DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
ROBERT A. YOUNG BUILDING - 1222 SPRUCE ST.
ST. LOUIS, MISSOURI 63103-2833

4 March 2014

Reply to:
US Army Corps of Engineers
St. Louis District
Environmental Compliance Section (PD-C)
1222 Spruce St.
St. Louis, MO 63103-2833

RE: Revision of the Wappapello Lake Water Control Plan, St. Francis River Basin, Missouri and Arkansas, Environmental Assessment and Draft Finding of No Significant Impact.

Dear Sir or Madam:

We are providing for your review an Environmental Assessment (EA) and Draft Finding of No Significant Impact (FONSI) for the Revision of the Wappapello Lake Water Control Plan, St. Francis River Basin, Missouri and Arkansas. The EA discusses impacts to the human environment related to proposed changes to the Water Control Plan for Wappapello Lake in the St. Francis River Basin. An electronic copy can be obtained from the St. Louis District's website at http://www.mvs.usace.army.mil/Missions/ProgramsProjectManagement/PlansReports.aspx. Please note that the Draft Finding of No Significant Impact is unsigned. The FONSI will be signed into effect only after having carefully considered comments received as a result of this public review.

Revision of the Wappapello Lake Water Control Plan is needed to assure timely and effective water control management and to avoid or limit physical, biological, social, and economic impacts in the watershed. The St. Louis District Water Control Management Office controls the water releases from Wappapello Dam on the St. Francis River by monitoring flow at various gauges and adjusting the dam gates.

We invite your comments related to the content of the environmental assessment. Please address your comments or questions to Francis Walton of the Environmental Compliance Section (CEMVP-PD-C), at telephone number (314) 331-8102, facsimile number (314) 331-8606, or e-mail at <francis.j.walton@usace.army.mil>, by close of business on April 4, 2014.

Thank you,

Timothy K. George

Timothy K. George
Chief, Environmental Compliance Section

Cover Sheet

Proposed Action:	The U.S. Army Corps of Engineers is proposing to revise the Wappapello Lake Water Control Manual which includes the Water Control Plan. Changes will be incorporated into the Water Control Plan as proposed by partners and stakeholders.
Type of statement:	Environmental Assessment (EA) (Draft)
Lead Agency:	U.S. Army Corps of Engineers
For further information:	U.S. Army Corps of Engineers Attn: Francis Walton (PD-C) Regional Planning and Environmental Division North Environmental Compliance Section 1222 Spruce St. St. Louis, Missouri 63103 314-331-8102 email: Francis.J.Walton@usace.army.mil

How to read this EA: Sections 1 and 2 are an Executive Summary and Sections 3 and 4 contain supporting information. Section 2 includes a matrix that presents a comparison of the alternatives.

ENVIRONMENTAL ASSESSMENT

and

Draft Finding of No Significant Impact (FONSI)

REVISION OF THE WAPPAPELLO LAKE WATER CONTROL PLAN ST. FRANCIS RIVER BASIN MISSOURI AND ARKANSAS

February 2014

U.S. Army Corps of Engineers
Regional Environmental Planning Division North
Environmental Compliance Section (CEMVP-PD-C)
1222 Spruce Street
St. Louis, Missouri 63103-2833
Commercial Telephone Number: (314-331-8102)

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Draft FONSI (Finding of No Significant Impact)

1 Purpose of and Need for Action

1.1 Purpose of and Need for Action:

Wappapello Lake and Wappapello Dam are located in the St. Francis River Basin approximately 213 miles upstream from its confluence with the Mississippi River. Wappapello Dam and Lake, in conjunction with channel improvements and leveed floodways, are part of a comprehensive plan for protecting the St. Francis River Basin between Wappapello, Missouri, and the Mississippi River backwater area from headwater flooding. The St. Francis River Basin encompasses 8,423 square miles of drainage area. Wappapello Dam and Lake regulates the runoff from 1,310 square miles of drainage area. The St. Francis River Basin is shown in Figure 1.

The lake and dam were authorized for downstream flood control by the Flood Control Act of 15 June 1936 (Overton Act). Located within the uppermost portion of the St. Francis River Basin, the lake and dam are part of a comprehensive plan for protecting the St. Francis River Basin from headwater flooding. In addition, drainage is improved downstream of the dam by moderating the river elevations.

The U.S. Army Corps of Engineers (Corps) is proposing to revise the Wappapello Lake Water Control Plan (WCP). The authorized WCP is included in the Wappapello Lake Water Control Manual (Chapter 7). Revision of the WCP is needed to assure timely and effective water control management and to avoid or limit physical, biological, social, and economic impacts in the watershed. The St. Louis District Water Control Management Office (WMO) controls the water releases from Wappapello dam on the St. Francis River by monitoring flow at various gauges and adjusting the dam gates.

The WMO has been operating under the current WCP for more than 15 years. To avoid or reduce negative impacts related to water management, the WMO has requested and used deviations to the current WCP. Deviations are temporary variations from the water control plan based on engineering judgment, engineering experience and prevailing circumstances and require USACE Mississippi Valley Division approval. Except for emergencies, the need to request a deviation can slow the deviation implementation and potentially cause adverse effects in the project area. Recognition of the need for a WCP with more flexibility that better addresses high water has culminated in this revision.

1.2 Issues Related to Revising the Water Control Plan:

1.2.1 Wappapello Lake contains a relatively small amount of storage at low lake elevations, particularly between the bottom of the flood control pool (i.e., elevation 354.74 feet) and the recreation pool (i.e., elevation 359.74 feet). All of the recreation areas along the perimeter of the lake are designed to be fully accessible and usable when the lake elevation is at the recreation pool. Higher lake elevations make recreation areas partially or completely unusable. Thus, the regulation of the lake for its original congressionally authorized purpose, coupled with the

physical constraint of small storage at low lake levels, creates a social and a political constraint in terms of recreation.

1.2.2 The regulation of the lake for its original congressionally authorized purpose also creates a social and a political constraint in terms of farming leased land within the flood control pool.

1.2.3 State Highway T crosses the area just downstream of the limited-use spillway. If the limited-use spillway is overtopped, this highway could become inundated and would likely be damaged by the flow of water over it.

1.2.4 The current WCP holds the pool level at 356.74 ft. NGVD during the transition from winter to summer pool which just covers some water hazards making boating potentially unsafe.

1.2.5 The Missouri Department of Conservation has commented on potential impacts to the Wappapello Lake fishery. They are concerned that an increase of 400 cfs to the current maximum release rate of 3800 cfs during the spring to fall seasons, as proposed in the revised WCP, may result in the flushing of nutrients and larval fish from the lake. They have requested this activity be limited and a lower discharge rate be used when weather conditions are appropriate and flood control is not compromised.

1.3 Water Control Objectives: Water control objectives which are accomplished without compromising the original Congressionally authorized purpose of downstream flood control are recreation, fish and wildlife conservation, forest and land lease management, and hydroelectric power production (i.e., incidental benefits). Two objectives have been identified for this revision:

1.3.1 In anticipation of high pool elevations, reduce pool elevation in accordance with the revised WCP without increasing adverse downstream flooding.

1.3.2 Avoid or limit impacts to the physical, biological and the socioeconomic resources of the watershed and reduce the need to request temporary deviations.

