Claiborne and Millers Ferry Locks and Dams Fish Passage Study

Attachment H-3 – Hydrology and Hydraulics HEC-ResSim Modeling May 2023







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H.3.1. Introduction

This report is an appendix to the "Claiborne and Millers Ferry Lock and Dams Fish Passage Study" Appendix- H: Hydrology and Hydraulics Preliminary Draft Feasibility Report. This supplement documents the HEC-ResSim reservoir operations models developed in support of the Fish Passage Study. The following excerpt offers insight to the background of this study:

"Eighteen major dams (six Federal and twelve non-Federal, Table H.3.1), which form sixteen reservoirs, are located in the ACT River Basin (Figure H.3.2). The ACT River Basin provides water resources for multiple purposes from northwestern Georgia down through central Alabama to the Gulf Coast at the mouth of Mobile Bay, extending approximately 320 miles and encompassing an area of approximately 22,800 square miles. Pursuant to Section 7 of the Flood Control Act of 1944, the USACE prescribes regulations for the operation of the USACE projects in the ACT River Basin for their authorized purposes, and for the non-federal projects that contain storage for the purposes of navigation or flood control (flood risk management), through water control plans and manuals.

Reservoir or Dam	Location	Year in Service	Owner
Allatoona	Etowah River	1965	USACE
Carters	Coosawattee River	1974	USACE
Carters Reregulation	Coosawattee River	1974	USACE
Claiborne	Alabama River	1969	USACE
H. Neely Henry	Coosa River	1966	APC
Harris	Tallapoosa River	1982	APC
Hickory Log Creek	Hickory Log Creek	2008	Private
Jordan	Coosa River	1928	APC
Lay	Coosa River	1914	APC
Logan Martin	Coosa River	1964	APC
Martin	Tallapoosa River	1926	APC
Millers Ferry	Alabama River	1970	USACE
Mitchell	Coosa River	1923	APC
Robert F. Henry	Alabama River	1971	USACE

Richland Creek*	Richland Creek	2019	Private
Thurlow	Tallapoosa River	1930	APC
Walter Bouldin*	Bouldin Canal	1967	APC
Weiss	Coosa River	1961	APC
Yates	Tallapoosa River	1928	APC

• APC is Alabama Power Company

• Richland Creek is currently under construction and is not included in the above paragraph.

• Walter Bouldin is a second dam on Jordan Lake.

The Mobile District is conducting the Claiborne and Millers Ferry Locks and Dams Fish Passage Feasibility Study to evaluate Federal interest in establishing fish passage around the two southernmost lock and dam structures on the Alabama River. The area of interest is show in Figure H.3.1. Fish passage around Claiborne and Millers Ferry Locks and Dams would restore historic connectivity in the Alabama and Cahaba Rivers and would reconnect over 230 miles of critical riverine spawning habitat for migratory species to the Mobile River Delta and the Gulf of Mexico. Increased access to upriver habitat should result in an increase in the size and distribution of native migratory fish populations. Construction of the Claiborne and Millers Ferry Locks and Dams severed this critical spawning habitat connectivity for several species including those listed as threatened and endangered species such as the Gulf Sturgeon and Alabama Sturgeon, respectively.

Initial modeling goals were to evaluate the availability of flows through the fish passage structures, the impact of the flows through Millers Ferry and Claiborne, and the hydropower impacts at Millers Ferry and the ACT hydropower system during the entire throughout the period of record Other modeling goals were to evaluate the drought zone impacts as well as impacts to the pool elevations at Millers Ferry and Claiborne. The main report contains details about the planning process, including planning constraints.









H.3.2. ACT ResSim Modeling History

The ACT River Basin was modeled in early reservoir simulation software HEC-5. Transition from the HEC-5 model to the then new HEC-ResSim software was initiated in 2006 in preparation for the update of the basin Water Control Manuals. Since then, numerous improvements and changes have been made to the model and to the software itself. The major ACT ResSim modeling efforts are shown in Figure H.3

Figure H.3.3. ACT ResSim Model Updates and Changes Timeline



By 2011 the Mobile District Water Control Manual Update was in the process of completing an Environmental Impact Statement. In conjunction, a report was developed to describe the modeling activities performed. The March 2011 report, "ACT HEC-ResSim Modeling of Reservoir Operations in Support of Water Control Manual Update" details the initial design of the ACT ResSim model. An addendum to the March 2011 report was written to describe further changes to the system done during the EIS response to comments (USACE, Jul 2014). These documents are useful references that detail the assumptions and methods used to model the system and create the model that this work. That the starting point for model. entitled "ACTwas HLC WCM 24Apr2014 HRPlansDFG", shall be referred to here as the 2014 model. It included 74 years (1939-2012) of continuously simulated, daily time step, lake levels and river flows throughout the ACT basin. The daily model was retitled "ACT-2018-daily". For this study, a modified ResSim model was created using the "ACT-2018-daily" model that was previously selected in the Allatoona- Coosa Reallocation Study. The changes and methods that were made to model the fish passage structures at Millers Ferry and Claiborne can be found in the Model Updates and Alternatives section.

H.3.3. Overview of this Report

No new baseline was developed during this study. The baseline for this study is the same as the final chose alternative for the Allatoona-Coosa Reallocation Study, A12_WS1MF. The changes to the model were to incorporate the alternative fish passage structures measures at Millers Ferry and Claiborne. These changes and updates to the physical and operational properties of the reservoir are described in Section H-9.

Also described in Section H-9 are the changes necessitated the development of a new network, new model input files, and new alternatives. These updates are described throughout this report.

The updates made to support results analysis are described in Section H-47 and Section H-50.

Examples of the results that were provided to Hydropower Analysis Center (HAC) for further hydropower analysis, to the Environmental team for availability of flows through the fish passage, and to the engineering team for pool duration impacts to the existing operations can be found in Section VI. Sample Post-Processing Results.

H.3.4. HEC-ResSim Version Selection

Because the HEC-ResSim software is being continually improved, it was important to establish a specific version to be used for the Millers Ferry and Claiborne Lock and Dam Fish Passage Study modeling. The ResSim build 3.4.1.32. was previously used for the 2019 Allatoona- Coosa River Water Reallocation study. The ResSim model that was utilized for the fish passage study was the updated ResSim model from the ACR study to which also reflects the 2022 updates for the ACT Water Control. HEC-ResSim 3.4.1.32 was initially used to extract the current ACT watershed files as well as model the alternative measures. The results that were produced for this study was in the HEC-ResSim 3.4.1.32, however after consultation with HEC, moving forward the model should be run in the latest ResSim model version 3.5.

H.3.5. Model Updates and Model Alternatives

The modeling for the Fish Passage Study began with the 2018 model that was used to study the system during the Allatoona-Coosa Reallocation study. The documentation of that work can be found in the 2022 report and the 2014 response to review comments. The *HRPIanG* alternative, which was the prior selected alternative, was updated to create a new baseline alternative, *Base2018*, for this phase of modeling within the Allatoona-Coosa Reallocation study. The 2018 model network, titled "*2018*" was updated to create the "*FPV1*" network as well as the variations of the "FPV1" in sequential order, "FPV2", "FPV3", "FPV4", "FPV5". The fish passage study is focused on implementing two fish passage structures at two USACE projects along the Alabama River, Millers Ferry Lock and Dam and Claiborne Lock and Dam. Figure H.4.5 shows the original 2018 network in the ResSim stream alignment at Millers Ferry. Figure H.6.7 shows the original 2018 network in the ResSim stream alignment at Claiborne Lock and Dam.

The basic model updates for this study applied to the network and the baseline alternative are described in this section of the document. Other model updates that varied based on alternative are found in later sections. This section addresses the following alternatives:

- A. Rock Weir Fish Passage Addition at Millers Ferry and Claiborne
- B. Natural Bypass Channel Addition at Millers Ferry and Claiborne
- C. Rock Weir Fish Passage Addition at Claiborne; Natural Bypass Channel Addition at Millers Ferry
- D. Natural Bypass Channel at Claiborne and Rock Weir Fish Passage at Millers Ferry

The details of the changes are described below in separate sections.

H.3.5.1. Rock Weir Fish Passage Addition at Millers Ferry Lock and Dam and Claiborne Lock and Dam

The rock weir fish passage additions at Millers Ferry Lock and Dam and Claiborne Lock and Dam was simulated in alternative "A03 RwBd" in simulation "Fish Passage

Alternatives POR Updated". Alternative "A03_RwBD" stands for Alternative 3 rock weirs at both dams. "A03_RwBd" alternative's results were compared to the base condition alternative "A12_WS1MF".

H.3.5.1.1. Network Updates

A new network, "FPV5" was created to simulate the rock weir additions at Millers Ferry Lock and Dam and Claiborne Lock and Dam. Controlled outlets were added at both Millers Ferry and Claiborne within this new network to simulate the rock weir structure. The controlled outlet at Millers Ferry Lock and Dam represents the rock weir gated fish passage structure. The controlled outlet is connected from the Millers Ferry reservoir to the tailwater gage downstream of Millers Ferry in the modeling software. Figure H.4.5 shows the updated 2018 network with the addition of the controlled outlet in the ResSim schematic at Millers Ferry. There is no visible difference between the baseline network and alternative measures network. The controlled outlet was also created at Claiborne Lock and Dam to simulate an ungated rock weir fish passage structure. This controlled outlet is connected from Claiborne Lock and Dam Reservoir to the downstream tailwater gage. Figure H.6.7 shows the original 2018 network in the ResSim stream alignment at Claiborne Lock and Dam. Figure H.6.7 shows the updated 2018 network with the addition of the controlled outlet at the Claiborne Lock and Dam. There is no visible difference between the baseline network at the controlled outlet at the Claiborne Lock and Dam. There is no visible difference between the baseline difference between the baseline network with the addition of the controlled outlet at the Claiborne Lock and Dam. There is no visible difference between the baseline network and alternative measures network.





Figure H.6.7: HEC-ResSim Network Module- Claiborne Lock and Dam



H.3.5.1.2. Physical Data

H.3.5.1.2.1. Overall Dam Length

The rock weir variation at Millers Ferry alters the overall dam length given their designed position in the existing spillway structure. Currently at Millers Ferry, the overall dam length is 3360.0 ft. With the rock weir variation, the dam length is 3260.00 ft.

H.3.5.1.2.2. Capacity of the Controlled Outlet

The physical capacity of the Millers Ferry and Claiborne controlled outlet was provided by the results of the HEC-RAS model. To create a binary switch which represents a gated versus ungated operation for different variations of the fish passage structure designs within the same simulation, the physical capacity of the controlled outlet of the rock weir fish passage was determined to be the maximum capacity of the physical structure at the lowest pool elevation where the structure ties into the reservoir and the highest spillway gate elevation. After the initial assessment of determining a gated or an ungated operation, the ungated operation sets at Millers Ferry were screened out due to the high risk and high impacts to the present authorized project purposes of hydropower and the overall structure of the dam. For Claiborne, the gated operation sets were screened out due to the initial design of the physical structure which tied into the top elevation of the fixed crest spillway.

