draft Phase 2 Report, it states that different flow scenarios potentially "reduce the amount of littoral habitat for juvenile fish and mollusks". This reduction in littoral habitat for reservoir tolerant juvenile fish and mollusks could be offset if an increase in upstream riverine habitat is produced for species of fish and mollusks that are riverine specialists. Including or referencing to a table indicating the amount of littoral habitat that will be lost or gained versus the amount of riverine habitat lost or gained for the different downstream release alternatives is recommended. Percentage of littoral habitat gained or lost compared to existing operations would assist in determining potential effects to aquatic resources	As indicated in Section 3.52 of the Downstream Release Alternatives Phase 2 Report, effects on aquatic resources in Harris Reservoir were qualitatively assessed. Although not required by the Study Plan, Alabama Power included this qualitative assessment to summarized potential impacts to aquatic resources on the reservoir. No data are available to determine potential increases in riverine habitat above the reservoir due to lower average reservoir elevations from the higher CMF alternatives.

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response
ADCNR		On page 42 of the Downstream Release Alternative Draft Phase 2 Report, specify the population of "Striped Bass" is referencing (for example, Harris Reservoir, Tailrace or Lake Martin). Note that ADCNR does not currently manage for Striped Bass in Harris Reservoir. The Auburn Report indicated Striped Bass collections at Lee's Bridge. If accurate, this would be the first records of Striped Bass in Harris Reservoir and needs to be further analyzed as to the populations size and sustainability. The statement on page 42 of the Downstream Release Alternative Draft Phase 2 Report, "In the summer, lower reservoir elevations compared to existing operations (GP) could reduce retention time and cause less pronounced thermal stratification. The impact on reservoir stratification could theoretically reduce the amount of cooler, oxygenated water during the summer months necessary for the survival of Striped Bass.", has many inaccuracies without supporting data and does not specify where the statement is referring to within the system. ADCNR does not stock Striped Bass in Harris Reservoir and does not have a management plan for a Striped Bass population in Harris Reservoir. Alternatively, ADCNR does stock and manage for Striped Bass in Lake Martin.	This sentence has been removed from the final report.
ADCNR		On page 42 of the Downstream Release Alternative Draft Phase 2 Report, fish entrainment is discussed. If lake levels will change with potential downstream release alternatives, so will the distance from lake surface to the penstock intake (if modeled using a set distance, upper penstock setting is input). Even if the water passing through the turbines would not differ among alternatives the location of water withdrawal in proportion to the surface change could potentially effect fish entrainment zones (FEZ). Studies have indicated that even turbine type can affect fish mortality risk. For example, "within field studies, Francis turbines resulted in a higher immediate mortality risk than Kaplan turbines" on fish (Algera et al. 2020). The fish entrainment zone (FEZ) at a dam portal is defined as the volume of water in which fish have a 90% or greater probability of moving into the portal (Johnson et al. 2004). Entrainment zones are important because they indicate the biological extent of influence of the portal's flow field. The Fish Entrainment Zone (FEZ) can vary depending upon many factors. A few of these include turbine, intake design, fish species/size, depth, distance from dam, season and time of day (Johnson et al. 2004, Johnson et al. 2009). APC recognizes that fish entrainment and turbine mortality occur at the Harris Hydroelectric Project which results in a loss of public trust resources. ADCNR is concerned with this issue and how the combinations of operating curve scenarios and downstream release alternatives modeled together may potentially influence fish entrainment. Entrainment issues have complicated Hydroelectric Project relicensing across the U.S.	Comment noted.

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response

Environmental Protection Agency (EPA)
 	
Note: footnotes included in the original letter have been omitted from this table
	06/07/2021
	
	20210607-5012
		The Draft Downstream Release Alternative Phase 2 report and the Final Aquatic Resources report indicate that an alternative modeled flow could reduce downstream temperature fluctuations, increase wetted perimeter, decrease wetted perimeter fluctuations and increase downstream DO.
		
		Comment: The EPA recommends providing a process for stakeholders to provide input to determine an alternate CMF or ModGP flow. This process would allow individual stakeholder concerns to be addressed based on a consensus of weighted outcomes for issues like habitat and water quality.
		