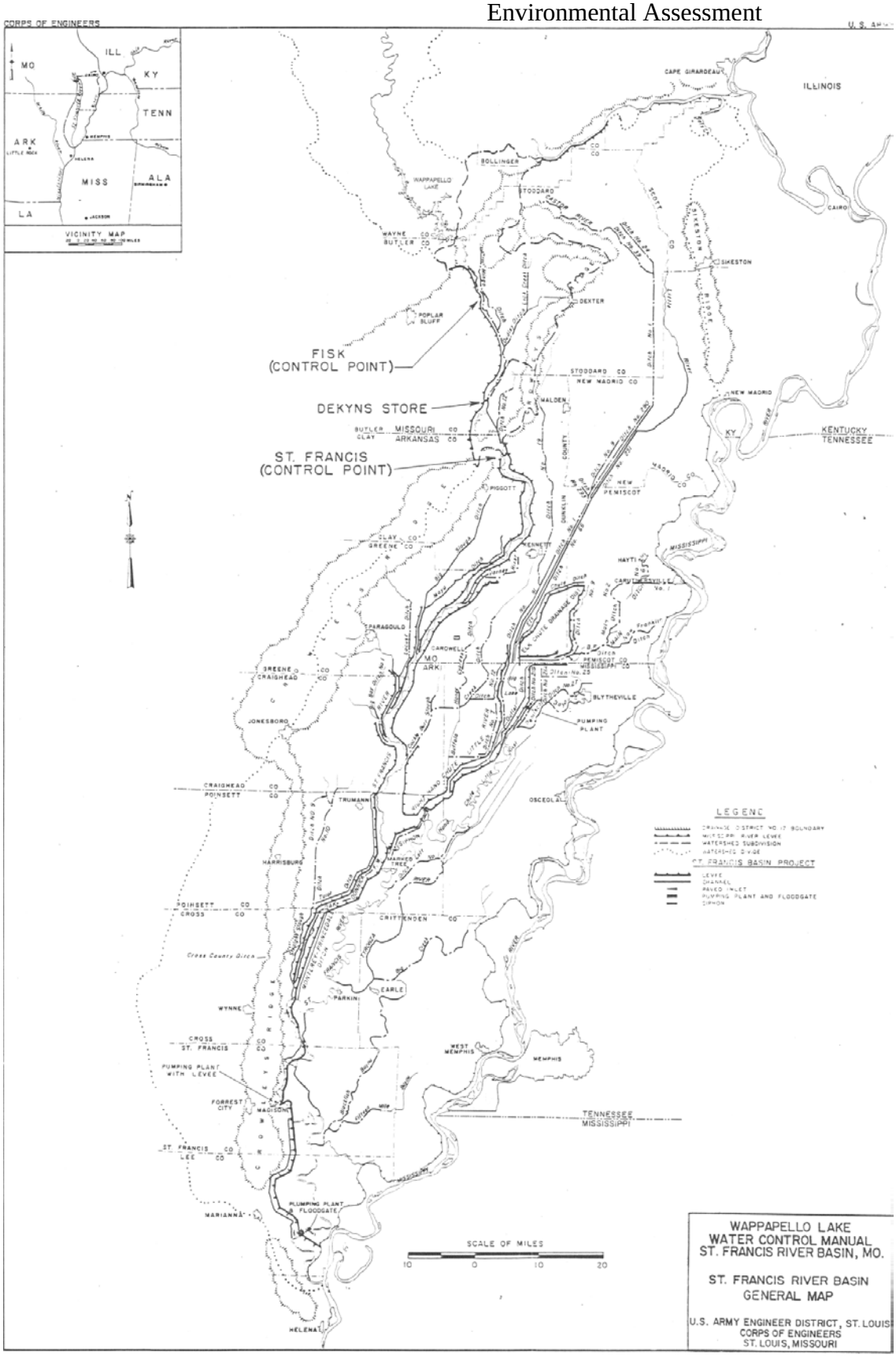

Figure 1 – The St Francis River Basin

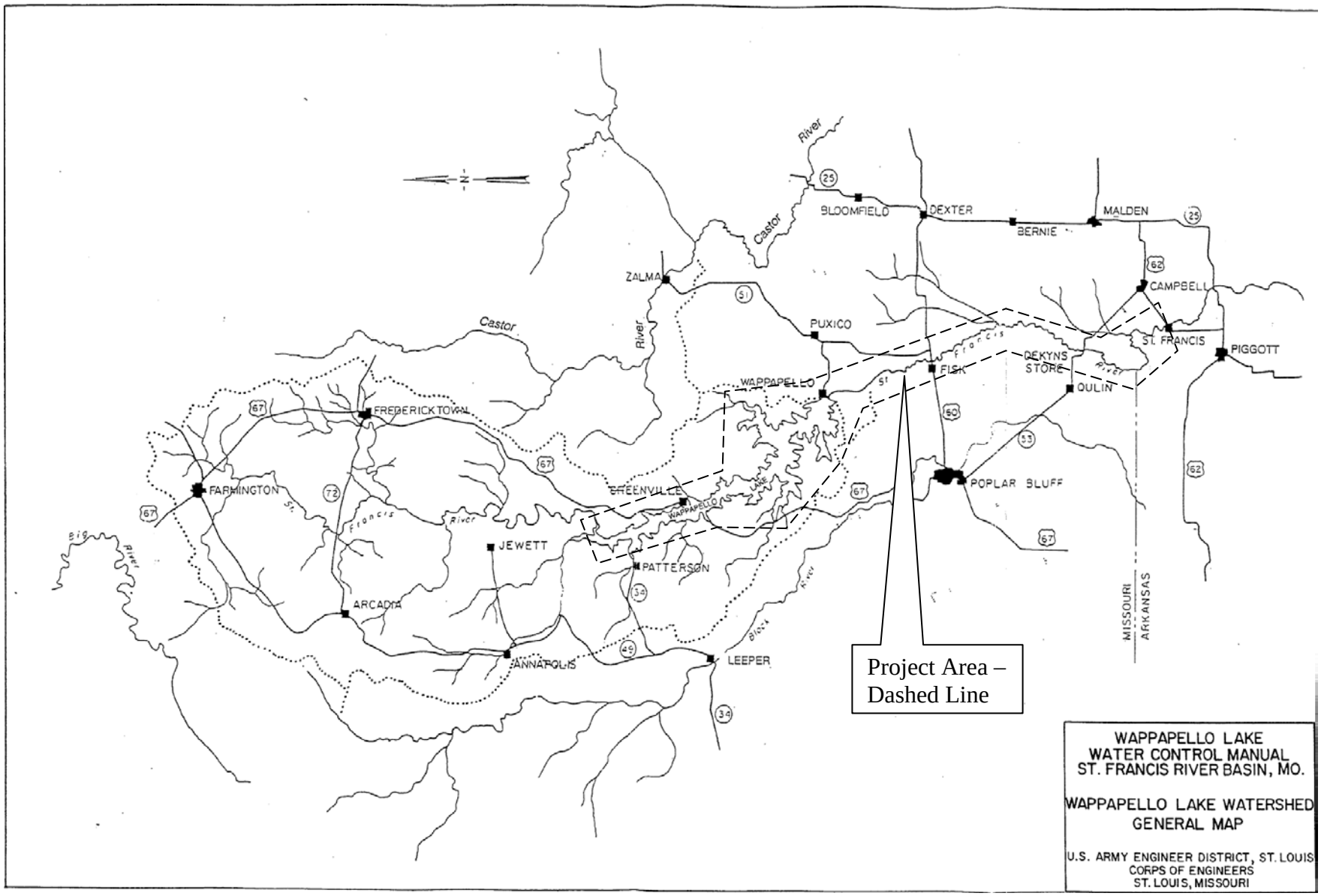

Figure 2 – The project area potentially affected by the revisions to the WCP.

1.4 Related Documents

1.4.1 Water Control Manual (WCM): The document "St. Francis River Basin Below Wappapello Lake, Mo. and Ar., General Design Memorandum 104, Supplement No. 2, Volume 1" was completed in June 1987 (USACE 1987) and is the basis for the current Water Control Manual which was last revised in 1996.

1.4.2 Appendix D of the Master Reservoir Regulation Manual contains the authorized WCP (Chapter 7 of the WCM) for the Wappapello Lake project located in the St. Francis River watershed of southeast Missouri.

1.4.3 Project Authorization: Authorization for Wappapello Lake is contained in the Flood Control Act of 15 June 1936 (Overton Act) and amended by subsequent Flood Control Acts. Wappapello Lake is operated as a flood control project. Subsequent to authorization, development and use of flood control reservoir areas for recreational and related purposes were authorized by Section 4 of the Flood Control Act of 1944. There has been no provision for modifying the water control operations in order to accommodate recreation. The operation of Wappapello Lake was authorized to afford protection for approximately 371,000 acres of mostly agricultural bottomland downstream of the dam.

1.4.4 Environmental Documentation: Environmental Assessments (EAs) or environmental reviews have been completed for some of the deviations from the WCP requested from the USACE Mississippi Valley Division Water Control Management Office since the authorization of the current WCP.

1.4.5 The Wappapello Lake Fishery Management Plan (MDC 1996) contains a request that the lake be maintained at a stable or at a rising elevation if at all possible during the gizzard shad spawning period to improve shad reproductive success. Each spring, the Missouri Department of Conservation will furnish the WMO with an estimate of when the gizzard shad spawning period will occur. A stable, or a rising, lake elevation also enhances mussel growth and development.

1.5 Decision Options: This environmental assessment provides information to determine the significance of the impacts to the human environment associated with the proposed revision of the WCP.

1.6 Scoping

1.6.1 Workshops: The WMO and the project staff at Wappapello Lake have consulted with various stakeholders in the St. Francis Basin in an attempt to optimize water levels and flows to address other project uses without increasing downstream flooding, within the guidelines of the approved WCP. Five initial public workshops were conducted in April 2012 throughout the watershed. At the second round of workshops, conducted in August and September of 2012, findings/evaluations from the April workshops were presented and then additional comments were received. Final meetings with

partners/stakeholders for clarification on the proposed plan occurred during the March through May 2013 timeframe. All meeting and mail-in comments were analyzed and the feasible proposals were incorporated into the proposed WCP. Appendix C includes the comments received by the WMO.

Agencies including the U.S. Fish and Wildlife Service (USFWS) and the Missouri Department of Conservation (MDC) have responsibility for the biological resources of the watershed. Communication with these agencies and stakeholders has resulted in a better understanding of the issues and concerns of all and permitted a cooperative approach to water management. See Appendix A for agency correspondence.

1.7 Relevant Resources

1.7.1 Project Area: The project area for the purpose of assessing impacts has been defined as the area from the upper end of Wappapello Lake (RM 225) to St. Francis, Arkansas. The project area includes the St. Francis River four miles upstream of Wappapello Lake, Wappapello Lake, and the St. Francis River from Wappapello Lake (river mile 213) to St. Francis, Arkansas. Counties within the project area from north to south include Wayne, Butler, Stoddard, and Dunklin counties in Missouri and Clay County in Arkansas. The project area is shown in Figure 2.

1.7.2 Fisheries: More visitors fish at Wappapello Lake than participate in any other activity and maintaining a good fishery is essential. On 7 June 1995 the President signed Executive Order 12962 addressing recreational fisheries. The Executive Order recognized the social, cultural and economic importance of recreational fisheries. Federal agencies were directed to restore and enhance aquatic systems to provide increased recreational fishing opportunities nationwide. The Executive Order also required development of a Recreational Fishery Resources Conservation Plan. USACE has adopted several implementation strategies related to this plan.

1.7.3 Socio-Economic: Activities impacted by St. Francis River and Wappapello Lake water levels (stage) include crop farming, duck hunting, marina operations, recreation/camping, swimming and boating activities. Proposed changes to the WCP have been driven by the desire to lessen impacts to these sectors.

1.7.4 Cultural Resources: Moderating water level changes in the pool and in the downstream channel would potentially lessen adverse impacts to cultural resources.