For Millers Ferry, the total maximum capacity is 5800 cfs at headwater pool elevations of 75.0 ft. and 88.0 ft. Figure H.8.9 shows the physical capacity rule curve for the Millers Ferry controlled outlet. For Claiborne, the total maximum capacity is 12,000 cfs at headwater pool elevations of 33.1 ft. and 62.0 ft. Figure H.3.10 shows the capacity rule curve for the Claiborne controlled outlet.

Figure H.8.9: Alternative A03_RwBD Millers Ferry Lock and Dam Controlled Outlet Physical Capacity

Reservoir Editor - Network: A03_R	wBD0:2018_FPV5			×
Reservoir Edit Outlet				
Reservoir Millers Ferry	Description Millers Ferring Millers Ferring Millers Ferring	y Reservoir		H 4 18 of 21 D H
Millers Ferry	Millers Ferry-Dam-Control	led Outlet		
Evaporation	Number of Gates of this ty	pe	1	
Dam Tailwater	Elevation (ft)	Max Capacity (cfs)	Total Max Capacity	90
Power Plant Controlled Outlet			5800.0	€ 84 84 82 80 78 76 74 0 2,000 4,000 6,000 Capacity (cfs)
	Physical Limitations: Max Rate of Increase (cfs/	hr)		
	Max Rate of Decrease (cfs	s/hr)		Edit Gate Settings
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Claiborne and Millers Ferry Fish Passage Study IFR/EA Appendix H – Hydrology and Hydraulics

Figure H.3.10: Alternative A03_RwBd Claiborne Lock and Dam Controlled Outlet Physical Capacity

👿 Reservoir Editor - Network: A03_R	wBD0:2018_FPV5				×
Reservoir Edit Outlet					
Reservoir Claiborne Lock and 💉	- Description Claiborn	e Reservoir		K	◀ 17 of 21 ▶ ▶
Physical Operations Observed D	ata				
Claiborne Lock and Dam	Claiborne Lock and Dar	n-Dam-Controlled Outle	et		
	Number of Gates of this	type	1		
Gated Spillway	Elevation	Max Capacity	Total Max	65	
Fixed Crest Spillway	(ft)	(cfs)	Capacity	60-	
	62.0	12000.0	12000.0	- 50 -	
				€ 45	
				<u>ش</u> 40-	
				35-	
				30+++	
				U 4,UL	
				Cap	acity (cis)
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	Max Rate of Decrease (cfs/hr)		Edit Ga	te Settings
			OK	Cono	al Apply
			OK	Canc	ei Appiy

H.3.5.1.2.3. Capacity Rating Curve

There were no changes to the spillway rating curve at Millers Ferry Lock and Dam. Adjustments were made to the fixed crest spillway rating curve at Claiborne Lock and Dam (Figure H.3.12). The baseline fixed crest spillway rating curve is shown in Figure H.3.14. The gated spillway rating curve remained unchanged from the baseline to the alternative (Figure H.3.11,Figure H.3.13).

Figure H.3.11: Alternative A03_RwBd Gated Spillway Rating Curve

Reservoir Editor - Network: A03_RwBD0:2018_FPV5					
Reservoir Edit Outlet					
Reservoir Claiborne Lock and	Description Claiborn	e Reservoir			H ■ 17 of 21 D H
Physical Operations Observed D	ata				
Claiborne Lock and Dam	Claiborne Lock and Da	m-Dam-Gated Spillway			
Dam	Number of Gates of this	s type	1		
Gated Spillway	Elevation	Max Capacity	Total Max	65	
Fixed Crest Spillway	(II)	(cis)	Capacity	00	
Controlled Outlet	31.0	52494.0	52494.0 🔺	55-	
	31.1	52776.0	52776.0	€ 50	
	31.2	53058.0	53058.0	₹ 45	
	31.3	53340.0	53340.0	ā 40-	
	31.4	53622.0	53622.0	25	
	31.5	53904.0	53904.0	30	
	31.0	54187.0	54187.0	30	
	31.7	54470.0	54470.0		60,000 120,000
	31.8	54753.0	54753.0		Capacity (cfs)
	31.9	55030.0	55030.0		
	32.0	55520.0	55500.0		
	32.1	55002.0	55002.0		
	32.2	50466.0	56466.0		
	32.3	56449.0	56449.0		
	32.4	56720.0	56720.0		
	32.5	57012.0	57012.0		
	32.0	57294.0	57294.0		
	32.7	57576.0	57576.0		
	32.0	57858.0	57858.0		
	33.0	58000.0	58000.0		
	33.0	0000.0	V		
	Physical Limitations:				
	Max Rate of Increase (c	fs/hr)			
	Max Rate of Decrease (cfs/hr)		Ed	it Gate Settings
			OF	((Cancel Apply

Figure H.3.12: Alternative A03_RwBd Fixed Crest Spillway Rating Curve

Reservoir Editor - Network: A03_RwBD0:2018_FPV5					
Reservoir Edit Outlet					
Reservoir Claiborne Lock and	Description Claiborne	Reservoir		H I 17 of 21 D H	
Physical Operations Observed Da	ata				
Claiborne Lock and Dam	Claiborne Lock and Dam	-Dam-Fixed Crest Spi	ilway		
Dam	Number of Gates of this t	type	1		
🕅 Tailwater 🗔 Gated Spillway	Elevation	Max Capacity	Total Max	65	
Fixed Crest Spillway	(ft)	(cfs)	Capacity	60	
Controlled Outlet	33.1	0.0	0.0 🔺	55	
	34.8	2400.0	2400.0	€ 50	
	35.5	3900.0	3900.0	a 45	
	36.0	5400.0	5400.0	Ξ ₄₀	
	37.0	8300.0	8300.0	25	
	38.0	13000.0	13000.0	357	
	39.0	18700.0	18700.0	30 + + + + + + + + + + + + + + + + + + +	
	40.0	23000.0	23000.0	0 30,000 60,000	
	41.0	35200.0	35200.0	Capacity (cfs)	
	42.0	47100.0	47100.0		
	46.0	50300.0	50300.0		
	48.0	53700.0	53700.0		
	50.0	55000.0	55000.0		
	52.0	56800.0	56800.0		
	54.0	59200.0	59200.0		
	56.0	61300.0	61300.0		
	58.0	65800.0	65800.0		
	60.0	69600.0	69600.0		
	62.0	73000.0	73000.0		
			v		
	Physical Limitations:				
	Max Rate of Increase (cfs	;/hr)			
	Max Rate of Decrease (cf	fs/hr)		Edit Gate Settings	
OK Cancel Apply					

Figure H.3.13: Base Condition A12_WS1MF Gated Spillway Rating Curve

ervoir Edit Outlet				
eservoir Claiborne Lock and	Description Claiborn	e Reservoir		H 🖪 17 of 21 🕨 J
hysical Operations Observed [Data			
Claiborne Lock and Dam	Claiborne Lock and Dar	n-Dam-Gated Spillway		
	Number of Gates of this	type	1	
Gated Spillway	Elevation	Max Capacity	Total Max	65
- 😓 Fixed Crest Spillway	(ft)	(cfs)	Capacity	60
	31.0	52494.0	52494.0 🔺	55
	31.1	52776.0	52776.0	£ 50
	31.2	53058.0	53058.0	≥ 45
	31.3	53340.0	53340.0	
	31.4	53622.0	53622.0	40
	31.5	53904.0	53904.0	35-
	31.6	54187.0	54187.0	30
	31.7	54470.0	54470.0	60,000 120,000
	31.8	54753.0	54753.0	Capacity (cfs)
	31.9	55036.0	55036.0	
	32.0	55320.0	55320.0	
	32.1	55602.0	55602.0	
	32.2	55884.0	55884.0	
	32.3	56166.0	56166.0	
	32.4	56448.0	56448.0	
	32.5	56730.0	56730.0	
	32.6	57012.0	57012.0	
	32.7	57294.0	57294.0	
	32.8	57576.0	57576.0	
	32.9	57858.0	57858.0	
	33.0	58000.0	58000.0	
	Physical Limitations:	00000	00000	
	Max Rate of Increase (c	fs/hr)		
	Max Rate of Decrease (cfs/hr)		Edit Gate Settings

Figure H.3.14: Base Condition A12_WS1MF Fixed Crest Spillway Rating Curve

👿 Reservoir Editor - Network: A12_W	S1MF-0:2018			×
Reservoir Edit Outlet				
Reservoir Claiborne Lock and	Description Claiborne	Reservoir		H I 17 of 21 D H
Physical Operations Observed Da	ata			
Claiborne Lock and Dam	Claiborne Lock and Dan	n-Dam-Fixed Crest Spi	llwav	
Pool	Number of Option of their		1	
Dam Tailwater	Number of Gates of this	type	1	
Gated Spillway	Elevation	Max Capacity	Total Max	65
Fixed Crest Spillway	(ft)	(cfs)	Capacity	60
	33.0	1000.0	1000.0 🔨	55
	34.0	3500.0	3500.0	₽ 50
	35.0	6000.0	6000.0	≥ ≥ 45
	36.0	9000.0	9000.0	
	37.0	14000.0	14000.0	40
	38.0	18000.0	18000.0	35-
	39.0	22000.0	22000.0	30
	40.0	25000.0	25000.0	60,000 120,000
	41.0	29000.0	29000.0	Capacity (cfs)
	42.0	30000.0	30000.0	
	43.0	32000.0	32000.0	
	44.0	33000.0	33000.0	
	45.0	40500.0	40500.0	
	40.0	40500.0	40300.0	
	47.0	43000.0	43000.0	
	49.0	50000.0	50000.0	
	50.0	54000.0	54000.0	
	51.0	58000.0	58000.0	
	52.0	62000.0	62000.0	
	53.0	66000.0	66000.0	
		00500.0	00500 0 ¥	
	Physical Limitations:			
	Max Rate of Increase (cf	s/hr)		
	Max Rate of Decrease (o	zfs/hr)		Edit Gate Settings
				(Oanael Aratic
			OF	Cancer Apply

H.3.5.1.3. Reservoir Operations

Two new operation sets were created to simulate flow through the controlled outlet. Figure H.3.15 shows the gated operation set with a gated rule at Millers Ferry named "MF_RockWeir_Gates". Figure H.3.16 represents the ungated operation set at Claiborne "CL_RockWeir_NoGate". The rating curves were provided by HEC-RAS modeling for the physical rock weir variations at each of the individual project.

H.3.5.1.3.1. Gated operations at Millers Ferry

Within the gated operations at Millers Ferry, a new rule named "MF_RockWeir_Gates" was created to reflect the gated operations of the fish passage structure. The "MF_RockWeir_Gates" rule is a function of the current value of the Millers Ferry pool elevation. To simulate the fish passage rock weir gate closing during high flow events, at headwater pool elevation 81.01, the flow is set to 0 cfs. To simulate the gate closing during a low flow period, at pool elevation 79.999 ft., the flow is also set to 0 cfs. This rule assists Water Management to control the fish passage structure during emergency time periods of either low flows or high flows. Figure H.3.15 depicts the corresponding releases with the headwater pool elevation(ft.) as an operational rule within ResSim.