		Downstream Release Alternatives Phase 2 DO (meeting presentation 4/1/2021) notes to consider:
		
		• downstream releases and/or continuous releases may have a beneficial effect on DO (downstream of dam)
		• continuous releases may provide additional aeration, having beneficial effect on DO in tailrace
		• as intake becomes shallower water withdrawn for generation is theoretically warmer with higher DO
		• daily temperature fluctuations were measurably reduced in all modeled downstream release alternatives in the tailrace and one mile downstream of Harris dam
		• higher flow simulations increased wetted perimeter littoral habitat and decreased wetted perimeter fluctuations
		  ○ ModGP (modified green plan) and 150CMF (continuous minimum flow) were least increased and 800 CMF was most increased
		  ○ 300CMF and 600CMF were moderately increased
			Comment noted.

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response
EPA		The Report (page 26) states that "Dissolved oxygen levels were consistently greater than 5 mg/L during the 2018-2020 monitoring periods, with lowest dissolved oxygen levels occurring in August of each year of the monitoring period. Dissolved oxygen levels in 2017 were lower than those measured during the 2018, 2019, and 2020 monitoring periods. This may be attributed to conditions in Harris Reservoir that were impacted by severe drought in the summer and fall of 2016, when inflows to the lake were at historic lows (Kleinschmidt 2021d)." Comment: The EPA recommends revising the above language. This language should accurately reflect the periods of time that the dissolved oxygen was not meeting the water quality standards. There were significant periods of time in 2017 and 2018 (44.2% 2017 and 18.3% Jul–Sept 2018) when DO showed non-compliance. The data from the generation site is limited and only represents about 21.5% of the time (measured in hours) in the months of June-October in 2017- 2020 and about 9% of the time (measured in hours) in 2017-2020. Data may indicate a significant water quality issue and that water quality may not be adequate to support the designated aquatic life and wildlife uses in this section of the River.	Alabama Power notes that although the EPA letter indicates this comment is on the final Water Quality Report, it references the page from the draft Downstream Release Alternatives Phase 2 Report. As indicated in Section 3.2.1 of the Downstream Release Alternatives Phase 2 Report, a variety of data sources were used to qualitatively describe potential effects on dissolved oxygen in the tailrace that may occur due to a change in downstream releases. However, there appears to be some confusion on the paragraph on page 26 of the draft report, as it pertains to the downstream release alternatives analysis, so the paragraph was removed from the final report.
EPA		Tallapoosa River Downstream of Harris Dam states that "Based on existing data and results from the Water Quality Study, overall water quality conditions support the designated uses of the tailrace." Comment: The EPA recommends revising the statement that "water quality conditions support the designated uses of the tailrace." To more accurately present the results of the monitoring efforts, the document should also reflect the periods of time when the dissolved oxygen was not meeting the water quality standards. The analysis of the monitoring data could identify water quality issues in different sections of the project area. The report results should be supported by monitoring data and then a summary statement about whether the designated uses of the tailrace are being met.	Alabama Power notes that although the EPA letter indicates this comment is on the final Water Quality Report, it references the page from the draft Downstream Release Alternatives Phase 2 Report. This sentence is included to characterize the data used to qualitatively describe potential effects on dissolved oxygen in the tailrace that may occur due to a change in downstream releases.