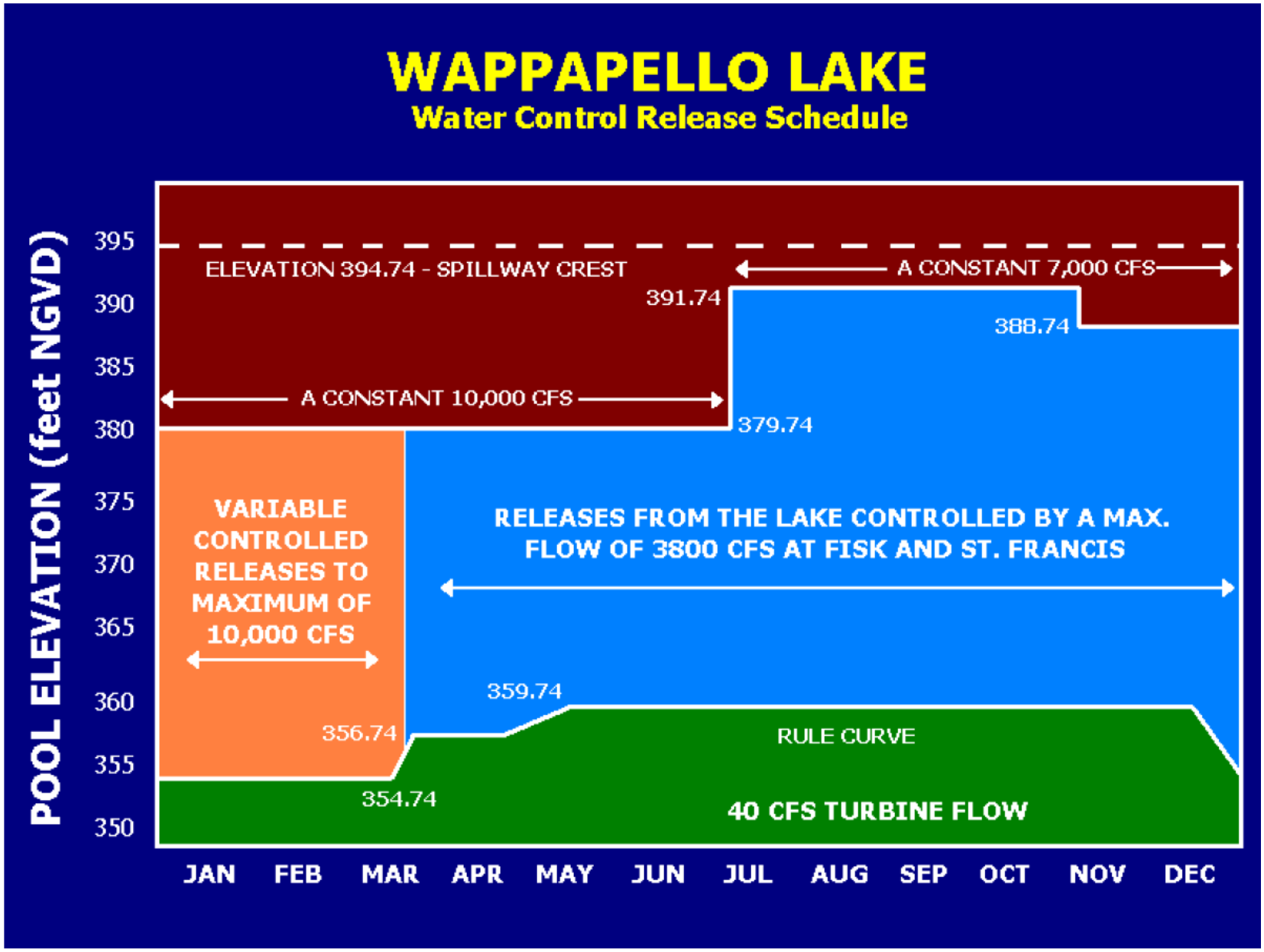
WAPPAPELLO LAKE
Water Control Release Schedule
POOL ELEVATION (feet NGVD)
395
390
385
380
375
370
365
360
355
350
ELEVATION 394.74 - SPILLWAY CREST
A CONSTANT 7,000 CFS
391.74
388.74
A CONSTANT 10,000 CFS
379.74
VARIABLE CONTROLLED RELEASES TO MAXIMUM OF 10,000 CFS
RELEASES FROM THE LAKE CONTROLLED BY A MAX. FLOW OF 3800 CFS AT FISK AND ST. FRANCIS
359.74
356.74
RULE CURVE
354.74
40 CFS TURBINE FLOW
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

Figure 3

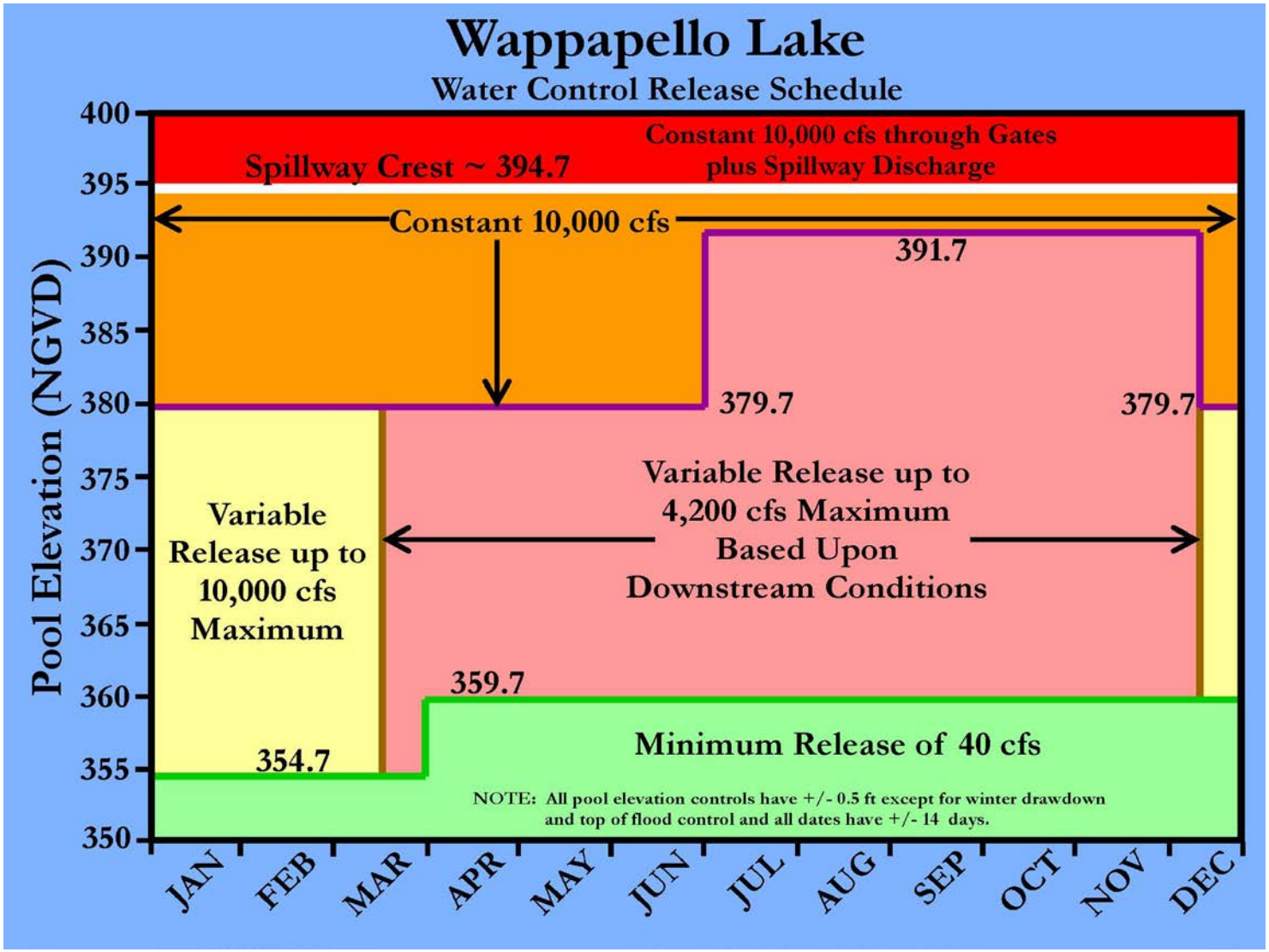
Wappapello Lake
Water Control Release Schedule
Pool Elevation (NGVD)
400
395
390
385
380
375
370
365
360
355
350
Spillway Crest ~ 394.7
Constant 10,000 cfs through Gates
plus Spillway Discharge
Constant 10,000 cfs
391.7
379.7
379.7
Variable
Release up to
10,000 cfs
Maximum
Variable Release up to
4,200 cfs Maximum
Based Upon
Downstream Conditions
359.7
354.7
Minimum Release of 40 cfs
NOTE: All pool elevation controls have +/- 0.5 ft except for winter drawdown
and top of flood control and all dates have +/- 14 days.
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

Figure 4

1.8 Permits

1.8.1 The proposed project will not involve the placement of dredged or fill materials into waters of the United States and consequently assessments under sections 404 and 401 of the Clean Water Act are not required.

2 Alternatives Including the Proposed Action

2.1 Formulation: This chapter describes and compares the alternatives in terms of their environmental impacts and their achievement of project objectives. Alternatives were formulated from comments provided by stakeholders, the public and resource agencies. In addition, the WMO also relied on their experiences with the Flood of Record in 2011 and the previous deviations that were needed. The proposed changes and intended outcomes to the Wappapello Lake WCP are presented in Table - 1 and represent the proposed changes that would allow more latitude by the WMO to manage for current conditions while benefitting project uses. The water control plan for Wappapello Lake for lake elevations below the limited-use spillway crest elevation is graphically represented in the Wappapello Lake Water Control Release Schedule (WCRS).

The current WCRS and the revised WCRS are shown in Figures 3 and 4 respectively. The WCRSs shows the minimum and the maximum releases, which are a function of both lake elevation and time of year. The WCRS also shows the rule curve, which varies with the time of year. The achievement of the rule curve is a goal in the regulation of the lake. When the lake elevation is at the rule curve, the original congressionally authorized purpose and other water control objectives are collectively optimized. From a practical standpoint, efforts are made to regulate the lake elevation within plus or minus 0.2 foot of the rule curve. The determination of the release from the lake is the responsibility of the WMO.

In addition to the technical analysis and the engineering judgment employed by the WMO in determining the release from the lake, the on-site perspective provided by the Wappapello Lake staff is a valuable resource for the regulation process. The release from the lake must be based upon the following factors: (1) The water control plan; (2) Engineering judgment and engineering experience (3) Prevailing conditions on the St. Francis River and on Wappapello Lake; (4) Forecast conditions on the St. Francis River and on Wappapello Lake; (5) Short-term and long-term rainfall forecasts; (6) Construction and maintenance activities; (7) Consultation with USACE Wappapello Lake Management Office (WLMO) and with USACE Memphis District (when necessary); and (8) Information from affected individuals.

The alternatives are defined and summarized in Section 2.2.

2.1.1 The alternatives were evaluated relative to the water control objectives cited in paragraph 1.3. The preferred alternative would allow more flexibility and responsiveness in water control operations, especially at the spring and winter season transitions.

Environmental impacts to Wappapello Lake fisheries resources and its impact on recreation were particularly considered in the analysis and evaluation of alternatives.

2.2 Alternatives: The alternatives are described in the following paragraphs and are compared and summarized in Table - 2.

2.2.1 Alternative A - No Action: Continue with Current WCP and Temporary Deviations. Under this alternative the WCP (Figure 3) would remain unchanged and include required dates for seasonal changes, and required elevations that govern water control releases. This alternative also includes infrequent requests for temporary deviations from the WCP to accommodate the requests or needs of upstream and downstream users and to address impacts to other project uses. The no action alternative takes into consideration past actions, current actions and future actions and represents the baseline condition for the proposed changes.

2.2.1.1 Past Actions: Several versions of the WCP were implemented until the current WCP was revised more than 15 years ago for clarity and format changes. The current WCP has worked well most of the time, but needs some adjustments to address flood events like the 2011 flood.

2.2.1.2 Current Actions: The current WCP does not provide the flexibility for managing high water levels. Stakeholders have indicated they would like to see changes to the current WCP to reduce the effects of large water events. Currently, temporary deviations are requested by the WMO and are authorized by the USACE Division Office in Vicksburg, Mississippi on a case by case basis.