Figure H.3.15: Alternative A03_RwBD Millers Ferry Rock Weir Gated Operation Rule Set

Reservoir Editor - Network: A03_RwBD0:2018_FPV5								
Reservoir Edit Operations Zone Rule IF_Block								
Reservoir Millers Ferry V Description Millers Ferry Reservoir								
Physical Operations Observe	d Data							
Operation Set MF_Rockweir_C	Operation Set MF_Rockweir_Gated V Description Millers Ferry Rock Weir Gated with Two sluice gates							
Zone-Rules Rel Alloc Outa	Zana Bulas Bal Allas Outages Star Credit Des Sched Breisted Flor							
Top of Dam	Operates Balance From: Willer	a Farry Controlled Outlet						
MF_RockWeir_Gates	Rule Name: Mr. Dookwair. Or	s reny-controlled Outlet						
Flood Control	MF_ROCKWEII_Ga	ales beschphon.						
MF_RockWeir_Gates	Function of: Millers Ferry-Pool	Elevation, Current Value			Define			
Conservation	Limit Type: Specified	✓ Interp.: Linear	× 3,000					
MF_RockWeir_Gates	Flev (ft)	Release (cfs)	2,500 9 2,000					
MinRel=Inflow_up to 66	75.0	0.0	م (m) 1,500					
MF_RockWeir_Gates	76.0	0.0						
nactive	78.0	1500.0	0					
	79.0	1800.0	74	76 78 80 82	84 86 88			
	80.0	2200.0		Elev (ft)				
	81.001	0.0	Period Av	verage Limit	Edit			
	83.0	0.0		av Multiplior	Edit			
	85.0	0.0		ay mulupiler	Euit			
	86.0	0.0	Day of W	eek Multiplier	Edit			
	87.0	0.0	Rising/Fa	alling Condition	Edit			
	00.0	0.0	Seasona	I Variation	Edit			
< >>			~					
			ОК	Cancel	Apply			

H.3.5.1.3.2. Ungated Operations at Claiborne

To simulate the ungated operation rule set at Millers Ferry, a new rule name "CL_RockWeir_NoGate" was created to reflect the ungated operations of the fish passage structure. The "CL_RockWeir_NoGate" rule is a function of the current value of the Claiborne's pool elevation. To simulate the uncontrolled gate operations, a rating curve with pool elevations within the range of 33.1 ft. and 62.0 ft. and the corresponding releases are implemented into the rule with a linear interpolation. Figure H.3.16 shows the ungated operation rating curve of the rock weir structure at Claiborne.

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Figure H.3.16: Alternative A03_RwBD Claiborne Rock Weir Ungated Operation Rule Set

Reservoir Editor - Network: A03_RwBD0:2018_FPV5 ×							
Reservoir Edit Operations Zone Rule IF_Block							
Reservoir Claiborne Lock and V Description Claiborne Reservoir							
Physical Operations Observed Data							
Operation Set CL_RockWeir_NoGate V Description Claiborne with rock weir channel with no gate, uncontrolled							
Zone-Rules Rel. Alloc. Outages Stor. Credit Dec. Sched. Projected Elev							
Top of Dam Operates Release From: Claiborne Lock and Dam-Controlled Outlet							
Flood Control Rule Name: DckWeir_Channel_NoGate Description: Rock Weir channel with reduce (shorter length) fix	e()						
Conservation Function of: Claiborne Lock and Dam-Pool Elevation, Current Value Defin	e						
Inactive Interp.: Linear ↓ 12,000 ↓ 10,0000 ↓ 10,0000 ↓ 10,0000 ↓ 10,0000 ↓ 10,0000 ↓ 10,000							
Elev (ft) Release (cfs)	-						
36.0 1000.0 A B 6,000	-						
39.0 3100.0 ° 2,000							
40.0 4000.0 30 35 40 45 50 55 60	65						
41.0 5200.0							
42.0 6000.0 Elevity							
44.0 7200.0 Period Average Limit	it						
46.0 /900.0							
50.0 8700.0 L Hour of Day Multiplier	it						
52.0 8400.0 Day of Week Multiplier Ed	it						
54.0 8700.0 Dising/Falling Condition	it						
56.0 9100.0 Statistical and Statistical and Statistical and Statistical and Statistical Activity	n						
58.0 9900.0 Seasonal Variation Ed	it						
60.0 10600.0 00.0 10600.0							
62.0 11500.0							
OK Cancel A	pply						

H.3.5.2. Natural Bypass Channel Addition at Millers Ferry and Claiborne

The rock weir fish passage additions at Millers Ferry Lock and Dam and Claiborne Lock and Dam was simulated in alternative "A05_BcBD" in simulation "Fish Passage Alternatives POR Updated". Alternative "A05_RwBD" stands for Alternative 5 bypass channel at both dams. "A05_RwBd" alternative's results were compared to the base condition alternative "A12_WS1MF".

H.3.5.2.1. Network Updates

A new network, "FPV2" was created to simulate the bypass channel structures at Millers Ferry Lock and Dam and Claiborne Lock and Dam. Controlled outlets were added at Millers Ferry and Claiborne within this new network to simulate the bypass channel structures. The controlled outlet at Millers Ferry Lock and Dam represents the bypass channel gated fish passage structure. The controlled outlet is connected from the Millers Ferry reservoir to the tailwater gage downstream of Millers Ferry in the modeling software. Figure H.3.17 shows the updated 2018 network with the addition of the controlled outlet in the ResSim schematic at Millers Ferry. The controlled outlet was also created at Claiborne Lock and Dam to simulate an ungated bypass channel fish passage structure.

This controlled outlet is connected from Claiborne Lock and Dam Reservoir to the downstream tailwater gage. Figure H.3.18 shows the updated 2018 network with the addition of the controlled outlet at the Claiborne Lock and Dam.

Figure H.3.17: HEC-ResSim Network Module- Millers Ferry Lock and Dam with Controlled Outlet



Figure H.3.18: HEC-ResSim Network Module- Claiborne Lock and Dam with Controlled Outlet



H.3.5.2.2. Physical Data

H.3.5.2.2.1. Overall Dam Length

The bypass channel variation at Millers Ferry alters the overall dam length given its designed position within the right bank emergency spillway. Currently at Millers Ferry, the overall dam length is 3360.0 ft. With the bypass channel variation, the dam length is 3110.00 ft.

H.3.5.2.2.2. Capacity of the Controlled Outlet

The physical capacity of the Millers Ferry and Claiborne controlled outlet was provided by the results of the HEC-RAS model. To create a binary switch which represents a gated versus ungated operation for different variations of the fish passage structure designs within the same simulation, the physical capacity of the controlled outlet of the rock weir fish passage was determined to be the maximum capacity of the physical structure at the lowest pool elevation where the structure ties into the reservoir and the highest spillway gate elevation. After the initial assessment of determining a gated or an ungated operation, the ungated operation sets at Millers Ferry were screened out due to the high risk and high impacts to the present authorized project purposes of hydropower and the overall structure of the dam. For Claiborne, the gated operation sets were screened out due to the fish passage's design tying into the existing spillway structure.

For Millers Ferry, the total maximum capacity is 2600 cfs at pool elevations of 75.0 ft. and 88.0 ft. Figure H.3.19 shows the physical capacity rule curve for the Millers Ferry controlled outlet. For Claiborne, the total maximum capacity is 12,000 cfs at pool elevations of 33.1 ft. and 62.0 ft. Figure H.3.20 shows the capacity rule curve for the Claiborne controlled outlet.

Figure H.3.19: Alternative A05_BcBd Millers Ferry Lock and Dam Controlled Outlet Physical Capacity

Reservoir Editor - Network: A05_BcBD0:2018_FPV2 X					
Reservoir Millers Ferry	Description Millers Ferry	y Reservoir			K
Millers Ferry Pool Dam Millers Ferry Dam Dam Note: Tailwater Spillway Power Plant Controlled Outlet	Millers Ferry-Dam-Controll Number of Gates of this ty Elevation (ft) 75.0 88.0 88.0 88.0 88.0 88.0 88.0 88.0 8	ed Outlet pe Max Capacity (cfs) 2600.0 2600.0 0 0 0 0 0 0 0 0 0 0 0 0	1 Total Max Capacity 2600.0 2600.0 	90 88 86 84 82 78 76 74 0	dit Gate Settings
			OK	(Cancel Apply

Figure H.3.20: Alternative A05_BcBd Claiborne Lock and Dam Controlled Outlet Physical Capacity

Reservoir Editor - Network: A05_B	cBD0:2018_FPV2			×
Reservoir Edit Outlet Reservoir Claiborne Lock and	Description Claiborne	Reservoir		K 4 17 of 21 D H
Physical Operations Observed D	ata			
Claiborne Lock and Dam	Claiborne Lock and Dan	n-Dam-Controlled Outlet		
	Number of Gates of this	type	1	
Gated Spillway	Elevation (ft)	Max Capacity (cfs)	Total Max Capacity	65
		57000.0 57000.0	57000.0	55 45 40 35 20,000 40,000 60,000 Capacity (cfs)
	Max Rate of Increase (cf	s/hr)		
	Max Rate of Decrease (c	:fs/hr)		Edit Gate Settings
			OK	Cancel Apply

H.3.5.2.2.3. Capacity Rating Curve

There were no changes to the spillway rating curve at Millers Ferry Lock and Dam. Adjustments were made to the fixed crest spillway rating curve at Claiborne Lock and Dam to encompass the ungated fish passage structure within the spillway. The updated fixed crest spillway rating curve to incorporate the fish passage structure is show in Figure H.3.22.