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response
EPA		Downstream Temperature (page 54) states that the magnitude of daily temperature fluctuations in the tailrace and one mile downstream were reduced when simulated flows increased (ModGP– 150CMF/+GP more reduced daily temperature fluctuations and 800CMF/+GP least reduced daily temperature fluctuations). Comment: The EPA recommends providing a process for stakeholders to provide input to determine an alternate CMF or ModGP flow. This process should allow individual stakeholder concerns to be addressed based on a consensus of weighted outcomes (habitat, water quality, etc.). The EPA recommends selecting the best alternative flow to address stakeholder concerns such as improving dissolved oxygen, unnatural lower temperatures and be more in line with natural pre-dam riverine temperatures during important times such as fish spawning and nesting.	Alabama Power notes that although the EPA letter indicates this comment is on the final Water Quality Report, it references the page from the draft Downstream Release Alternatives Phase 2 Report. The relicensing process has been used for stakeholders to provide input to the various downstream release alternatives.
EPA		Table 4-1 shows that water quality in the Tallapoosa River is not affected by flows, however, Exhibit S (Mar 24, 1980 of FPC Dec 27, 1973 license page 3-4) includes information on how to maintain minimum stream flows and maintain 5 ppm DO in the Harris discharge (under the section entitled Water Quality). Also, as noted in the letter from AP, the revised Exhibit S describes measures that will be implemented to maintain or enhance water quality downstream of the project consistent with the license application requirements. Comment: The EPA recommends revising table 4-1 and elaborate more re the statement that the water quality is not affected by the flows, but then measures that will be implemented are needed to maintain requirements. Is water quality affected? And therefore, measures are necessary?	Table 4-1 is intended to provide a summary of effects of the downstream release alternatives and does not need further elaboration. There is no effect because discharges from Harris Dam will meet state water quality standards.
Federal Energy Regulatory Commission (FERC) Note: footnotes and tables included in the original letter have been omitted from this table	June 9, 2021 20210609-3045	Table 3-7, Section 3.4.2 of the Draft Downstream Flow Alternatives Phase 2 Report presents the average daily water surface fluctuation (in feet) exceedance for each of the modeled downstream release alternatives at a location on the Tallapoosa River 7.7 miles downstream from Harris Dam. For the 1 percent exceedance value, fluctuations varied from 6.48 feet (Pre-Green Plan) to 4.97 feet (800 continuous minimum flow [CMF] and 800 CMF with Green Plan releases). Table 3-8 in the draft report presents the same information for the downstream release alternatives at a location 20.6 miles downstream from Harris Dam. The 1 percent exceedance values for fluctuations at this location range from 8.27 feet (Green Plan) to 6.37 feet (800 CMF and 800 CMF with Green Plan releases). The increase in magnitude of fluctuations seems inconsistent with the report's conclusion that fluctuations attenuate with distance from Harris Dam. Please confirm the accuracy of the values for the 1 percent exceedance line in table 3-8. If the values are correct, please explain why river fluctuations would be greater 20.6 miles downstream compared to the location 7.7 miles downstream from Harris Dam for the lowest percent exceedance value.	The values reported are accurate. Certain cross-sections may experience a higher magnitude of water level fluctuations due to a combination of factors, including channel geometry, slope, and proximity to hydraulic controls along the length of the river.

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response
FERC		Table 3-8, reports that the 1 percent exceedance value for the average daily fluctuation under the Pre-Green Plan is 7.67 feet and the value for the Green Plan is 8.27 feet. The average daily fluctuations drop with each successive release alternative, including continuous minimum flows both with and without the Green Plan releases. For every other exceedance level, the average daily fluctuations decrease between the PreGreen Plan and the Green Plan alternatives. Please verify the accuracy of the 1 percent exceedance values for the Pre-Green Plan and Green Plan release alternatives. If the values are correct, please explain why the average daily fluctuation is greater for the Green Plan alternative compared to the Pre-Green Plan alternative at the 1 percent exceedance level.	Several of the values in the GP column of this table were incorrectly copied. The correct values have been inserted in the Final Study Report. Note that Figure 3-17 was updated as well to reflect these corrected values.
FERC		Table 3-10 of the Draft Downstream Flow Alternatives Phase 2 Report presents a comparison of the percent difference from existing conditions in average wetted perimeter for each downstream release alternative. Table 3-11 in the draft report presents a comparison of percent difference from existing conditions in daily wetted perimeter fluctuation for each of the downstream release alternatives. Finally, table 3-12 in the draft report presents the water temperature statistics downstream from Harris Dam for each of the release alternatives. As highlighted in the tables shown below, there are specific values that fall outside the overall general trends seen in the output from the HEC-RAS Model. Please check these values for accuracy. If found to be accurate, please explain why the anomaly(ies) exist.	The values reported are accurate. Certain cross-sections may experience a higher magnitude of wetted perimeter due to a combination of factors, including channel geometry, slope, and proximity to hydraulic controls along the length of the river.

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response
Alabama Rivers Alliance (ARA) Note: footnotes included in the original letter have been omitted from this table	06/11/2021 20210611-5070[1]	A. Evaluation of Providing a Continuous Minimum Flow ARA encourages the release of a continuous minimum flow to reduce both flow and water temperature fluctuations in the river downstream of Harris, which could lead to improved aquatic habitat, lessen erosion, and benefit recreationists. As part of an adaptive management program and along with other operational changes, a continuous minimum flow could be help restore a more natural flow and thermal regime. Following the scientific literature, we continue to stress the importance of considering flows and temperature together and not assuming that any particular level of continuous minimum flow will yield a positive ecological response if water temperatures below the dam remain out of line with unregulated reaches. In fact, a continuous minimum flow of excessively cold water could disrupt thermal cues for breeding and inhibit the productivity of the aquatic environment. Figures 3-31, 3- 32, and 3-33 of the DRA Phase 2 Report contain clear visual representations of how temperatures at the unregulated Heflin site compare to water temperatures below Harris. The difference in water temperatures downstream from unregulated water temperatures is most pronounced in spring and fall, which are critical spawning seasons. Releases from Harris result in both substantial daily and hourly temperature fluctuations and also have a more general dampening effect on maximum and minimum temperatures, such that the river below Harris does not reach the high temperatures it would ordinarily reach in the summer nor the level of natural low temperatures in the winter. Data from the DRA Phase 2 Report shows that releasing a continuous minimum flow may not significantly shift overall water temperatures, but it could reduce large swings in temperature close to the dam. For instance, Table 3-12 shows that the 300CMF alternative could reduce maximum daily and hourly temperature changes by roughly half in the tailrace and one mile downstream compared to current operations.	Comment noted.