2.2.1.3 Future Actions: If no action is taken, the current WCP would continue to be in effect and there would be no flexibility to release water when it would reduce impacts to lake and river resources. In addition, temporary deviations would continue to be requested and authorized on a case by case basis. Although these deviations have been consistently approved in the past, there is no assurance that they will continue to be approved in the future. Potentially, this could affect the ability of the St. Louis District WMO to respond to unique hydrologic and hydraulic (precipitation and flow) situations. If no action is taken, USACE will lose the opportunity to incorporate the knowledge gained by the record flood of 2011 and ability to operate with the flexibility needed to address current conditions.

2.2.2 Alternative B – Revise the WCP (Figure 4) (Preferred Alternative): Alternative B would address the potential for high water based on the comments received from stakeholders and the WMO's experience with the 2011 record flood. It would also incorporate some of the actions associated with previously requested deviations as well as other suggestions to allow flexibility in water management. The transition from winter pool to summer pool has been addressed as well as the transition back to winter pool. The proposed WCP would include a plus or minus 14 days for transition dates and plus or minus 0.5 feet for winter drawdown and top of flood control pool. Figure 5 is an illustration of how the proposed WCP changes could have reduced the elevation and

stage of the 1982 flood levels. Proposed changes to the WCP and the intended outcomes are presented in Table - 1.

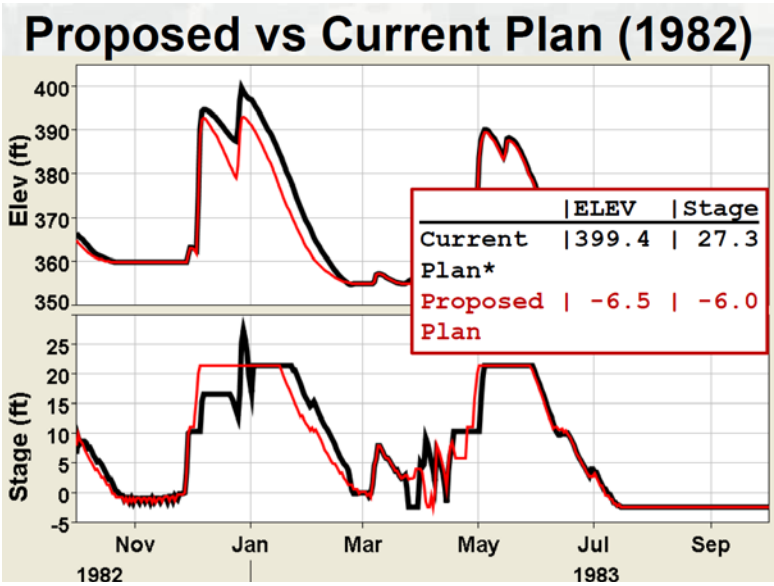

Figure 5 – An illustration of how the proposed WCP could have affected 1982 flood levels.

2.3 Alternative Impacts

Impacts related to the two alternatives were developed based on Sections 3 and 4 of this EA. They are synopsized in Table - 2. Table - 4 shows the impacts for each individual change.

Table - 1 Change from Current WCP to Proposed WCP and Intended Outcome		
Old Plan	**Proposed WCP 2013**	**Intended Outcome of Proposed WCP**
Transition from 354.74 to 356.7 on Mar 15 to Mar 31	Transition from 354.74 to 359.7 on April 1st (+/-14 days)	The interim transition elevation of 356.7 to summer guide elevation results in hazardous conditions for boaters. The proposed plan will not prescribe to target this elevation and provide flexibility to allow operating for current conditions.
Start winter drawdown on December 15th	Start winter drawdown on December 15th (+/-14 days)	The proposed plan will allow for the needed flexibility to operate for current conditions.
Regulate for crop season starting March 15th	Regulate for crop season starting March 15th (+/-14 days)	The proposed plan will allow for the needed flexibility to operate for current conditions.
Crop season release restriction max. is 3,800 cfs ▪ Based upon downstream conditions	Increase crop season release restriction from 3,800 cfs to 4,200 cfs ▪ Based upon downstream conditions	The proposed plan will allow more to be released when downstream conditions warrant (if the ground is already saturated releasing more water over a shorter period would be preferred), thereby reducing higher pool elevations and the potential for flooding.
N/A	Cut back to allow for crop field drainage	With the proposed plan of increasing max release during crop season based on downstream conditions, the WMO will coordinate with downstream interests and cutback releases to allow fields to drain and be planted.
Constant release 7,000 cfs (JUL-DEC) when pool elevation reaches 391.7	Constant 10,000 cfs (JUL-DEC) when pool elevation reaches 391.7	Based on input from downstream interests, because a 7,000 cfs release floods them, they are in favor of a 10,000 cfs release to reduce higher pool elevations and the potential for an extended flooding duration.
Mandatory 7,000 cfs release during NOV-DEC at elevation 388.7	Mandatory 10,000 cfs release during NOV-DEC at elevation 391.7	The proposed plan will provide increased flood control from elevation 388.7 to 391.7 before higher releases are made. Once 391.7 is achieved, 10,000 cfs will be released instead of the old plan of 7,000 cfs which will reduce pool elevations

Table - 1 Change from Current WCP to Proposed WCP and Intended Outcome		
Old Plan	**Proposed WCP 2013**	**Intended Outcome of Proposed WCP**
Start 10,000 cfs max. variable release on 1 January	Start 10,000 cfs variable release on December 15th (+/- 14 days)	The proposed plan will allow the flexibility to manage for the end of crop and start of waterfowl seasons
N/A	Preemptive releases within the flood control pool (<394.74) Based upon water on the ground forecast	Based upon water on the ground and pool forecast, opening to prescribed releases will lower pool elevations and reduce potential flooding.
N/A	Preemptive releases leading up to surcharge, not to exceed 15,000 cfs through gated outlet works. Based upon water on the ground forecast	Based upon water on the ground and pool forecast, opening to prescribed releases (from surcharge curve for elevations above 394.7) and releasing up to 15,000 cfs through gated outlet works will lower pool elevations. Lowering pool elevations during surcharge operation may reduce the length and volume of releases
Transition from gate openings to gate closings as spillway is overtopped to maintain a constant 10,000 cfs release until elevation 397.3 is achieved.	Keep the gated outlet works open to 10,000 cfs throughout surcharge event (>394.74)	The proposed plan will initially increase total release (until elevation 397.3), but ultimately decrease pool elevations which will reduce total releases.

Table - 2 - Summary and Comparison of Alternatives

Alternative	Physical	Biological	Socio-Economic	Meets Project Objectives
A - No Action – Manage water using the current WCRS and continue to request deviations to the WCP when necessary.	Impacts to the physical environment, if deviations cannot be obtained, impacts could include increased erosion and sedimentation due to high peak releases.	If deviations are not obtained, greater releases and higher water levels could result in more impacts to the vegetative resources and the aquatic habitat downstream and in the pool.	If deviations are not obtained or are delayed, greater impacts are expected in the agricultural and recreational sectors. Cultural resources may experience adverse impacts. Aesthetics would be impacted due to erosion.	No. Does not address the need for flexibility to address current weather and hydrologic conditions and would continue the need for deviations.
B – Revise the WCP - Manage the water using the proposed WCRS and incorporate some actions associated with typical deviations.	With more moderate flows, Impacts to the physical environment would be potentially reduced, i.e., erosion along the river corridor and sedimentation in the river. Downstream land owners may experience lesser duration flooding.	This alternative is expected to reduce the number of temporary deviations. This will allow the WMO to be more responsive to the need of stakeholders and potentially lessen the negative impact to the aquatic habitat and lake fisheries.	Incorporating actions typically requested in deviations would permit flexibility in responding to flows and help avoid or reduce impacts to agricultural, recreational and cultural resources. Aesthetics would be less likely to be impacted due to erosion.	Yes. The need for flexibility is incorporated into the WCP while potentially reducing impacts to other project resources.

3 Affected Environment

3.1 General Description: This section describes the physical, biological, social and economic resources that may be affected by the proposed revision of the WCP. The existing environment affected by this project includes both natural and man-made features. Wappapello Lake and the St. Francis River are generally rural in nature.

The scope of the resource descriptions is focused primarily on the St. Francis River, beginning four miles upstream of Wappapello Lake to St. Francis, Arkansas, which is located near the Missouri-Arkansas border. The following sections provide an overview of the river resources potentially affected by the proposed revisions to the WCP.

3.2 Physical Resources: The St. Francis River flows south from its headwaters in the St. Francois Mountains and enters the Mississippi Embayment (a topographically low-lying basin filled with fluvial sediments) just downstream of the Wappapello Lake and Dam. The St. Francis River north of the lake possesses an incised valley having steep slopes and a narrow floodplain. South of the lake the river exits the Ozark Escarpment and meanders through the low-lying bottom lands of the Mississippi Alluvial Valley to its mouth at the Mississippi River near Helena, Arkansas. The St. Francis River originates in Iron County in Southeast Missouri and flows 225 miles of its 426 miles before it reaches the Missouri/Arkansas border. In Missouri, the basin is equally divided (north and south) between the high-relief Ozark Plateau and the low-relief Mississippi Alluvial Plain. Wappapello Dam and Lake are located on the divide. For inventory and planning purposes, the basin is separated into two dissimilar subbasins: the upper subbasin above Wappapello Dam and the lower subbasin below Wappapello Dam.

The St. Francis Basin drains 1,839 square miles in Missouri. The headwater area is dominated by igneous rock in the Ozark uplift (St. Francois Mountains), followed in a downstream direction by sandstone and dolomites. The alluvial plain of the lower subbasin is topped with a layer of unconsolidated gravel, sand, silt, and clay and is bordered on the east by Crowley's Ridge. Drainage in the lower subbasin has been altered by a system of levees and drainage ditches. Most of the west bank of the lower St. Francis River is a levee, which prevents drainage into the river from the west.

The St. Francis River passes through Lake Wappapello, which was formed by Wappapello Dam constructed in 1941. The lake is confined by the steeply sloped Ozark Hills. The main portion of the lake is formed by the St. Francis River Valley. The topography varies due to the many small tributaries that enter the river above the dam site. This results in ravines, valleys, and an irregular shoreline. Many of the slopes are timbered. The lake has a water surface area of 8,400 acres at recreation pool with a shoreline 180 miles in length. The pool at this elevation extends approximately 28 miles above the dam and is a maximum of 47 feet deep.