Figure H.3.21: Alternative A05_BcBd Claiborne Lock and Dam Gated Spillway Rating Curve

Reservoir Editor - Network: A05_BcBD0:2018_FPV2 X						
Reservoir Edit Outlet						
Reservoir Claiborne Lock and 、	Description Claiborn	e Reservoir		K 4 17 of 21 K H		
Physical Operations Observed Da	ata					
Claiborne Lock and Dam	Claiborne Lock and Dan	n-Dam-Gated Spillway				
Dam	Number of Gates of this	type	1			
Gated Spillway	Elevation	Max Capacity	Total Max	65		
Controlled Outlet	31.0	52494.0	52494.0 A	55		
_	31.1	52776.0	52776.0	€ 50		
	31.2	53340.0	53340.0	<u>à</u> 45		
	31.4	53622.0	53622.0	ш 40-		
	31.5	53904.0	53904.0	35		
	31.6	54187.0	54187.0	30		
	31.7	54470.0	54470.0	60.000 120.000		
	31.8	54753.0	54753.0	Connectity (of a)		
	31.9	55036.0	55036.0	Capacity (cis)		
	32.0	55320.0	55320.0			
	32.1	55602.0	55602.0			
	32.2	55884.0	55884.0			
	32.3	56166.0	56166.0			
	32.4	56448.0	56448.0			
	32.5	56730.0	56730.0			
	32.6	57012.0	57012.0			
	32.7	57294.0	57294.0			
	32.8	57576.0	57576.0			
	32.9	57858.0	57858.0			
	33.0	58000.0	58000.0			
	Physical Limitations:		0.000			
	Max Rate of Increase (cf	s/hr)				
	Max Rate of Decrease (cfs/hr)		Edit Gate Settings		
			OF	Cancel Apply		

ervoir Claiborne Lock and	✓ Description Claiborne	Reservoir		H 🖣 17 of 21 🕨
vsical Operations Observed	Data			
Claiborne Lock and Dam	Claiborne Lock and Dam-	-Dam-Fixed Crest Sp	illway	
Dam	Number of Gates of this t	уре	1	
🗔 Tailwater 🗔 Gated Spillway	Elevation	Max Capacity	Total Max	65
Fixed Crest Spillway	(ft)	(cfs)	Capacity	60
Controlled Outlet	33.0	1000.0	1000.0	55
	34.0	3500.0	3500.0	
	35.0	6000.0	6000.0	> 45
	36.0	9000.0	9000.0	
	37.0	14000.0	14000.0	40-
	38.0	18000.0	18000.0	35
	39.0	22000.0	22000.0	30
	40.0	25000.0	25000.0	60,000 120,000
	41.0	29000.0	29000.0	Conocity (cfo)
	42.0	30000.0	30000.0	Capacity (cis)
	43.0	32000.0	32000.0	
	44.0	33000.0	33000.0	
	45.0	38000.0	38000.0	
	46.0	40500.0	40500.0	
	47.0	43000.0	43000.0	
	48.0	47000.0	47000.0	
	49.0	50000.0	50000.0	
	50.0	54000.0	54000.0	
	51.0	58000.0	58000.0	
	52.0	62000.0	62000.0	
	53.0	66000.0	66000.0	
		00500.0	00500.0	
	Physical Limitations:			
	Max Rate of Increase (cfs	/hr)		
		,		Edit Oata Oatlinea

Figure H.3.23: Base Condition A12_WS1MF Fixed Crest Spillway Rating Curve

Reservoir Editor - Network: A12_WS1MF-0:2018								
Reservoir Edit Outlet								
Reservoir Claiborne Lock and V Description Claiborne Reservoir H 4 17 of 21 D								
Physical Operations Observed D	Physical Operations Observed Data							
Claiborne Lock and Dam	Claiborne Lock and Dan	n-Dam-Fixed Crest Sp	illway					
Pool								
Dam	Number of Gates of this	type	1					
Gated Spillway	Elevation	Max Capacity	Total Max	65				
Fixed Crest Spillway	(ft)	(cfs)	Capacity	60				
	33.0	1000.0	1000.0 🔺	55				
	34.0	3500.0	3500.0	₽ 50				
	35.0	6000.0	6000.0	₹ 3 45				
	36.0	9000.0	9000.0					
	37.0	14000.0	14000.0	40				
	38.0	18000.0	18000.0	357				
	39.0	22000.0	22000.0	30				
	40.0	25000.0	25000.0	60,000 120,000				
	41.0	29000.0	29000.0	Capacity (cfs)				
	42.0	30000.0	30000.0					
	43.0	32000.0	32000.0					
	44.0	38000.0	38000.0					
	46.0	40500.0	40500.0					
	47.0	43000.0	43000.0					
	48.0	47000.0	47000.0					
	49.0	50000.0	50000.0					
	50.0	54000.0	54000.0					
	51.0	58000.0	58000.0					
	52.0	62000.0	62000.0					
	53.0	66000.0	66000.0					
	Physical Limitations:	00500.0	00000					
	Max Rate of Increase (cf	is/hr)						
	Max Nate of Micrease (C			Edit Gate Settings				
	Max Rate of Decrease (us/mr)						
			O	K Cancel Apply				

Figure H.3.24: Base Condition A12_WS1MF Gated Spillway Rating Curve

👿 Reservoir Editor - Network: A12_W	/S1MF-0:2018			×
Reservoir Edit Outlet				
Reservoir Claiborne Lock and	Description Claiborn	e Reservoir		H 4 17 of 21 D H
Physical Operations Observed D	ata			
Claiborne Lock and Dam	Claiborne Lock and Da	m-Dam-Gated Spillway		
Dam	Number of Gates of this	s type	1	
Gated Spillway	Elevation (ff)	Max Capacity (cfs)	Total Max Capacity	65
Pixed Crest Spiriway	31.0	52494.0	52494.0	55
	31.1	52776.0	52776.0	€ 50
	31.2	53058.0	53058.0	a 45
	31.3	53340.0	53340.0	
	31.4	53622.0	53622.0	25
	31.5	53904.0	53904.0	35
	31.6	54187.0	54187.0	30
	31.7	54470.0	54470.0	60,000 120,000
	31.8	54753.0	54753.0	Capacity (cfs)
	31.9	55036.0	55036.0	
	32.0	55320.0	55320.0	
	32.1	55602.0	55602.0	
	32.2	55884.0	55884.0	
	32.3	56166.0	56166.0	
	32.4	56448.0	56448.0	
	32.5	56730.0	56730.0	
	32.6	57012.0	57012.0	
	32.7	57294.0	57294.0	
	32.8	57576.0	57576.0	
	32.9	57858.0	57858.0	
	33.0	58000.0	58000.0	
	Physical Limitations:		0.000	
	Max Rate of Increase (o	fs/hr)		
	Max Rate of Decrease ((cfs/hr)		Edit Gate Settings
			OF	Cancel Apply

H.3.5.2.3. Reservoir Operations

Two new operation sets were created to simulate flow through the controlled outlet. Figure H.3.25 shows the gated operation set with the gated rule at Millers Ferry with the right bank variation of the bypass channel named "MF_RB_Bypass_Gated". Figure H.3.26 represents the ungated operation set with the gated rule at Claiborne with the right bank variation of the bypass channel named "CL_RB_Bypass_NoGate". The rating curves were provided by HEC-RAS modeling for the physical rock weir variations at each of the individual project.

H.3.5.2.3.1. Gated Operations at Millers Ferry

Within the gated operations at Millers Ferry, a new rule named "MF_RB_Bypass_Gated" was created to reflect the gated operations of the fish passage structure. The "MF_RB_Bypass_Gated" rule is a function of the current value of the Millers Ferry pool elevation. To simulate the gate closing during high flow events, at pool elevation 81.001, the flow is set to 0 cfs. To simulate the gate closing during a low flow period, at pool elevation 77.999 ft., the flow is also set to 0 cfs. This rule assists Water Management to control the fish passage structure during emergency time periods of either low flows or

high flows. Figure H.3.25 shows the operation rule of the corresponding releases (cfs) with the pool elevation (ft).

Figure H.3.25: Alternative A05	BcBD Millers Ferr	v Rock Weir Gated C	Deration Rule Set
Igure merzer / mernaure / loo		y noon from Gatoa G	

Reservoir Edit Operations Zone Rule IF_Block Reservoir Millers Ferry Description Millers Ferry Reservoir Image: Constraint of the serve						
Physical Operations Observe Operation Set MF_RB_Bypass Zone-Rules Rel. Alloc. Outa Top of Dam MF_Bypass_Gates Flood Control Geck Dil_Nav-rev MF_Bypass_Gates Conservation Get Conservation Get Conservation MF_Bypass_Gates Operating Inactive MinRel=Inflow_up to 66 MinRel=Inflow_up to 66 MinRel=Inflow_up to 66 MF_Bypass_Gates	d Data _Gated V Descr ges Stor. Credit Dec. Sched. Operates Release From: Miller Rule Name: MF_Bypass_Gate Function of: Millers Ferry-Pool Limit Type: Specified Elev (ft) 77.990 77.990 77.990 80.0 80.0 80.0 81.001 82.0 83.0 84.0 84.0 85.0 85.0 86.0	iption Controlled Bypass Channe Projected Elev s Ferry-Controlled Outlet as Description: Elevation, Current Value ✓ Interp.: Linear Release (cfs) 0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0	A at Millers Ferry Right Bank			
< >>	87.0		Seasonal Variation	Edit		
			OK Cancel	Apply		

H.3.5.2.3.2. Ungated Operations at Claiborne

To simulate the ungated operation rule set at Millers Ferry, a new rule name "CL_RB_Bypass_NoGate" was created to reflect the ungated operations of the fish passage structure. The "CL_RB_Bypass_NoGate" rule is a function of the current value of the Claiborne's pool elevation. To simulate the uncontrolled gate operations, a rating curve with pool elevations within the range of 33.1 ft. and 62.0 ft. and the corresponding releases are implemented into the rule with a linear interpolation. Figure H.3.26 shows the ungated operation rating curve of the rock weir structure at Claiborne.

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Figure H.3.26: Alternative A05_BcBD Claiborne Rock Weir Ungated Operation Rule Set

Reservoir Editor - Network: A05_BcBD0:2018_FPV2 ×							
Reservoir Edit Operations Zone Rule IF_Block							
Reservoir Claiborne Lock and V Description Claiborne Reservoir							
Physical Operations Observed Data							
Operation Set CL_RB_Bypass_NoGate							
	_						
Zone-Rules Rel. Alloc. Outa	ges Stor. Credit Dec.	Sched. Proje	ected Elev				
RB Bypass NoCate	Operates Release Fro	m: Claiborne I	Lock and Dam-Controlled	Outle	et		
Flood Control	Rule Name: RB_Byp;	ass_NoGate	Description: Right E	Bank I	Bypass channel, outlet c	apacity values ce	
Conservation	Function of: Claiborn	e Lock and Da	m-Pool Elevation, Curren	it Valu	le	Define	
RB_Bypass_NoGate	Limit Type: Specifie	t v	Interp.: Linear	~	80,000		
nacive					_ල 60,000		
	Elev (π)	22.4	Release (cts)		5 40 000		
		35.0	1200		0,000 8		
		36.0	2100.0	ō	₩ 20,000		
		38.0	3700.	0	" 0++++		
		40.0	7300.	0	30 35 40 4	15 50 55 60 65	
		42.0	9500.	0	Elev	(ft)	
		44.0	14000.0	0			
		46.0	21000.0		🗌 Period Average Lir	nit Edit	
		40.0	33800		Hour of Day Multipl	ior Edit	
		52.0	40000.	ŏ			
		54.0	45500.0	0	Day of Week Multip	lier Edit	
		56.0	52000.	0	Rising/Falling Con	dition Edit	
		58.0	59200.0	0			
		60.0	65800.	0	Seasonal variation	Ealt	
		62.0	/0000.	0			
				~			
	,						
					OK Cano	el Apply	

H.3.5.3. Rock Weir Fish Passage Addition at Claiborne; Natural Bypass Channel Addition at Millers Ferry

The rock weir fish passage additions at Millers Ferry Lock and Dam and Claiborne Lock and Dam was simulated in alternative "A12_rCLbMF" in simulation "Fish Passage Alternatives POR Updated". Alternative "A12_rCLbMF" stands for Alternative 3 rock weirs at both dams. "A12_rCLbMF" alternative's results were compared to the base condition alternative "A12_WS1MF".