[1] In addition to comments filed with FERC concerning the Operating Curve Feasibility Analysis Phase 2 Report, ARA provided similar comments to Alabama Power via email dated 05/27/2021. The 05/27/2021 comments are included within the stakeholder consultation record for reference.

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response
ARA		B. Flow Impacts on Reservoir Levels According to Licensee's analysis, the HEC-ResSim model indicates that "PreGP, 150CMF, and 300CMF have negligible effects on average reservoir elevations," but 300CMF+GP, 600CMF, and 800CMF scenarios do begin to lower reservoir levels. The DRA Phase 2 Report does not specify, however, what level of continuous minimum flow (with or without Green Plan pulsing) begins to affect reservoir levels. ARA supports releasing the greatest continuous minimum flow possible that will not adversely affect reservoir levels, and we request that one further step of analysis be conducted to determine what amount of minimum flow can be released without impacting lake levels. For instance, if a 400cfs or 500cfs minimum flow could be released without impacting reservoir levels, that could represent substantial gains in habitat downstream and even further reduce fluctuations in river levels and water temperatures. As the report notes, "[g]enerally, results show that river fluctuations are lower with increasing continuous minimum flows." The point at which a minimum flow begins to impact lake levels is an important piece of information for stakeholders and FERC to have, and determining this point should not require extensive additional effort on Licensee's part. We request that it be included in the final report.	Alabama Power evaluated the downstream release alternatives noted in its July 10, 2020 response to comments on the Initial Study report and further required by FERC in its August 10, 2020 Determination on Study Modifications. Determining the minimum flow that "impact lake levels" is beyond the scope of this study.
ARA		C. Possible Addition of a New Continuous Minimum Flow Turbine The DRA Phase 2 Report describes generating off of the various minimum flow scenarios and employs a "theoretical unit that pulls water from the existing penstock" to use in Licensee's HydroBudget model. We encourage Licensee to investigate ways to supply any new generating unit used to pass a minimum flow with well-oxygenated and warmer water from the epilimnion layer of the reservoir. Releasing and generating off of a continuous minimum flow of warmer water with higher levels of dissolved oxygen could benefit water quality and aquatic resources substantially. If a new continuous minimum flow turbine is proposed, it should be designed to draw from as high as possible in the reservoir in order to provide the greatest gains in water quality and benefits to aquatic resources downstream. The existing intake and penstock could potentially be modified to accommodate this, or a separate intake may be needed for a new generating unit.	Alabama Power is proposing to design, install, operate, and maintain a minimum flow unit to provide a continuous minimum flow (CMF) in the Tallapoosa River below Harris Dam. Based on conceptual design, there are two factors affecting the location and size of the minimum flow unit. First, the only suitable location that would accommodate an additional unit is on the outside of the Unit 1 side of the powerhouse. The minimum flow unit would require an addition to the east side of the powerhouse and would connect to the Unit 1 penstock. The minimum flow will meet state water quality standards.

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response
FERC	12/23/2021 20211223-3032	The values for the effects of potential changes to the operating curve and alternative downstream releases on generation across the entire Alabama Power fleet, and generation and revenue specific to Harris Dam were clarified and revised at two places in the license application, (i.e., Page 56, table 4-1 in the Draft Operating Curve Change (Phase 2) Study Report and pages 20 and 21, figures 3-11 through 3-14 in the Draft Downstream Release Alternatives (Phase 2) Study Report). In addition to the revisions in the license application, please make similar revisions to provide the effect on generation and revenue of the potential changes/alternatives presented in: b. Figures 3-11 through 3-14 in the Final Downstream Release Alternatives (Phase 2) Study Report [i.e., Revise the titles to read "Change in Average Annual Generation (Revenue) for Harris Dam (Alabama Power's Hydro System) Based on HydroBudget Model of Downstream Release Alternatives."]	These changes have been made in the revised final report dated June 2022.