Below the dam the river meanders through cane forests and willow swamplands, transitioning from a clear stream into a slow and silt-laden muddy river as it enters the flat lands of the Mississippi embayment. In its lower course the river parallels Crowley's Ridge and is part of a navigation and flood-control project involving a network of diversion channels and ditches including the Castor and Little Rivers. Below the mouth of the Little River in Poinsett County, Arkansas, the St. Francis is navigable by barge. It joins the Mississippi River in Phillips County, Arkansas, about 7 miles (11 km) north of Helena.

3.2.1 Geology: The lake (pool) lies within the southeastern limits of the Salem Plateau section of the Ozark Plateau Physiographic Province. This province is frequently referred to as the Ozark Dome since the area is topographically an east-west elongated dome of outward dipping Paleozoic rocks. The Salem Plateau section contains most of the higher summits of the province. The steep slopes results in quick run-off.

The lands surrounding the lake are moderately dissected with outcrops of bedrock occurring along the streams. Some of the ridges extend a considerable distance into the lake forming long bays and peninsulas of land; others are stubby with short bays. There is a difference of nearly 340 feet between normal pool elevation and the higher ridgetops. The northern end of the lake narrows to the point that it occupies only the old riverbed. The steep slopes also limit the capacity of the lake to hold flood waters.

3.2.2 Soils: The most abundant soil association at Wappapello Lake is that of the Clarksville-Fullerton-Lebanon series found on the cherty-stony uplands. The soil is excessively to moderately well-drained. Major problems are droughtiness, steepness, erosiveness, and low fertility. On the flat ridgetops, the Fullerton series possesses a cherty fragipan at 18-30 inches. On some gently to steeply sloping areas are soils of the Baxter-Dewleyville-Hagerston series. These are red cherty soils developed from cherty limestone. The soils are similar to the above, being suited for forests, grassland, and orchards. Huntington silt loam occupies the first terraces of the bottomland. This is a deep, well-drained, silty alluvial soil. On the extreme bottomlands Enis soils may be found. These are similar to the above. These soils allow quick run-off and support a flashy hydrology.

3.2.3 Hydrology:

3.2.4
General. The climate of the area is mild, with the average annual temperature about 57.2° Fahrenheit. The annual rainfall is well distributed throughout the year at an average 46.79 inches. Much of the precipitation is in the form of rain.

Precipitation. The normal annual rainfall in the St. Francis Basin in the Ozark uplands is about 47 inches per year. Normal monthly rainfall varies from about 3.0 to 5.2 inches in the region, the heaviest occurring in the period March through July. In the southern portion, or that part which lies in the alluvial valley of the Mississippi River, the normal monthly rainfall varies from about 2.8 to 6.0 inches, with the heaviest occurring during

the months November through May. The hydrology is primarily influenced by the winter and spring rains.

Flood Control: The St. Francis Basin has been subject to periodic floods throughout its history, with most of the flood damage confined to agricultural areas. The predominance of impervious rock in the upper basin limits infiltration and subsurface flows causing rapid runoff, flashy hydrographs, frequent flooding, and a poor aquifer that provides low, unstable base flows. Six dams are located in the upper subbasin which can affect flows and fish movement. These include Wappapello Dam and Lake (8,400 acres) the dam at DiSalvo Lake on the main stem and four dams located on main stem tributaries. Flow in the lower subbasin is primarily regulated by water released through Wappapello Dam. However, extensive infiltration in the lower subbasin produces a good aquifer with abundant groundwater supplies.

Dam Structure: The complete structure consists of an earth dam, a concrete outlet structure, and a concrete emergency spillway. The outlet control structures are 400 feet south of the dam in the right abutment. The conservation pool weir, with crest elevation at 354.74 ft. NGVD and a length of 70 feet, is pierced by five sluices, each 6 feet wide and 7.5 feet high, with invert elevation at 338.74 ft. NGVD. The intake section of the control structure lies within the gate house and contains three water passages, each controlled by a motor-operated, tractor-type gate, 10 feet wide and 20 feet high. The outlet works also contain a penstock. This provides for the operation of 125-kVA hydroelectric unit to furnish power and lights for the dam, gate house, and some recreation facilities. A diesel engine directly connected to a 50-kVA generator serves as a stand-by unit. An uncontrolled emergency spillway is provided in a natural saddle about 1,200 feet south of the south end of the dam. This concrete structure, founded on bedrock, has a 740-foot long spillway with a crest elevation of 394.74 ft. NGVD.

3.2.5 Lake Regulation : Flow in the lower St. Francis River is primarily regulated by water released through Wappapello Dam (USACE 2000). However, extensive infiltration produces a good aquifer with abundant groundwater supplies, high base flows, and a water table high enough to maintain standing water in large drainage ditches during prolonged dry periods. The high water table can also cause major agriculture problems.

Flood flows (typically exceeding 25,000 cfs) in the upper river are stored in Wappapello Lake and released at rates which reduce flooding in the lower subbasin. The current WCRS for Wappapello Dam is dictated by reservoir stage, time of year (expected precipitation), and downstream agricultural activities. The maximum possible release through the dam is 10,000 cfs, which is authorized only if reservoir storage capacity is threatened. The normal maximum discharge is 7,000 cfs during January and February, which can cause some limited agricultural flooding downstream if Mingo Ditch and Dudley Main Ditch have significant discharges. During most of the agricultural year (April through November), the preferred maximum discharge through the dam will produce a controlled maximum flow of 3,800 cfs at the Fisk, Missouri and St. Francis, Arkansas gage stations. The minimum authorized low flow discharge through Wappapello Dam is 40 cfs, although it is actually more like 60 cfs.

Peak flows at the Fisk gage station, 23 river miles below the dam, seldom exceed the channel capacity of 8,090 cfs. At the St. Francis gage station, 54 river miles below the dam, peak winter flows average 14,700 cfs, frequently exceeding the channel capacity of 6,300 cfs. Overbank flows in this channelized reach of river, however, are contained within an extensive levee system. There is not enough watershed area between the dam and the Fisk gage to provide significant runoff. However, major storm events can produce additional runoff that causes some overbank flows near the St. Francis gage (MDC 2013).

Water Control Release Schedule (WCRS): Water stages in the lower St. Francis River Basin are controlled by the operation of the Wappapello Dam. The general objective is to provide flood protection to downstream interests during wet periods while maintaining the pool as nearly as possible at rule curve elevation. Rule curve is defined as the elevation at which a reservoir is desired to be maintained to accommodate reservoir functions or uses (other than flood control) plotted against the time of year.

3.2.6 Current Regulation Procedure

3.2.6.1 Non-crop Season. The non-crop season is considered to exist from 1 January through 31 March. During this period the release rate may reach the maximum of 10,000 cfs independent of pool elevation. Rate of release shall match rate of inflow as nearly as possible up to 10,000 cfs and be maintained at this rate until the storm inflow is depleted or the pool approaches its lower limit. Some discretion is allowed in the discharge rate at elevations below 379.74 ft. NGVD, but when this elevation is exceeded, 10,000 cfs must be discharged.

3.2.6.2 Crop Season. The crop season is considered to exist from 1 April through 31 December, the date when all crops have normally been harvested. During this period the maximum non-damaging flow rate at Fisk, Missouri, and St. Francis, Arkansas, is 3800 cfs. The outflow from the Lake must be controlled in order not to exceed the 3800 cfs at Fisk and St. Francis unless the pool level should exceed one of the elevations shown in Table - 3, at which time the outflow would be increased to a constant discharge rate as noted.

Table - 3

Period	If pool exceeds: (Elevation NGVD)	Outflow is increased to: (Constant Discharge)
1 Jan-30 Jun	379.74 ft.	10,000 cfs
1 Jul -31 Oct	391.74 ft.	7,000 cfs
1 Nov-31 Dec	388.74 ft.	7,000 cfs

3.2.7 Water Quality: Basin streams generally exhibit good water quality and most streams are classified as full use attainment. However, there have been some minor isolated problems with mining and smelting activities and inadequate waste water treatment facilities in the upper subbasin. Two permitted water supply surface withdrawals exist in the upper subbasin. In the lower subbasin, headcutting, streambank

erosion, and the resulting increased sediment load and deposition downstream adversely affect water quality. Irrigation is a major use of groundwater.

3.2.8 Erosion: Streambank erosion is not a major problem in the upper subbasin, where riparian corridors are mostly forested and usually rated as good. Channel substrates are generally stable and diverse. Big Creek is the only upper subbasin stream with abundant gravel. Excessive streambank erosion and headcutting are serious problems in the channelized section of the lower subbasin main stem and most of its tributaries. The quality of the riparian corridor varies considerably. The streambed is primarily composed of clay and sand, with very little diversity. Excessive sedimentation is occurring below the channelized sections. The release from the lake may be increased as much as 2,500 cfs per day, and only increased by no more that 500 cfs per hour.

River interests are very concerned about river bank stability. River bank caving results in the loss of valuable land. When the release from Wappapello Lake is curtailed, it is done gradually so as to promote river bank stability. The gradual curtailing of the release is particularly important if the river banks have become very wet or saturated. A reasonable rate of fall of the St. Francis River downstream of Wappapello Dam as the result of gate operation is about one foot per day. The use of this rate has promoted river bank stability. However, the natural fall of the river that occurs on the recession side of the local runoff hydrograph may result in a fall of the river much greater than one foot per day. The use of the technique known as the critical release schedule produces a gradual, a systematic, and an orderly curtailing of the release as the lake elevation is lowered and approaches the rule curve.

3.3 Biological Resources:

3.3.1 Aquatic Resources: The waters of the lake and tailwater also have many diverse forms of phytoplankton, zooplankton, aquatic insects, crustaceans, amphibians, reptiles and mollusks. In one life stage or another, all are an integral part of the food chain, necessary to sustain the life of lake organisms. The food supply of fishes is supplemented also by numerous terrestrial forms, particularly during periods of rainfall or strong winds. Maintenance of good water quality (relatively free of inorganic or organic pollutants) is also necessary for the well being of the diverse aquatic populations. The fishes of Wappapello Lake are typical of Midwestern waters. Major sport species are white and black crappie, bluegill, green sunfish, red ear, long ear, largemouth bass, and white bass. Also present are channel, blue, yellow and flathead catfish, gizzard shad, and a variety of other fish species. All totaled, there are approximately 50 species of fish within this region.

The Wappapello Lake Fishery Management Plan (MDC 1996) recommends that the lake be maintained at a stable or at a rising elevation if possible during the gizzard shad spawning period to improve shad reproductive success. In accordance with the plan, the Missouri Department of Conservation will furnish WMO with an estimate of when the gizzard shad spawning period will occur.