H.3.5.3.1. Network Updates

A new network, "FPV3" was created to simulate the bypass channel structures at Millers Ferry Lock and Dam and Claiborne Lock and Dam. To reflect the alternate fish passage measures at both Millers Ferry Lock and Dam and Claiborne Lock and Dam, controlled outlets were added at both Millers Ferry and Claiborne Lock and Dam. The natural bypass channel measure at Millers Ferry is reflected via the added controlled outlet in the HEC-ResSim simulation. The rock weir fish passage measure was added as a controlled outlet at Claiborne. The controlled outlet is connected from the Millers Ferry reservoir to the tailwater gage downstream of Millers Ferry in the modeling software. A controlled outlet is connected from Claiborne Lock and Dam Reservoir to the downstream tailwater gage.

H.3.5.3.2. Physical Data

H.3.5.3.2.1. Overall Dam Length

The bypass channel variation at Millers Ferry alters the overall dam length given its designed position within the right bank emergency spillway. Currently at Millers Ferry, the overall dam length is 3360.0 ft. With the bypass channel variation, the dam length is 3110.00 ft. There is no change in the dam length at Claiborne.

H.3.5.3.2.2. Capacity of the Controlled Outlet

The physical capacity of the Millers Ferry and Claiborne controlled outlet was provided by the results of the HEC-RAS model. To create a binary switch which represents a gated versus ungated operation for different variations of the fish passage structure designs within the same simulation, the physical capacity of the controlled outlet of the rock weir fish passage was determined to be the maximum capacity of the physical structure at the lowest pool elevation where the structure ties into the reservoir and the highest spillway gate elevation. After the initial assessment of determining a gated or an ungated operation, the ungated operation sets at Millers Ferry were screened out due to the high risk and high impacts to the present authorized project purposes of hydropower and the overall structure of the dam. For Claiborne, the gated operation sets were screened out due to the fish passage's design tying into the existing spillway structure.

For Millers Ferry, the total maximum capacity of the fish passage structure is 2600 cfs at pool elevations of 75.0 ft. and 88.0 ft. Figure H.3.27 shows the physical capacity rule curve for the Millers Ferry controlled outlet. For rock weir fish passage structure at Claiborne, the total maximum capacity is 12,000 cfs at pool elevations of 33.1 ft. and 62.0 ft. Figure H.3.28 shows the capacity rule curve for the Claiborne controlled outlet.

Reservoir Editor - Network: A12_ Reservoir Edit Outlet	rCLbMF0:2018_FPV3			×
Reservoir Millers Ferry	✓ Description Millers Ferrare	rry Reservoir		K 4 18 of 21 K H
Physical Operations Observed	Data			
Millers Ferry	Millers Ferry-Dam-Contro	lled Outlet		
	Number of Gates of this t	type	1	
Dam Tailwater	Elevation (ft)	Max Capacity (cfs)	Total Max Capacity	90
Controlled Outlet	Physical Limitations:	2600.0 2600.0	2600.0 2600.0	€ 84 84 80 78 76 74 0 1,000 2,000 3,000 Capacity (cfs)
	Max Rate of Decrease (d	ís/hr)		Edit Gate Settings
<u>. </u>			ОК	Cancel Apply

Figure H.3.27: Alternative A12_rCLbMF Millers Ferry Lock and Dam Controlled Outlet Physical Capacity

Figure H.3.28: Alternative A12_rCLbMF Claiborne Lock and Dam Controlled Outlet Physical Capacity

💘 Reservoir Editor - Network: A12_r	CLbMF0:2018_FPV3			×
Reservoir Edit Outlet				
Reservoir Claiborne Lock and	 Description Claiborne 	e Reservoir		H 🗐 17 of 21 🕨 H
Physical Operations Observed [Data			
Claiborne Lock and Dam	Claiborne Lock and Dan	n-Dam-Controlled Outlet		
Dam	Number of Gates of this	type	1	
Gated Spillway	Elevation (ft)	Max Capacity (cfs)	Total Max Capacity	65
	Physical Limitations: Max Rate of Increase (cf Max Rate of Decrease (cf	is/hr)		Edit Gate Settings
			04	Cancel Apply
			UK	Cancer Apply

H.3.5.3.2.3. Capacity Rating Curve

There were no changes to the spillway rating curve at Millers Ferry Lock and Dam. Adjustments were made to the fixed crest spillway rating curve at Claiborne Lock and Dam to encompass the ungated fish passage structure within the spillway. The updated fixed crest spillway rating curve to incorporate the fish passage structure is show in Figure H.3.30.

Figure H.3.29: Alternative A12_rCLbMF Claiborne Lock and Dam Gated Spillway Rating Curve Х

Reservoir Editor - Network: A12_rCLbMF0:2018_FPV3

Reservoir Edit Outlet					
Reservoir Claiborne Lock and	Description Claiborne F	Reservoir		[K 4 17 of 21 🕨 H
Physical Operations Observed D	ata				
Claiborne Lock and Dam	Claiborne Lock and Dam-I	Dam-Gated Spillwa	ау		
Dam	Number of Gates of this ty	pe	:	L	
Gated Spillway	Elevation	Max Capacity	Total Max	65	
Fixed Crest Spillway	(ft)	(cfs)	Capacity	60-	
Controlled Outlet	31.0	52494.0	52494.0	55-	
	31.1	52776.0	52776.0	_ ⇔ 50−	
	31.2	53058.0	53058.0	2 45-	
	31.3	53340.0	53340.0		
	31.4	53622.0	53622.0	40-	
	31.5	53904.0	53904.0	35-	
	31.6	54187.0	54187.0	30-	-+++++
	31.7	54470.0	54470.0		60,000 120,000
	31.8	54753.0	54753.0		Capacity (cfs)
	31.9	55036.0	55036.0		
	32.0	55320.0	55320.0		
	32.1	55602.0	55602.0		
	32.2	55884.0	55884.0		
	32.3	56166.0	56166.0		
	32.4	56448.0	56448.0		
	32.5	56730.0	56730.0		
	32.6	57012.0	57012.0		
	32.7	57294.0	57294.0		
	32.8	57576.0	57576.0		
	32.9	57858.0	57858.0		
	33.0	58000.0	58000.0	/	
	Physical Limitations:			_	
	Max Rate of Increase (cfs/	hr)			
	Max Rate of Decrease (cfs	s/hr)			Edit Gate Settings
				ОК	Cancel Apply

Figure H.3.30: Alternative A12_rCLbMF Claiborne Lock and Dam Fixed Crest Spillway Rating Curve



Figure H.3.31: Base Condition A12_WS1MF Fixed Crest Spillway Rating Curve

Reservoir Editor - Network: A12_W	VS1MF-0:2018			×
Reservoir Edit Outlet				
Reservoir Claiborne Lock and	Description Claiborne	Reservoir		H 4 17 of 21 D H
Physical Operations Observed D	ata			
	Claiborne Lock and Dam-	Dam-Fixed Crest Spi	illway	
Dam	Number of Gates of this ty	pe	1	
Cated Spillway	Elevation	Max Capacity	Total Max	65
Eived Crest Spillway	(ft)	(cfs)	Capacity	60
i ixed crest Spilway	33.0	1000.0	1000 0	55
	34.0	3500.0	3500.0	- 50-
	35.0	6000.0	6000.0	€ 30
	36.0	9000.0	9000.0	
	37.0	14000.0	14000.0	⁴⁰ 40
	38.0	18000.0	18000.0	35-
	39.0	22000.0	22000.0	30
	40.0	25000.0	25000.0	60,000 120,000
	41.0	29000.0	29000.0	Canacity (cfs)
	42.0	30000.0	30000.0	capacity (elo)
	43.0	32000.0	32000.0	
	44.0	33000.0	33000.0	
	45.0	38000.0	38000.0	
	46.0	40500.0	40500.0	
	47.0	43000.0	43000.0	
	48.0	47000.0	47000.0	
	49.0	50000.0	50000.0	
	50.0	54000.0	54000.0	
	51.0	58000.0	58000.0	
	52.0	62000.0	62000.0	
	53.0	66000.0	66000.0	
	Physical Limitations:			
	Max Rate of Increase (cfs)	hr)		
	Max Rate of Decrease (cfs	s/hr)		Edit Gate Settings
			OF	Cancel Apply

avoir Edit Outlet				
servoir Claiborne Lock and	- Description Claiborn	e Reservoir		H 🖣 17 of 21 🕨
ysical Operations Observed D	oata			
Claiborne Lock and Dam	Claiborne Lock and Dar	m-Dam-Gated Spillway		
Dam	Number of Gates of this	type	1	
Gated Spillway	Elevation	Max Capacity	Total Max	65
	(ft)	(Cfs)	Capacity	60-
	31.0	52494.0	52494.0 🔺	55
	31.1	52776.0	52776.0	€ 50
	31.2	53058.0	53058.0	≥ 45-
	31.3	53340.0	53340.0	
	31.4	53622.0	53622.0	40
	31.5	53904.0	53904.0	35
	31.6	54187.0	54187.0	30
	31.7	54470.0	54470.0	60,000 120,000
	31.8	54753.0	54753.0	Canacity (cfs)
	31.9	55036.0	55036.0	
	32.0	55320.0	55320.0	
	32.1	55602.0	55602.0	
	32.2	55884.0	55884.0	
	32.3	56166.0	56166.0	
	32.4	56448.0	56448.0	
	32.5	56730.0	56730.0	
	32.6	57012.0	57012.0	
	32.7	57294.0	57294.0	
	32.8	57576.0	57576.0	
	32.9	57858.0	57858.0	
	33.0	58000.0	58000.0	
	Physical Limitations:	00000		
	Max Rate of Increase (d	fs/hr)		
	Max Rate of Decrease (cfs/hr)		Edit Gate Settings

Figure H.3.32: Base Condition A12_WS1MF Gated Spillway Rating Curve

H.3.5.3.3. Reservoir Operations

The operation sets that were previously created were used to simulate the reservoir operations. The operation set that was used to simulate the bypass channel fish passage structure was "MR_RB_Bypass_Gated". Figure H.3.33 shows the gated operation set with the gated rule at Millers Ferry with the right bank variation of the bypass channel named "MF_RB_Bypass_Gated". Figure H.3.34 represents the ungated operation set with the gated rule at Claiborne with the right bank variation of the bypass channel named "CL_RockWeir_NoGate". The rating curves were provided by HEC-RAS modeling for the physical rock weir variations at each of the individual project.