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response
FERC	02/15/2022 20220215-3039	As part of the study plan, Commission staff requested that Alabama Power model, and evaluate the effects of 150-cubic feet per second (cfs), 300-cfs, 600-cfs, and 800-cfs continuous minimum flows (with and without Green Plan pulsing) on downstream resources in the Tallapoosa River. Based on the outcome of that work, on October 1, 2021, Commission staff requested that Alabama Power determine what continuous minimum flow between 300 cfs and 600 cfs (with or without Green Plan pulsing) would result in a more than negligible effect on Harris Lakes levels. Table 5-1 in section 5.2, Alternatives Considered but Eliminated from Further Analysis, of Exhibit E (page E-44) provides Alabama Power's preliminary analysis of the effects of continuous minimum flows of 350 cfs, 400 cfs, and 450 cfs on the average and minimum reservoir levels in Harris Lake. During the January 20, 2022, Harris Modeling Technical Meeting, Alabama Power representatives confirmed that the evaluation was done using the HEC-ResSim model, and that they had not had time to model the potential effects of the three minimum flows on downstream resources (e.g., erosion and sedimentation, water use, water quality, aquatic habitat, terrestrial and botanical resources, recreation, and cultural) using the HEC-RAS model. In addition to the potential effects on the lake levels, considering the potential effects of these flows on downstream resources is important. Having the results of the additional analysis for the 350 cfs, 400 cfs, and 450 cfs continuous minimum flows will facilitate staff's review of the proposed project and inform the Commission's licensing decision. Therefore, please complete the evaluation of the 350 cfs, 400 cfs, and 450 cfs continuous minimum flows using the HEC-RAS model, as well as Alabama Power's Hydrobudget model (for generation and cost information), and apply the results of those model runs in evaluating the effects on downstream resources in the same manner as was performed under the study plan for the 150-cfs, 300-cfs, 600-cfs, and 800-cfs continuous minimum flows. In addition, please describe any options, including mechanisms and costs, to release flows greater than 300 cfs from Harris Dam.	An evaluation of 350 cfs, 400 cfs, and 450 cfs continuous minimum flows has been added to the revised final report dated June 2022. Evaluations of the mechanisms to release flows greater than 300 cfs from Harris Dam is provided in the June 15, 2022 filing.

Commenting Entity	Date of Comment & FERC Accession Number	Comment on Draft Downstream Release Alternatives Phase 2 Study Report	Alabama Power Response
FERC	02/15/2022 20220215-3039	Section 3.2.2, Results – Harris Reservoir, of the final Downstream Release Alternatives Phase 2 Report indicates that "Reductions in retention time [associated with higher minimum flows than currently occur] could theoretically result in lower surface water temperatures and less pronounced thermal stratification." However, the report provides no support for this conclusion. To facilitate Commission staff's review of the effects of Tallapoosa River continuous minimum flows on retention times, water levels, and water quality in Harris Lake, please describe the information relied upon to support the report's conclusion regarding reduced retention time of water in the lake, changes in water levels, and cooler water temperatures drawn through the intakes. As part of the response to this AIR, please include any relevant peer-reviewed articles and other literature cited. Also, section 3.2.2, Results – Tallapoosa River Downstream of Harris Dam, of the downstream release report states that "As the depth from the lake surface to the intake becomes shallower, water withdrawn by Harris Dam for generation would likely be warmer and have higher dissolved oxygen concentrations." This statement about lower Harris Lake levels and warmer water in the intakes' withdrawal zone seems inconsistent with the conclusion, above, regarding reduced retention times, lower lake levels, and cooler water temperatures in the withdrawal zone associated with higher continuous minimum flow releases. Please reconcile these two conclusions.	Alabama Power has updated Section 3.2.2 of the revised final report dated June 2022 and provided the following reference: Soares, M. C. S., Marinho, M. M., Huszar, V. L. M., Branco, C. W. C., & Azevedo, S. M. F. O. (2008). The effects of water retention time and watershed features on the limnology of two tropical reservoirs in Brazil. Lakes & Reservoirs: Research & Management, 13(4), 257–269. Available at: http://dx.doi.org/10.1111/j.1440-1770.2008.00379.x [dx.doi.org]. Based on these revisions, there is no longer an inconsistency between the two conclusions.