The basin exhibits good aquatic biodiversity. One hundred thirty fish species in 20 families have been collected. Twenty-three fish species found in the basin are state-listed as species of conservation concern. Of these, one is considered extirpated from Missouri and six are listed as state endangered. No federally listed fish species are indicated for the project area.

Most streams support a diverse benthic invertebrate fauna. Forty -two mussel species were collected, primarily from the main stem in 2002 (Hutson and Barnhart 2002). Twelve mussels that were collected are listed as Missouri species of conservation concern. Two federally listed mussel species were collected in the project area: snuffbox and rabbitsfoot. The federally listed mussel species located in the counties of the project area include the snuffbox, Curtis' pearlymussel, pink mucket, rabbitsfoot, and fat pocketbook.

Flora. The original flora of Wappapello Lake consisted of woodlands that were part of the eastern temperate deciduous forest formation composed primarily of oak-hickory. Over 80 percent of the 20,172 acres of woodland found on public lands at Wappapello Lake is of this type. Major species include white oak, black oak, shagbark hickory, and mockernut hickory. The drier ridgetops are dominated by pignut hickory and post oak. Where a sandstone soil base exists, shortleaf pine and pine-oak mixture stands are found. Eastern red cedar may be locally abundant where limestone is close to the surface. Toward the ravines and lower elevations the oak-hickory association grades into stands possessing more mesic species such as red oak and chinquapin oak, white ash, green ash, basswood, black walnut, and bitternut hickory. Persimmon, blackgum, butternut, and sugar maple occur here also. On the low, poorly drained bottomland, sycamore, sweetgum, cottonwood, and river birch predominate. Understory trees of the uplands include primarily redbud, flowering dogwood, and shadbush. The diversity of some of the mesic stands is quite high. For example, within the Johnson Tract, in one small area less than 100 meters across, at least 27 species of forest trees were recorded. Pondberry, running buffalo clover and decurrent false aster may occur in the project area and are discussed further under threatened and endangered species section. Other minor plant communities may be found on lake lands. Small canebrakes consisting of cane grow along the St. Francis River. Willow thickets are sometimes quite extensive.

3.3.2 Wildlife. Fauna typical of deciduous woodlands and its edge habitat exist at Wappapello Lake. Otters and beavers are found along the St. Francis River and lake as well as game species typical of edge habitats, such as eastern cottontails, bobwhite quail, and squirrels. Deer and wild turkeys are abundant in numbers. Migratory waterfowl use the lake for resting and feeding and are relatively abundant during the fall and winter months. Gray bat, Indiana bat, northern long-eared bat, Ozark hellbender, and Hine's emerald dragonfly are listed species that may occur in the project area.

3.3.3 Threatened and Endangered Species - (Biological Assessment) In compliance with Section 7(c) of the Endangered Species Act of 1973, as amended, a listing of federally threatened or endangered species, currently classified or proposed for

classification, that may occur in the vicinity of the proposed project area was obtained by consulting websites maintained by the U.S. Fish and Wildlife Service on February 7, 2014 (USFWS 2014a). There are potentially 14 federally listed or candidate species within the proposed project area (Table - 4). Proposed critical habitat for the rabbitsfoot mussel occurs within the proposed project area (USFWS 2014b). Counties within the project area from north to south include Wayne, Butler, Stoddard, and Dunklin in Missouri and Clay in Arkansas.

Table - 4. Federally listed and candidate species known from the area of Wappapello Lake and the St. Francis River in Missouri and Arkansas.

Species	Status	Distribution (State - County)	General Habitat
Indiana bat (*Myotis sodalis*)	Endangered	Missouri - Butler, Dunklin, Stoddard, Wayne Arkansas - Clay	Hibernacula – caves and mines; Maternity and foraging habitat – small stream corridors with well developed riparian woods; upland forests
Gray bat (*Myotis grisescens*)	Endangered	Missouri - Wayne	Caves
Ozark hellbender (*Cryptobranchus alleganiensis bishop*)	Endangered	Arkansas - Clay	White River
Curtis' pearlymussel (*Epioblasma florentina curtisi)*	Endangered	Missouri - Butler, Wayne	Little Black River
Pink mucket (*Lampsilis abrupta*)	Endangered	Missouri - Butler, Wayne Arkansas - Clay	Rivers
Rabbitsfoot (*Quadrula cylindrica cylindrica*)	Threatened; Proposed Critical Habitat	Missouri - Butler, Wayne Arkansas - Clay	Rivers; Proposed Critical Habitat (St Francis River – Wayne Co., Mo.)
Fat pocketbook (*Potamilus capax*)	Endangered	Missouri - Dunklin	Rivers
Snuffbox (*Epioblasma triquetra*)	Endangered	Missouri - Wayne	Small to medium-sized creeks with a swift current
Hine's emerald dragonfly (*Somatochlora hineana*)	Endangered	Missouri - Wayne	Streams and associated wetlands overlying dolomite bedrock
Hine's emerald dragonfly (*Somatochlora*	Critical Habitat Designated	Missouri - Wayne	Located near Williamsville and associated with Brushy Creek (Black River)

Species	**Status**	**Distribution (State - County)**	**General Habitat**
hineana)			
Pondberry (*Lindera melissifolium*)	Endangered	Missouri - Butler Arkansas - Clay	Bottomland hardwood forest
Running buffalo clover (*Trifolium stolonifereum*)	Endangered	Missouri - Dunklin, Wayne	Disturbed bottomland meadows
Decurrent false aster (*Boltonia decurrens*)	Threatened	Missouri - Dunklin	Disturbed alluvial soils
Northern long-eared bat *Myotis septentrionalis*	Proposed as Endangered	Butler	Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests during spring and summer.

Indiana bat. Indiana bats (*Myotis sodalis*) winter in caves in over 15 states in east-central United States. A substantial portion of the species' population is supported by caves in eastern Missouri; a small proportion uses caves in northern Arkansas (USFWS 2007a). In the spring, females leave the caves to disperse to outlying forests that serve as summer habitat, in which pregnant individuals establish maternity roosts. During the warm season these bats forage for insects along stream corridors and in the tree canopy. Summer habitat extends across the east-central states, including much of Missouri as well as northern Arkansas. Summer surveys conducted in forests on USACE and U.S. Forest Service lands surrounding Wappapello Lake have detected its seasonal presence. Trees preferred for maternity roosting include dead individuals with shaggy or loose bark, of larger rather than smaller diameters. Roost trees occur in floodplains as well as uplands, and tree species used for roosting include various ash, elm, hickory, maple, poplar, and oak. Males often roost separately from females and young. Disturbance and vandalism, improper cave gates and structures, natural hazards such as flooding or freezing, microclimate changes, forest losses in maternity range, chemical contamination, and most recently, white nose syndrome are the leading causes of population decline in the Indiana bat (USFWS 2007a).

Gray bat. The gray bat (*Myotis grisescens*) occurs in numerous Missouri counties where it inhabits caves during summer and winter. This species leaves the cave daily to forage for insects over rivers and reservoirs adjacent to forests. This bat has been captured during summer surveys along the St. Francis River on USACE lands at Wappapello Lake (USFS 2011). Although the cave used by the captured bats was not found, "it is highly likely [it] exists somewhere along the St. Francis River" (USFS 2011).

Northern long-eared bat. The northern long-eared bat (*Myotis septentrionalis*) is a federal candidate for listing as an endangered species throughout its range (Federal Register 2 October 2013). The northern long-eared bat is sparsely found across much of the eastern and north central United States, and all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and eastern British Columbia. Northern long-eared bats spend winter hibernating in large caves and mines. During summer, this species roosts singly or in colonies underneath bark, in cavities, in crevices of both live and dead trees. Foraging occurs in interior upland forests. Forest fragmentation, logging and forest conversion are major threats to the species. One of the primary threats to the northern long-eared bat is the fungal disease, white-nose syndrome, which has killed an estimated 5.5 million cave-hibernating bats in the Northeast, Southeast, Midwest and Canada. Suitable maternity and foraging habitat is most likely present and would consist of floodplain forest along the Mississippi and Missouri rivers and forest fragments scattered within cropland.

Ozark hellbender. The Ozark hellbender (*Cryptobranchus alleganiensis bishop*) is a fully aquatic giant salamander. The Ozark subspecies is restricted to streams of the highlands in southern Missouri and northern Arkansas. It is known historically from portions of the Spring, White, Black, Eleven Point, and Current Rivers and their tributaries. The current distribution is limited to the North Fork of the White River, the Eleven Point River, and the Current River (USFWS 2011).

Curtis' pearlymussel. Curtis' pearlymussel (*Epioblasma florentina curtisi)* prefers riffles within transitional zones of clean streams and rivers, between the swift-flowing headwaters and more leisurely, meandering currents farther downstream. This species inhabits creeks and streams with shallow (less than 36 inches) flowing water and a stable substrate. The mussel occurs in the Black, Castor, and Little Black Rivers and in Cane Creek. Prefers moderate nutrient concentrations (mesotrophic) and is restricted to clean waters that have not been exposed to pollution (saprophobic).

Pink mucket. The pink mucket (*Lampsilis abrupta*) is a rounded to slightly elongate mussel with a thick, inflated, smooth, yellowish-brown shell. It lives in flowing waters of large streams among gravel, cobble, and sand. The pink mucket occurs in the lower Mississippi and Ohio rivers and their larger tributaries. In Missouri, the pink mucket occurs in the Meramec, Gasconade, Black, Little Black, Osage, Sac, and St. Francis rivers. In the St. Francis River, it is known from only one locality in Missouri. Oesch (1984) encountered this species upstream of Wappapello Lake in the vicinity of Highway 34, about 5 miles north of Greenville. More recently, this species was not encountered during a mussel survey of the St. Francis River in Missouri conducted about 10 years ago (Hutson and Barnhart 2004). It has not been reported from that portion of the St. Francis River in Arkansas (Harris et al. 2009). The principal cause of decline has been habitat alteration from dam construction, channelization, and dredging.

Rabbitsfoot. This mussel (*Quadrula cylindrica cylindrica*) is a candidate for listing under the Endangered Species Act. In Missouri, this species occurs in the Spring, Black, and St. Francis rivers (Oesch 1984). Critical habitat is proposed for 40.0 river miles of

the St. Francis River from the Twelvemile Creek confluence west of Saco, Madison County, Missouri, downstream to the upstream point of inundation by Lake Wappapello, Wayne County, Missouri. In the St. Francis River in Missouri, it is known from a restricted portion of the river in northern Wayne County at a considerable distance upstream from Wappapello Lake (Hutson and Barnhart 2004). It has not been reported from the St. Francis River in Arkansas (Harris et al. 2009).