H.3.5.3.3.1. Gated Operations at Millers Ferry

Within the gated operations at Millers Ferry, a new rule named "MF_RB_Bypass_Gated" was created to reflect the gated operations of the fish passage structure. The "MF_RB_Bypass_Gated" rule is a function of the current value of the Millers Ferry pool elevation. To simulate the gate closing during high flow events, at pool elevation 81.001, the flow is set to 0 cfs. To simulate the gate closing during a low flow period, at pool elevation 77.999 ft., the flow is also set to 0 cfs. This rule assists Water Management to

control the fish passage structure during emergency time periods of either low flows or high flows. Figure H.3.33 shows the operation rule of the corresponding releases (cfs) with the pool elevation (ft).

eservoir Millers Ferry	 Description 	iption Millers Ferry Re:	servoir			8 of 21 🕨
hysical Operations Observe	d Data					
Operation Cat. ME. D.D. Dungag	Catad	Description	Depresente Miller	ra Forni Dial	ht Bank Dunana Channal an ai	ated atruct
Operation Set MP_R6_Bypass	_Galed	 Description 	r Represents Miller	is relly Rig	ni bank bypass Channel as a g	Jaleu struct
Zone-Rules Rel. Alloc. Outa	ges Stor. Cre	edit Dec. Sched. Pro	jected Elev			
Top of Dam	Operates Re	lease From: Millers Fe	rry-Controlled Outlet	t		
Flood Control	Rule Name:	MF_Bypass_Gates	Description:			
<pre>Check DIL_Nav-rev</pre>	Function of	Milloro Forry Bool Flor	ution OurrentValue			Defer
MF_Bypass_Gates	i uncuon oi.	Millers Ferry-Pool Elev	ation, Current value	3		Define
Conservation Check DIL_Nav-rev	Limit Type:	Specified ~	Interp.: Linear	~	2,000	
MF_Bypass_Gates		Elev (ft)	Release (cfs)		(g) 1,600	
Operating Inactive MinRel=Inflow up to 66		75.0	1(616436 (613)	0.0	8 200	
MF_Bypass_Gates		77.99		0.0		
nactive		78.0		400.0		
		79.0		1200.0		84 86 88
		80.7		1700.0	Eloy (#)	04 00 00
		81.0		1900.0	Elev (ii)	
		81.0001		0.0	Period Average Limit	Edit
		82.0		0.0	Hour of Day Multiplion	Edit
		84.0		0.0		Euit
		85.0		0.0	Day of Week Multiplier	Edit
		86.0		0.0	Rising/Falling Condition	Edit
		87.0		0.0		Edit
		88.0		0.0		Eult
				~		

Figure H.3.33: Alternative A12_rCLbMF Millers Ferry Rock Weir Gated Operation Rule Set

H.3.5.3.3.2. Ungated Operations at Claiborne

To simulate the ungated operation rule set at Millers Ferry, a new rule name "CL_RockWeir_NoGate" was created to reflect the ungated operations of a rock weir fish passage structure. The "CL_RockWeir _NoGate" rule is a function of the current value of the Claiborne's pool elevation. To simulate the uncontrolled gate operations, a rating curve with pool elevations within the range of 33.1 ft. and 62.0 ft. and the corresponding releases are implemented into the rule with a linear interpolation. Figure H.3.34 shows the ungated operation rating curve of the rock weir structure at Claiborne.

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Figure H 3 34: Alternative A12	rCI bMF Claiborne Rock Weir Ungated Operation Rule Set
Iguic 11.0.04. Alternative ATE	TOESIM States of the ongated operation have been

Claiborne Lock and .	V Description Claiborne F	leservoir	K 4 17 of 21 🕨
vsical Operations Observe	ed Data		
peration Set CL_RockWeir_I	NoGate v Descr	ption Claiborne with rock weir cha	annel with no gate, uncontrolled
one-Rules Rel. Alloc. Outa	iges Stor. Credit Dec. Sched.	Projected Elev	
Top of Dam	Operates Release From: Claib	orne Lock and Dam-Controlled Ou	tlet
Flood Control	Rule Name:)ckWeir_Channel	_NoGate Description: Rock Weir	channel with reduce (shorter length) fixe
RockWeir_Channel_Nd Conservation	Function of: Claiborne Lock a	nd Dam-Pool Elevation, Current Va	lue Define
RockWeir_Channel_No	Limit Type: Specified	V Interp.: Linear V	, 12,000
macuve			
	Elev (π) 33.1	Release (crs)	g 6,000
	34.8	500.0	
	35.5	1000.0	
	37.0	1400.0	35 40 45 50 55
	39.0	2400.0	Elev (ft)
	40.0	3700.0	Period Average Limit Edit
	41.0	5700.0	Hour of Day Multiplier Edit
	44.0	7000.0	Day of Week Multiplier Edit.
	46.0	7400.0	Bising/Folling Condition Edit
	50.0	8300.0	
	52.0	9400.0	Seasonal Variation Edit
	54.0	10700.0	
>		· · · · · · · · · · · · · · · · · · ·	

H.3.5.4. Natural Bypass Channel Addition at Claiborne; Rock Weir Fish Passage Addition at Millers Ferry

The rock weir fish passage additions at Millers Ferry Lock and Dam and Claiborne Lock and Dam was simulated in alternative "A13_bCLrMF" in simulation "Fish Passage Alternatives POR Updated". Alternative "A13_bCLrMF" stands for Alternative 3 rock weirs at both dams. "A13_bCLrMF" alternative's results were compared to the base condition alternative "A12_WS1MF".

H.3.5.4.1. Network Updates

A new network, "FPV4" was created to simulate the bypass channel structures at Millers Ferry Lock and Dam and Claiborne Lock and Dam. To reflect the alternate fish passage measures at both Millers Ferry Lock and Dam and Claiborne Lock and Dam, controlled outlets were added at both Millers Ferry and Claiborne Lock and Dam. The rock weir measure at Millers Ferry is reflected via the added controlled outlet in the HEC-ResSim simulation. The bypass channel fish passage measure was added as a controlled outlet at Claiborne. The controlled outlet is connected from the Millers Ferry reservoir to the tailwater gage downstream of Millers Ferry in the modeling software. A controlled outlet is connected from Claiborne Lock and Dam Reservoir to the downstream tailwater gage.

H.3.5.4.2. Physical Data

H.3.5.4.2.1. Overall Dam Length

The rock weir variation at Millers Ferry alters the overall dam length given its designed position within the right bank emergency spillway. Currently at Millers Ferry, the overall dam length is 3360.0 ft. With the rock weir variation, the dam length is 3260.00 ft. There is no change in the dam length at Claiborne.

H.3.5.4.2.2. Capacity of the Controlled Outlet

The physical capacity of the Millers Ferry and Claiborne controlled outlet was provided by the results of the HEC-RAS model. To create a binary switch which represents a gated versus ungated operation for different variations of the fish passage structure designs within the same simulation, the physical capacity of the controlled outlet of the rock weir fish passage was determined to be the maximum capacity of the physical structure at the lowest pool elevation where the structure ties into the reservoir and the highest spillway gate elevation. After the initial assessment of determining a gated or an ungated operation, the ungated operation sets at Millers Ferry were screened out due to the high risk and high impacts to the present authorized project purposes of hydropower and the overall structure of the dam. For Claiborne, the gated operation sets were screened out due to the fish passage's design tying into the existing spill way structure.

For Millers Ferry, the total maximum capacity is 5800 cfs at pool elevations of 75.0 ft. and 88.0 ft. Figure H.3.35 shows the physical capacity rule curve for the Millers Ferry controlled outlet. For Claiborne, the total maximum capacity is 12,000 cfs at pool elevations of 33.1 ft. and 62.0 ft. Figure H.3.36 shows the capacity rule curve for the Claiborne controlled outlet.

apacity Reservoir Editor - Network: A1 Reservoir Edit Operations Zone	3_bCLrMF0:2018_FPV4 Rule IF_Block			×
Reservoir Millers Ferry Physical Operations Observe Operation Set MF_RockWeir_ Zone-Rules Rel. Alloc. Outa	Description Millers Ferry for the second sec	Reservoir tion		K 4 18 of 21 M
Top of Dam MF_RockWeir_Gates Flood Control Flood Control MF_RockWeir_Gates Conservation MF_RockWeir_Gates Operating Inactive MinRel=Inflow_up to 66 MF_RockWeir_Gates Inactive	Storage Zone Top of Dam Function of Date Date 01Jan	Top Elevation (ft) 85.	0 ↑ 86 85 84 83 82 82 81 82 81 79 78 77 76 Jan Mar	Define
< >>			ОК	Cancel Apply

Figure H.3.35: Alternative A13_bCLrMF Millers Ferry Lock and Dam Controlled Outlet Physical Capacity

Figure H.3.36: Alternat Capacity Reservoir Editor - Network: A1	tive A13_bCLrMF Cla	iborne Lock and L	Dam	Controlled Ou	ıtlet Physical ×
Reservoir Edit Operations Zone	Rule IF_Block				
Reservoir Claiborne Lock and .	V Description Claiborne R	eservoir			【 4 17 of 21 ▶ ▶
Physical Operations Observe	ed Data				
Operation Set CL_RB_Bypass Zone-Rules Rel. Alloc. Outa	s_NoGate v Descrip	Claiborne with right bar Projected Elev	nk bypa	iss channel with no ga	te, uncontrolled 🛄
Top of Dam RB_Bypass_NoGate	Storage Zone Top of Dam	Description			
Flood Control RB_Bypass_NoGate	Function of Date				Define
Conservation RB_Bypass_NoGate	Date	Top Elevation (ft)		50	
inactive 🔁	01Jan	50	0.0		
				€ 45	
				5 te 40	
				à	
				35	
				30	
				Jan Mai May J	ar seh ma
			¥		
	Zone Sort Elevation				
				OK Can	cel Apply

H.3.5.4.2.3. Capacity Rating Curve

There were no changes to the spillway rating curve at Millers Ferry Lock and Dam. Adjustments were made to the fixed crest spillway rating curve at Claiborne Lock and Dam to encompass the ungated fish passage structure within the spillway. The updated fixed crest spillway rating curve to incorporate the fish passage structure is show in Figure H.3.38.

Figure H.3.37: Alternative A13_bCLrMF Claiborne Lock and Dam Gated Spillway Rating Curve

👿 Reservoir Editor - Network: A13_b	CLrMF0:2018_FPV4					×
Reservoir Edit Outlet						
Reservoir Claiborne Lock and	 Description Claiborr 	ne Reservoir				7 of 21 🕨 🕅
Physical Operations Observed D)ata					
Claiborne Lock and Dam	Claiborne Lock and Da	m-Dam-Gated Spillwa	у			
Dam Dam	Number of Gates of this	s type]	L		
Gated Spillway	Elevation	Max Capacity	Total Max Capacity	65		
Controlled Outlet	31.0	52494.0	52494 0 A	55-		
	31.1	52776.0	52776.0	~ 50-		
	31.2	53058.0	53058.0	E 30		
	31.3	53340.0	53340.0	a 45-	/	
	31.4	53622.0	53622.0	40-		
	31.5	53904.0	53904.0	35-		
	31.6	54187.0	54187.0	30		
	31.7	54470.0	54470.0		60,000	120,000
	31.8	54753.0	54753.0		Canacity (c	fe)
	31.9	55036.0	55036.0		Cupacity (c	
	32.0	55320.0	55320.0			
	32.1	55602.0	55602.0			
	32.2	55884.0	55884.0			
	32.3	56166.0	56166.0			
	32.4	56448.0	56448.0			
	32.5	56730.0	56730.0			
	32.6	57012.0	57012.0			
	32.7	57294.0	57294.0			
	32.8	5/5/0.0	5/5/0.0			
	32.9	57858.0	52000.0			
	33.0	50000.0	50000.0 V	·		
	Physical Limitations:					
	Max Rate of Increase (or	cfs/hr)				
	Max Rate of Decrease	(cfs/hr)		E	Edit Gate Sett	ings
				ОК	Cancel	Apply
						, de le co

CUIVE Reservoir Editor - Network: A13_b Reservoir Edit Outlet	CLrMF0:2018_FPV4			×
Reservoir Edit Outlet Reservoir Claiborne Lock and Physical Operations Observed D Claiborne Lock and Dam Pool Dam Tailwater Gated Spillway Fixed Crest Spillway Controlled Outlet	Description Claiborne Re Pata Claiborne Lock and Dam-Da Claiborne Lock and Dam-Da Material Number of Gates of this type Elevation (ft) 33.0 34.0 35.0 36.0 37.0 38.0 39.0 40.0 41.0 42.0 43.0 44.0 45.0 46.0 47.0 48.0 48.0	servoir 	Dillway Total Max Capacity 1000.0 3500.0 6000.0 9000.0 14000.0 22000.0 22000.0 25000.0 29000.0 33000.0 33000.0 33000.0 33000.0 40500.0 40500.0 40500.0	H 1 7 of 21 H H
	48.0 49.0 50.0 51.0 52.0 53.0 Physical Limitations: Max Rate of Increase (cfs/hr) Max Rate of Decrease (cfs/hr)	47000.0 50000.0 54000.0 62000.0 66000.0 66000.0 r)	4700.0 50000.0 54000.0 62000.0 66000.0 €000.0 €0000.0 €0000.0 €0000.0 €0000.0 €0000.0 €0000.0 €000	Edit Gate Settings K Cancel Apply

Figure H.3.38: Alternative A13_bCLrMF Claiborne Lock and Dam Fixed Crest Spillway Rating Curve

Figure H.3.39: Base Condition A12_WS1MF Fixed Crest Spillway Rating Curve

Reservoir Editor - Network: A12_W	VS1MF-0:2018			×		
Reservoir Edit Outlet						
Reservoir Claiborne Lock and	> Description Claiborn	e Reservoir		H 4 17 of 21 H H		
Physical Operations Observed D	ata					
Claiborne Lock and Dam	Claiborne Lock and Dar	m-Dam-Fixed Crest Sp	illwav			
Pool			1			
Dam	Number of Gates of this	type	1			
Gated Spillway	Elevation	Max Capacity	Total Max	65		
Fixed Crest Spillway	(ft)	(cfs)	Capacity	60		
	33.0	1000.0	1000.0 🔺	55		
	34.0	3500.0	3500.0	€ 50		
	35.0	6000.0	6000.0	ă 45 −		
	36.0	9000.0	9000.0			
	37.0	14000.0	14000.0	25		
	38.0	18000.0	18000.0	33		
	39.0	22000.0	22000.0	30		
	40.0	2000.0	2000.0	60,000 120,000		
	41.0	29000.0	29000.0	Capacity (cfs)		
	43.0	32000.0	32000.0			
	44.0	33000.0	33000.0			
	45.0	38000.0	38000.0			
	46.0	40500.0	40500.0			
	47.0	43000.0	43000.0			
	48.0	47000.0	47000.0			
	49.0	50000.0	50000.0			
	50.0	54000.0	54000.0			
	51.0	58000.0	58000.0			
	52.0	62000.0	62000.0			
	53.0	66000.0	66000.0			
	Physical Limitations:					
	Max Rate of Increase (d	fs/hr)				
	Max Rate of Decrease (cfs/hr)		Edit Gate Settings		
			O	K Cancel Apply		

Figure H.3.40: Base Condition A12_WS1MF Gated Spillway Rating Curve

👿 Reservoir Editor - Network: A12_W	/S1MF-0:2018			×
Reservoir Edit Outlet				
Reservoir Claiborne Lock and	Description Claiborne	Reservoir		K 4 17 of 21 D H
Claiborne Lock and Dam	Claiborne Lock and Dam-	Dam-Gated Spillway	/	
Dam	Number of Gates of this ty	/pe		
Gated Spillway	Elevation (ft)	Max Capacity (cfs)	Total Max Capacity	65
	31.0	52494.0	52494.0 🔺	55
	31.1	52776.0	52776.0	€ 50
	31.2	53058.0	53058.0	₹ 3 45
	31.3	53340.0	53340.0	
	31.4	53622.0	53622.0	25-
	31.5	53904.0	53904.0	30
	31.0	54187.0	54187.0	30
	31.7	54470.0	54470.0	60,000 120,000
	21.0	55026.0	55026.0	Capacity (cfs)
	32.0	55320.0	55320.0	
	32.0	55602.0	55602.0	
	32.1	55884.0	55884.0	
	32.3	56166.0	56166.0	
	32.4	56448.0	56448.0	
	32.5	56730.0	56730.0	
	32.6	57012.0	57012.0	
	32.7	57294.0	57294.0	
	32.8	57576.0	57576.0	
	32.9	57858.0	57858.0	
	33.0	58000.0	58000.0 🗸	
	Bhysical Limitations:	0.0000	00000	
	Physical Limitations.			
	Max Rate of Increase (cfs/	/hr)		
	Max Rate of Decrease (cfs	s/hr)		Edit Gate Settings
			O	K Cancel Apply

H.3.5.4.3. Reservoir Operations

Two new operation sets were created to simulate flow through the controlled outlet. Figure H.3.41 shows the gated operation set with the gated rule at Millers Ferry with the right bank variation of the bypass channel named "MF_RockWeir_Gates". Figure H.3.42Figure H.3.41 represents the ungated operation set with the gated rule at Claiborne with the right bank variation of the bypass channel named "CL_RB_Bypass_NoGate". The rating curves were provided by HEC-RAS modeling for the physical rock weir variations at each of the individual project.

H.3.5.4.3.1. Gated Operations at Millers Ferry

Within the gated operations at Millers Ferry, a new rule named "MF_RockWeir_Gates" was created to reflect the gated operations of the fish passage structure. The "MF_RockWeir_Gates" rule is a function of the current value of the Millers Ferry pool elevation. To simulate the gate closing during high flow events, at pool elevation 81.001, the flow is set to 0 cfs. To simulate the gate closing during a low flow period, at pool elevation 77.999 ft., the flow is also set to 0 cfs. This rule assists Water Management to control the fish passage structure during emergency time periods of either low flows or

high flows. Figure H.3.41 shows the operation rule of the corresponding releases (cfs) with the pool elevation (ft).

Figure H.3.41: Alternative A13_bCLrMF Millers Ferry Rock Weir Gated Operation Rule Set



H.3.5.4.3.2. Ungated Operations at Claiborne

To simulate the ungated operation rule set at Millers Ferry, a new rule name "CL_RB_Bypass_NoGate" was created to reflect the ungated operations of the fish passage structure. The "CL_RB_Bypass_NoGate" rule is a function of the current value of the Claiborne's pool elevation. To simulate the uncontrolled gate operations, a rating curve with pool elevations within the range of 33.1 ft. and 62.0 ft. and the corresponding releases are implemented into the rule with a linear interpolation. Figure H.3.42 shows the ungated operation rating curve of the rock weir structure at Claiborne.

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Figure H.3.42: Alternative A13_bCLrMF Claiborne Rock Weir Ungated Operation Rule Set

Claiborne Lock and .	H 4 17 of 21 F		
hysical Operations Observe	ed Data		
Operation Set CL_RB_Bypass	s_NoGate v Descrip	Claiborne with right bank by	pass channel with no gate, uncontrolled
Zone-Rules Rel. Alloc. Outa	ges Stor. Credit Dec. Sched.	Projected Elev	
Top of Dam	Operates Release From: Claibo	tlet	
Flood Control	Rule Name: RB_Bypass_NoGa	ate Description: Right Ban	k Bypass channel, outlet capacity values ce
RB_Bypass_NoGate	Function of: Claiborne Lock an	lue Define	
RB_Bypass_NoGate	Limit Type: Specified	V Interp.: Linear V	80,000
	Elev (ft)	Release (cfs)	g ^{60,000}
	33.1	0.0	a 40,000
	35.0	1200.0	20.000
	36.0	2100.0	
	38.0	7300.0	
	42.0	9500.0	Flew (#)
	44.0	14000.0	Elev (ii)
	46.0	21000.0	Period Average Limit Edit
	48.0	27500.0	
	52.0	40000	Hour of Day Multiplier Edit
	54.0	40000.0	Day of Week Multiplier Edit
	56.0	52000.0	Rising/Falling Condition
	58.0	59200.0	
	60.0	65800.0	Seasonal Variation Edit
	62.0	70000.0	
		v	

H.3.6. Sample ResSim Results and Reporting Updates

Each simulated alternative produced daily time step results reports including reservoir release (distributed by outlet) and storage, and streamflow at all junctions throughout the model. To assist with the analysis of so many results, scripted plot templates and report generation templates were created to provide on-demand illustrations of the state of various reservoir systems operations, including the interested reservoirs.

This section describes updates made related to the storing and processing of results. Model time series outputs were reduced to reduce the output file size. Updates were made to the post processing reports.

H.3.6.1. DSS Outputs

The DSS file encompassed one simulation which encompassed all the alternatives for the entire period of record of 01January 1939 to 01January2011.

H.3.6.1.1. Release Decision Report

Figure H.3.43 shows the release decision report for Millers Ferry Lock and Dam from 01Oct2004 to 22Oct2004, simulating the A05_BcBD fish passage alternative. The report

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shows the Active Zone Pool Elevations where the reservoir moves from the Conservation zone to an Operating Inactive Zone during a low flow period within the period of record. It also shows the net inflow, the active rules, and the release from each outlet at each time step, including the fish passage structure which is named in the simulation as the "Controlled Outlet Active Rule Flow (cfs)". This report type is available for each reservoir for every alternative in the "Fish passage Alternatives POR Updated" simulation.