Fat pocketbook. The fat pocketbook (*Potamilus capax*) is listed as endangered and occurs in the Ohio River; a tributary of the Mississippi River and in the Lower Mississippi River. This species uses sand substrates and may be found individually or in beds with other species. Activities that impact the fish host species for these mussels may ultimately adversely affect the species. The 1989 USFWS recovery plan (USFWS 1989) states that "While the fish host of *P. capax* is unknown, it is probably a large river species.

Snuffbox. Snuffbox (*Epioblasma triquetra*) mussels are typically found living in gravel substrates, in shallow (< 1m), swiftly flowing water. They have also been reported in mud, silt, sand and bedrock substrates. Usually found in riffles, this species is distributed in large rivers as well as small ones, and has been recovered from pools as well as lakes. The snuffbox is within a very environmentally sensitive group of mussels. Probable causes for the decline include habitat modification and degradation, and the introduction of exotic bivalves.

Hine's emerald dragonfly. The Hine's emerald dragonfly (*Somatochlora hineana*) was Federally-listed as an endangered species in 1995 (USFWS 2001). It currently is known to exist in only the following states: Illinois, Michigan, Missouri, and Wisconsin. The habitat is largely restricted to spring-fed wetlands in areas of dolomite bedrock. Critical habitat has been designated in Wayne Co. along Brushy Creek which is a tributary to the Black River. Hine's emerald dragonfly critical habitat is not located in the project area.

Pondberry. Pondberry (*Lindera melissifolium*) is a low growing, deciduous shrub ranging in height from 1.5 to 6.5 feet. The plants commonly grow in clumps of numerous scattered stems somewhat resembling a "plum thicket." Pondberry is presently found in the Mississippi River alluvial plains of Missouri, Arkansas, and Mississippi, and the Coastal Plains region of Alabama, Georgia, South Carolina, and North Carolina. Historically, pondberry locations have also been reported from Louisiana and western Florida. However, populations of these states are considered extirpated (Tucker, 1984; Wofford, 1983; USFWS, 1990). Approximately 262 colonies/populations/sites of pondberry are currently known to exist across its 7-state range. Approximately 194 colonies have been reported in Mississippi, primarily in Delta National Forest (DNF) (182 colonies in DNF and 12 colonies on private lands approximately 65 miles north of the Forest); 2 colonies in Alabama; 36 colonies in Arkansas; 8 populations in Georgia (includes new colony found in March 2004); 15 colonies in South Carolina; 2 populations in North Carolina; and 5 colonies composing 1 natural population in Missouri.

Running buffalo clover. Running buffalo clover (*Trifolium stolonifereum*)is a native Missouri clover believed to have originally inhabited the ecotone between open forest and prairie in the eastern and central U.S. The species apparently depended on grazing and disturbance by large animals such as the buffalo for population viability, and partial shading also appears to have been an important component of its original habitat. Current habitats include disturbed bottomland meadows and areas with rich moist soils that are subjected to mowing, trampling, or grazing, especially disturbed areas in woodlands. Running buffalo clover is known from 24 counties in Missouri. This species should be searched for whenever prairie remnants are encountered. Running buffalo clover is found in Indiana, Kentucky, Missouri, Ohio, and West Virginia. It has been extirpated from Arkansas, Illinois, and Kansas.

Decurrent false aster. The decurrent false aster *(Boltonia decurrens)* is a perennial floodplain plant of open, wetland habitats, and its distribution in Missouri includes scattered counties along the Mississippi River (USFWS 2001). Historically it occurred in wet prairies, shallow marshes, and shores of rivers, creeks, and lakes on the floodplain of the Illinois and Mississippi Rivers (Schwegman and Nyboer 1985). Currently it is found most often in old agricultural fields and along roadsides and lake shores where alluvial soils have been disturbed. This plant is an early successional species that requires either natural or human disturbance to create and maintain suitable habitat. In the past, the annual flood/drought cycle of the Illinois and Mississippi rivers provided the natural disturbance required by this species. Annual spring flooding created open, high-light habitat and reduced competition by killing other less flood-tolerant, early successional species. Field observations indicate that in "weedy" areas without disturbance, the species is eliminated by competition within 3 to 5 years (USFWS 1990). *Boltonia decurrens* has high light requirements for growth and seed germination (Smith *et al.* 1993, Smith *et al.* 1995), and shading from other vegetation is thought to contribute to its decline in undisturbed areas. Seeds of this plant can be dispersed by flooding, or carried by wind and animals.

Bald Eagle. The bald eagle (*Haliaeetus leucocephalus*) was removed from the List of Endangered and Threatened Species in August 2007 but it continues to be protected under the Bald and Golden Eagle Protection Act and by the Migratory Bird Treaty Act. Recommendations to minimize potential project impacts to the bird and its nest are provided by the U.S. Fish and Wildlife Service in that agency's National Bald Eagle Management Guidelines publication (USFWS, 2007b). Those guidelines recommend: (1) maintaining a specified distance between the activity and the nest (buffer area); (2) maintaining natural areas (preferably forested) between the activity and nest trees (landscape buffers); and (3) avoiding certain activities during the breeding season. Specifically, construction activity is prohibited within 660 feet of an active nest during the nesting season, which in the Midwest is generally from late January through late July.

The bald eagle is identified as breeding and/or wintering along the St. Francis River Basin in Missouri. Eagles often are associated with open water areas bordered by suitable perch trees. Trees within 100 feet of the shore are preferred (USFWS 2000).

3.4 Socio-Economic Environment

3.4.1 Land use: Historical land use in the upper subbasin includes mining, timber harvesting, annual burning, upland row cropping, and livestock grazing. Presently, land-use in the upper subbasin can be classified as 77 percent woodland, 10 percent grassland, 7 percent cropland, and 6 percent other uses. Wetland drainage, timber clearing, and flood control projects have converted the lower subbasin from an immense swampland forest to a vast agricultural area. Eighty eight percent of the lower subbasin is now used for crop land, followed by 7 percent woodland, and 3 percent grassland.

Public ownership in the basin totals more than 218,000 acres, with about 83 percent in the upper subbasin. The U. S. Forest Service is the largest landowner in the basin. The Missouri Department of Conservation owns 46,800 acres, which includes 28 Conservation Areas. Public lands provide 123 miles of stream frontages throughout the basin.

3.4.2 Economics: The history of the St. Francis River Basin indicates that it has been subject to periodic floods, with most of the flood damage confined to agricultural areas. Four floods which occurred prior to construction of Wappapello Dam (August 1915, May 1933, March 1935, January 1937) were particularly destructive. The August 1915 flood exceeded all previous floods on the upper St. Francis River, with a peak flow rate at Wappapello estimated as about 85,000 cfs. This flood was one of the most destructive of record within the St. Francis River Basin, causing damages of about $5,000,000. The May 1933 flood overflowed approximately 207,000 acres (of which 91,000 acres were cultivated), causing damages of about $826,000. The March 1935 flood produced the highest stage of record at St. Francis, Arkansas. This flood overflowed an area of 337,000 acres (including 151,000 cultivated acres), causing damages of about $2,000,000. The January 1937 flood produced the greatest flow rate on the lower St. Francis River, being the culmination of a series of storms totaling approximately 17 inches in 25 days. It caused damages of $600,000 resulting from an overflowed area of 371,000 acres (including 195,000 cultivated acres).

The flood history for the Upper St. Francis River Basin and Wappapello Lake during the periods 1993 through 2012 is given in Table-5. Values for economic damage prevented were computed in the year that the damage was prevented.

3.4.3 Aesthetics: The project area is represented by river and lake landscapes that attract thousands to recreate and inhabit. The topography of gently rolling hills and valleys with some steeper sloped areas along major creeks and streams provides a break from the flat fields converted from bottomland forest or prairie. In some locations, shoreline and river erosion are detractions to the landscape aesthetics such as what occurred downstream of the overflow spillway in the 2011 flood.

3.4.4 Cultural Resources: The principal effect of water level changes on cultural resources is erosion of shoreline archaeological sites. The erosion can occur by the steady effects of waves lapping the shoreline at a particular water level, or by changes in

water flow created by fluctuations in the lake water level. In the first case, the damage is cumulative as long as the water level remains at the same level. In the case of water level changes, the damage is increased when water level changes and flows occur quickly. Under the current water level control regime, maintaining water levels for extended times and then making relatively rapid adjustments results in a higher level of damage to shoreline sites.

Table – 5 - Damages Prevented by Wappapello Lake

Damages Prevented by Wappapello Lake	
Year	**(2012 Price Level in $1,000)**
2012	$605
2011	$14,304
2010	$10,713
2009	$3,070
2008	$7,877
2007	$2,088
2006	$3,411
2005	$3,534
2004	$1,453
2003	$2,845
2002	$3,055
2001	$3,403
2000	$4,117
1999	$1,273
1998	$3,429
1997	$5,654
1996	$60
1995	$916
1994	$3,021
1993	$5,655
SUM	**$80,483**

3.4.5 Recreation: The lake attracts visitors to the area to recreate in its 14 recreation areas and 34,000 acres of open lands (USACE 2000). Visits to the lake average around two million annually. Statewide survey estimated 88,500 annual fishing trips in the St. Francis River basin, which ranked it 15th out of 38 basins surveyed. The basin was ranked 13th in total recreational worth in Missouri. In the lower subbasin, intense agriculture, poor land use, and channel modifications were cited as the primary problems that lowered recreational worth in the recreational value survey. However, the rule curve

includes the recreation pool, i.e., elevation Wappapello Dam and Lake was authorized for downstream flood control by the Flood Control Act of 15 June 1936 (Overton Act). Development of recreation and public-use areas on USACE reservoir areas was authorized by Section 4 of the Flood Control Act of 22 December 1944, as amended by Section 209 of the Flood Control Act of 3 December 1954. These flood control acts which authorized the development of recreation and public-use areas made no provision for modifying reservoir water control plan in order to accommodate recreation. Therefore, Wappapello Dam and Lake is regulated so as to provide downstream flood control. However, the rule curve includes the recreational pool (i.e., elevation 359.74 ft. NGVD) during early May through mid-December. This lake level enhances recreation on the lake. The recreation pool provides an 8,400-acre lake surface. All of the recreation areas along the perimeter of the lake are designed to be fully accessible and usable when the lake elevation is at the recreation pool. Since the lake has a relatively small amount of storage at low lake elevations, rainfall runoff can cause the lake to rise quickly and thus make these recreation areas inaccessible and unusable.