Figure H.3.43: Millers Ferry Reservoir Alternative A05_BcBD Release Decision Report
Release Decision Report: Millers Ferry
File Options

							Alternative: A05_BcBD0:A05_BcBD Run: A05_BcBD0		
.ookback: 06 Jan 193 Start Time: 20 Jan 19	39, 0000 39, 0000								
nd Time: 01 Jan 201 ule Key: GC=Guide	12, 0000 Curve RO=Release Ove	erride EO=Elevation ()verride ZB=Zone Bou	indary					
Date-Time	Millers Ferry								
	Active Zone	Net Inflow (cfs)	Millers Ferry	-Dam	-Dam I &O	-Snillway	-Power Plant	-Controlled Outlet	
	Flov (ff)	Net milew (cis)	Active Rule	Active Rule	Uncontrolled	Active Rule	Active Rule	Active Rule	
	LIEV(II)		Flow (cfc)	Flow (cfc)	Elow (cfc)	Flow (cfc)	Flow (cfc)	Flow (cfc)	
			Flow (cis)	Flow (cis)	Flow (cis)	Flow (cis)	Flow (cls)	Flow (cis)	
040-10004-04-00	Conservation	10.000.00	Min@Claiborne	Min@Claiborne	Unctri	Min@Claiborne	Min@Claiborne	MF Bypass Gates	
010ct2004, 24:00	80.33	12,260.28	12,909.12	12,909.12	0.00	0.00	11,474.39 Min 001 siberma	1,434.73	
000+0004_04:00	Conservation	10,170,00	MingClaiborne	MingClaiborne	Unctri	MingClaiborne	MingClaiborne	Mr Bypass Gates	
020012004, 24.00	50.20 Concention	12,172.92	13,311.13	13,311.13	0.00	0.00	11,965.64	1,345.29	
000-10004-04-00	Conservation 70.02	12 060 71	MinecialDorne	MinecialDorne	Uncuri	Minecialborne	MinecialDorne	Mr Dypass Gates	
03002004, 24.00	Concorrection	12,060.71	14,505.79	14,505.79	U.00	0.00	15,559.09	1,104.70	
0400004 24:00	CONSELVACION	11 020 44	14 220 EE	MinecialDorne	010011	Millecramorile	12 256 60	Mr bypass Gates	
04002004, 24.00	Concorrection	11,020.44	14,230.55	14,230.33	U.00	0.00	13,230.00	MP Pupper Cater	
050ct2004_24:00	CONSELVACION 70.17	11 064 79	14 256 66	14 256 66	0.00	ATTICCTATIONTIC	12 472 27	The Dypass Gates	
000012004, 24.00	Concorrection	11,064.70	14,230.00	14,230.00	U.00	U.UU	13,472.37	MP Pupper Cater	
060ct2004_24:00	CONSELVACION 70 00	10 207 20	12 562 22	12 562 22	0.00	ATTIGCTATIOTTIC	11 026 72	Mr Dypass Gates	
00002004, 24.00	Concorrection	10,251.35	Min@Claiborno	Min@Claibowno	U.00	Min@Claiborno	Min@Claiborno	MP Purpage Catog	
070012004 24:00	Conservation 70 50	10 962 01	12 251 50	12 251 50	Unctri	Minecialborne	12 776 24	Mr Dypass Gates	
07002004, 24.00	Concorrection	10,965.01	13,351.59	13,331.39	U.00	U.UU	12,770.24	MP Puppag Catog	
000000000000000000000000000000000000000	CONSELVACION 70 20	10 975 06	12 566 52	12 566 52	0.00	ATTIGCTATIOTTIC	12 051 62	FIA ED	
00002004, 24.00	Concorrection	10,973.00	Min@Claiborno	Min@Claibowno	U.00	Vin@(laihorno	Min@Claiborno	MP Purpage Catego	
000000004 24:00	Conservation	0 905 05	MinecialDorne	AINGCIAIDOFNE	ONCUTI	Millectarborne	MinecialDorne	Mr bypass dates	
030012004, 24.00	Concomption	5,053.53	Min@Claiborno	Min@Claibowno	U.00	Vin@(laihorno	Min@Claiborno	MP Purpage Catego	
100012004 24:00	Conservation 78.01	0 222 02	10 294 24	10 204 24	0.00	MINGCIALDOFINE		An bypass Gaues	
10002004, 24.00	Concorrection	9,202.02	10,004.04	10,304.34	U.00	0.00	9,901.00	402.00	
11002004 24:00	Conservation 78.00	7 702 01	7 952 64	7 052 64	0.00	0.00	7 460 59	Mr Dypass Gates	
11002004, 24.00	Openating Tax	1,103.91	Vin@Claiborno	Vin@Claibowno	U.ou	Vin@(laihorno	Vin@Claiborno	MP Purpage Catego	
12002004 24:00	operating ma	0 020 51	Alliectarborne	AINGCIAIDOFNE	0.00	MINGCIAIDOFNE		Mr Dypass Gates	
12002004, 24.00	Concernation	5,520.31	S,020.33	S,020.33	Unctrl	Min@Claiborne	Min@Claiborne	MF Bunace Cates	
13Oct2004, 24:00	78 21	10 063 69	6 306 34	6 306 34	0.00		8 846 50	A62 84	
	Concervation	10,003.03	Min@Claiborne	Min@Claiborne	Unctrl	Min@Claiborne	Min@Claiborne	ME Bunnes Cates	
14Oct2004_24:00	78.09	8 732 66		9 696 45	0.00		9 270 40	A26.05	
14002004, 24.00	Conservation	0,752.00	5,050.45	78	Unctrl	78	78	MF Bunass Gates	
15Oct2004_24:00	78.00	8 080 43	8 762 96	8 762 96	0.00	0.00	9 362 95	Ann of	
130012004, 24.00	Operating Tra	0,000.43	0,702.90	0,702.90	Unctrl	0.00	0,302.33	ME Bunner Cater	
16Oct2004_24:00	78.00	7 926 35	7 926 35	7 926 35	0.00	0.00	7 541 92	284 52	
100012004, 24.00	Operating Tpa	7,520.33	MinBel=Inflow	MinBel=Inflow	Unctri	MinBel-Inflow	MinDel=Inflow	ME Bunner Cater	
170ct2004_24:00	79 41	11 374 51	6 600 00	6 600 00	0.00	0.00	6 017 77	ERD SPass Galles	
11002004, 24.00	Concervation	11,374.51	Min@Claiborne	Min@Claibornc	Unctri	Min@Claiborne	Min@Claibornc	ME Bunass Gates	
18Oct2004_24:00	79.16	14 310 60	6 615 /8	6 015 /9	0.00		9 137 66	THE Dypass Gates	
180012004, 24.00	Concernation	14,510.60	5,515.40	5,515.40	Unotri	Min@Claiborne	9,137.00	ME Burnage Categ	
10Oct2004 24:00	70.09	17 024 78	10 097 02	10 087 02	0.00		9 996 95	1 100 07	
19002004, 24.00	Concernation	17,024.70	10,007.02	10,007.02	Unotri	0.00	0,050.55	ME Bunner Cotor	
200ct2004, 24:00 210ct2004, 24:00	COIISELVACIOI	10 929 49	16 025 33	16 025 33	0.00	0.00	14 539 64	1 495 70	
	Concervation	15,020.40	10,023.33	10,025.55	Unctri	0.00	14,005.04	ME Bunage Gates	
	00000000000000000000000000000000000000	24 439 65	24 439 65	24 439 65	0.00	0.00	22 952 61	1 485 74	
	Concervation	24,400.00	24,430.00	24,400.00	Unotri	0.00	22, 552.91	MF Bunage Cator	
220dt2004_24-00	00000000000000000000000000000000000000	26 776 49	26 776 40	26 776 49	0.00	0.00	25 290 77	1 485 72	
220012004, 24.00	Concervation	20,110.49	20,110.49	20,110.49	Unctri	0.00	20,250.11	MF Bynage Gaton	
23Oct2004 24:00	00000000000000000000000000000000000000	26 291 79	26 291 70	26 291 79	0.00	0.00	24 806 09	1 485 71	
200012004, 24.00	Concervation	20,251.19	20,231.19	20,251.19	Unotri	0.00	24,000.00	ME Bunnes Cotor	
24Oct2004 24:00	00000000000000000000000000000000000000	24 303 09	24 303 09	24 303 09	0.00	0.00	22 817 37	1 485 71	
240012004, 24.00	Conservation	24,303.00	24,505.00	24,303.00	Unctrl	0.00	22,011.37 CC	MF Bynass Gater	
					Million I.			The second se	

H.3.6.1.2. ResSim Default Plots

ResSim allows easy viewing via built in plot types that can be opened directly from the simulation module. Below are default reservoir plots for Millers Ferry (Figure H.3.44) and Claiborne (Figure H.3.45). Results from the A12WSF, our baseline alternative (green) and the fish passage alternative measures (blue) are shown in each plot, along with observed data (red). Likewise, the Claiborne pool elevation plot is shown in Figure H.3.46 with the same alternatives and observed data timeseries. The dotted lines represent the

minimum and maximum operating limits for each respective project. This plot is important for determining when changed operations may affect the flows at the projects. In the plots below, the results of the fish passage alternatives on top of the baseline alternative indicates that the pool elevation at the projects have very little changes. Discharge plots were also generated to indicate that the baseline alternative and the fish passage alternatives will have no impact to the downstream minimum navigation flow requirements.









Figure H.3.46: Downstream of Claiborne Junction Discharge Plot

H.3.6.1.3. Jeh Report

The "jeh Report" is a ResSim results report that is generated for alternatives in batch using the "jeh_reports_2018" post-processing script contained in the watershed. The report includes time series results that were requested by James Hathorn (jeh) to easily conduct his results analysis.

The report is updated to show Allatoona-Dam Tailwater/FLOW instead of Allatoona_OUT/FLOW. This change should have no impact. Unlike the other reservoirs, which use their Pool/FLOW-OUT time series, Allatoona's flow was taken from its out node. This ensured the diverted outlet flows were not included. Switching to take the flow from the Dam Tailwater/FLOW will have the same effect.

The reports generated by this script were used to create post processing graphs which were presented to the PDT. The reports assisted int transferring data to the Hydrologic Analysis Center (HAC) for hydropower impacts analysis.

H.3.7. Post Processing Results

The data sets that were generated by the ResSim model of all modeled alternatives were placed into post-processing reports generated by the script "jeh Report". The output extension file for the post-processing reports by the "jeh Report" script was .csv file. The data was then copied into a post-processing .xlsm excel file to generate clear charts for presentations. Examples of such data set results and charts are shown below.

H.3.7.1. Hydropower Flows Results

The raw data from the ResSim model presented the data in a .csv file format to be extracted and post-processed into a .xlsx format. The charts that were produced to represent the hydropower generated for each alternative and the baseline are show in Figure H.3.47. Similar charts were produced for all hydropower projects within the ACT basin to show the effects of the different measures at both Millers Ferry and Claiborne. The raw hydropower data was passed forward to the Hydropower Analysis Center (HAC) for further analysis.





H.3.7.2. Pool Duration Results

The pool duration charts were produced to demonstrate the fluctuations of the pool elevations of the alternatives from the baseline. It also demonstrates the percentage of days the pool elevation is exceeded at the reservoirs as shown in Figure H.3.48. Claiborne's pool elevation duration charts were also generated.





H.3.7.3. Percent Flow Duration through Millers Ferry and Claiborne

The percent flow duration charts were generated to demonstrate the percentage of days certain flows would be flowing through Millers Ferry and Claiborne. Monthly and annual charts were produced with 5000 cfs, 50,000 cfs, and 150,000 cfs markers. An example of an annual chart is Figure H.3.49. The discharge chart shows only one blue line since the results of the discharge at Millers Ferry have very little differences between the alternatives and the baseline. These charts and raw data were disseminated to our environmental team to support their habitat unit modeling analysis.

Figure H.3.49: Millers Ferry Annual Pool Elevation Duration



H.3.7.4. Percent Flow through Fish Passage Structures

The percent flow through the fish passage structures chart were also produced to visually present the availability of flows if the structure was to be implemented. The annual charts and the monthly charts depicted the percentage of days a certain flow would be available. The most noticeable difference is the rock weir measures (inblue) versus the bypass measures (in green) at Millers Ferry in Figure H.3.50. The blue line is shown, but has the same results for any rock weir fish passage measure at Millers Ferry while the green shows the results of the alternatives that have a bypass structure measure at Millers Ferry.

Figure H.3.50: Millers Ferry Annual Fish Passage Bypass Discharge Duration