4 Environmental Consequences

4.1 General Description: This chapter is organized by alternatives. All resource impacts for each alternative appear under the discussion of that alternative. Impacts associated with threatened and endangered species are summarized in Table - 6. Impacts associated with the proposed changes are summarized in Table - 7. All impacts associated with the proposed project and the no-action alternatives are shown in Table - 8.

4.2 Alternative A: No Action Alternative: Use Current WCP with Requests for Temporary Deviations

4.2.1 Physical Resources: With the potential for more extreme weather events like what has been experienced in recent years, possibly due to climate change, more impacts to the physical environment may be expected. Greater impacts could include those associated with river processes, i.e., bank and shoreline erosion, lake and river sedimentation, over the bank scouring and flooding. If WCP deviations are not obtained, the potential to avoid or reduce negative impacts to the physical environment is taken away.

4.2.2 Biological Resources: It is expected that the present conditions and impacts of the water control management plan would remain the same except when the extreme precipitation events that have become more common occur and there is no flexibility in the WCP to respond to them. There may be instances when a needed deviation could not be obtained and that might result in an adverse impact, i.e., a reduction in the success of the fish spawn, or disturbance to the mussel resources downstream of the dam due to high flows.

4.2.3 Socio-economic Environment: If the temporary deviations are not obtained as requested, negative impacts could occur to the agricultural and recreational business sectors. Upstream impacts would impact lake recreational facilities, i.e., marinas and park facilities and outdoor activities such as duck hunting. Downstream impacts would primarily affect agricultural interests during the crop season, generally 1 May to 1 November.

4.2.3.1 Cultural Resources: The principal effect of water level changes on cultural resources is erosion of shoreline archaeological sites. The erosion can occur by the steady effects of waves lapping the shoreline at a particular water level, or by changes in water flow created by fluctuations in the lake water level. In the first case, the damage is cumulative as long as the water level remains at the same level. In the case of water level changes, the damage is increased when water level changes and flows occur quickly. Under the current water level control regime, maintaining water levels for extended times and then making relatively rapid adjustments results in a higher level of damage to shoreline sites.

4.2.3.2 Aesthetics: During high water events, erosion and flooding would continue to cause negative impacts to aesthetics.

4.3 Alternative B: Revise the WCP (Preferred Alternative)

4.3.1 Physical Resources: The physical size of the project area, the variable and almost infinite nature of water stages and finite funding of the analysis has resulted in a limited ability to analyze in detail the environmental impacts of the proposed changes to the WCP. However, in general, the changes proposed to the WCP are expected to reduce the frequency of lake water levels in the extreme high ranges. Consequently, the negative impacts of water control management would be expected to be reduced by the proposed changes.

Overall, there are no physical changes expected other than the normal river processes that continue to have minor impacts to the river corridor, i.e., erosion and sedimentation. The ability to use cutbacks, while not increasing the duration or increasing the crest levels, would reduce upstream and downstream (agricultural) impacts. Water quality would be unchanged or slightly improved due to a reduction in the extreme high water levels that result in erosion and sedimentation. This would be a better plan to manage atypical or unique flows because it would allow more flexibility in water management and reduce the need to request deviations to avoid impacts to other project resources during flood control operations.

4.3.2 Biological Resources: The listed federal and state, threatened and endangered species would not be impacted by the proposed revisions to the WCP or incorporating actions associated with the typical deviations. The flows and lake levels associated with this alternative would be less extreme and have the tendency to lessen the impacts of water control management rather than increase the impacts. The physical environment and habitats of the listed species would be less impacted; consequently, fewer impacts to

the species would be expected. No adverse impacts to threatened and endangered species are anticipated.

Table – 6 Summary of Federally Threatened and Endangered Species Determinations	
Indiana bat (*Myotis sodalis*)	No suitable Indiana bat trees would be directly impacted by this action; therefore, this action would have no effect on this species.
Gray bat (*Myotis grisescens*)	No caves would be directly impacted by this action; therefore, this action would have no effect on this species.
Northern long-eared bat *Myotis septentrionalis*	No bat trees or uplands would be directly impacted by this action; therefore, this action would have no effect on this species.
Ozark hellbender (*Cryptobranchus alleganiensis bishop*)	The Ozark hellbender is only known in the White River system; therefore, this action would have no effect on this species.
Curtis' pearlymussel (*Epioblasma florentina curtisi)*	This species has been collected from the Little Black River but not the St. Francis River; therefore, the proposed action should have no effect on Curtis' pearlymussel.
Pink mucket (*Lampsilis abrupta*)	This species was reported by Oesch (1984) upstream of Wappapello Lake, but more recent surveys have not encountered it; therefore, the proposed action should have no effect on the pink mucket.
Rabbitsfoot (*Quadrula cylindrica cylindrica*)	This species has been collected above the flood control pool (394.74 ft. NGVD) upstream of Wappapello Lake; therefore, the proposed action may affect, but is not likely to adversely affect the rabbitsfoot mussel.
Rabbitsfoot – Proposed Critical Habitat	Proposed Critical Habitat: This habitat would experience river flood pulses for all except the lower four miles. Wappapello Lake pool would inundate this area during a flood. This proposed critical habitat may be affected, but not adversely affected by the revision of the WCP.
Fat pocketbook (*Potamilus capax*)	According to studies, (FHA et al. 2003 and Harris et al. 2009) it does not appear that the fat pocketbook is present in the upper or lower St. Francis; therefore, this action would have no effect on the fat pocketbook mussel.
Snuffbox (*Epioblasma triquetra*)	Species was collected live upstream of the Wappapello Lake flood control pool (394.74 ft. NGVD); therefore, the proposed action may affect, but is not likely to adversely affect the rabbitsfoot mussel.
Hine's emerald dragonfly (*Somatochlora hineana*)	Typical Hine's emerald dragonfly habitat such as spring-fed wetlands in areas of dolomite bedrock would not be directly impacted by the proposed action; therefore, this action would have no effect on this species.
Pondberry (*Lindera melissifolium*)	No known pondberry habitat would be directly impacted by this action; therefore, the project would have no effect on this species.
Running buffalo clover (*Trifolium stolonifereum*)	No known running buffalo clover habitat would be directly impacted by this action; therefore, the project would have no effect on this species.
Decurrent false aster (*Boltonia decurrens*)	No known decurrent false aster habitat would be directly impacted by this action; therefore, the project would have no effect this species.

4.3.2.1 Fisheries: The continued implementation of the Wappapello Lake Fishery Management Plan and the revised WCP would maintain fish spawning success and recruitment. The key is stable or rising water levels from mid-March to Mid-July, which

will facilitate spawning success and recruitment. Lake elevations above summer pool during this time of year will allow more acreage for spawning habitat for both predator and prey fish species. Rising water is a cue for spawning activity in fish, therefore rapid reduction in lake elevation after a rise can result in spawning failure and larval stages being stranded. In most fish species it takes 7-14 days after egg fertilization for the larval fish to hatch and become free-swimming. After this critical period they are less vulnerable to mortality due to loss of water. Many of the sport fish including crappie, bass, and bluegill can overcome nest failure by spawning multiple times throughout the year, but this is generally not the case for gizzard shad. Gizzard shad are the foundation of the food chain for sport fish. The revised WCP allows the lake to reach summer pool elevation earlier in the year compared to the current WCP, which will be beneficial to the fishery. The revised WCP also includes an increase in the variable release rate during the spring to fall months from 3800 cfs to 4200 cfs. This should not significantly increase nutrient or larval fish flushing since most of the nutrients have a tendency to drop out once they hit the slack lake or pool waters. In addition, although there may be higher flows, flushing may not occur because there would not be any strong current in the lake due to the high lake volume when this type of release is needed.

4.3.3 Socio-economic Environment: The revised WCP will allow the WMO to maintain the pool and river levels closer to the rule curve which should result in fewer impacts than the current plan for farming on leased land in the pool and for landowners and farmers downstream of the dam. Implementation of this alternative would allow adjustments for recreation and agricultural interests. Adjusting the start of the crop season and the dormant season would benefit other project purposes. The ability to adjust winter drawdown would also permit the project to continue to provide recreational opportunities later in the season, i.e., for waterfowl hunting in the upper end of the lake.

4.3.3.1 Cultural Resources: The more moderate water level changes proposed in the preferred alternative will reduce the two forms of erosion that affect shoreline archaeological sites. By making changes in water level more gradually, there will be less constant-level erosion by wind-driven waves. The more gradual changes in water levels will also reduce erosion resulting from changes in water flows. While the effects of the construction of Wappapello Lake on shoreline sites will continue to be adverse, the preferred alternative will reduce those effects.

4.3.4 Cumulative Impacts: The no action alternative impacts would be similar to what they have been since the current WCP was implemented along with the temporary deviations. However, implementation of the revised WCP would permit greater flexibility in adjusting the water control releases based on all the project purposes and provide an opportunity to reduce flooding impacts by reducing crest or duration of flooding. Over time the impacts of the revised WCP would be less than continuing with the current plan.

4.3.5 Climate Change: Heavy downpours are now twice as frequent in the Midwest as they were a century ago. Under the higher-emissions scenario, Missouri's spring rainfall is projected to increase almost 15 percent over the next several decades and up to 30

percent toward the end of the century. This may lead to more flooding, delays in the planting of spring crops, and declining water quality in rivers, streams, and storage reservoirs (UCS 2009). The proposed revisions to the WCP should help address future climate change if and when it should occur.

4.4 Unavoidable Adverse Impacts: No unavoidable adverse impacts are anticipated for the revised WCP; however, with the no action alternative there is potential for adverse impacts to the physical (erosion and sedimentation) and biological environment (sedimentation of mussel beds) during high water events. Table - 7 summarizes the impacts to the various resources for each alternative.

4.5 Relationship of Short -Term Uses and Long -Term Productivity: The desired outcome of the revised WCP would be to establish a more sustainable water management program that would reduce adverse impacts in the short-term and that would permit continued viability in all the project purposes. Short-term would be defined as the impacts that may accrue over a couple years whereas long-term would be defined as the impacts that may span a decade or more. The revised WCP would not be expected to alter substantially the present relationship between short-term uses of man's environment and maintenance and enhancement of long-term productivity.

4.6 Irreversible or Irretrievable Commitments of Resources - Irreversible or irretrievable resource commitments are related to the use of nonrenewable resources and the effects that use of those resources will have on future generations. Irreversible effects primarily result from use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the use or loss in value of an affected resource that cannot be restored as a result of the action (e.g., extinction of a threatened or endangered species). The revision of the WCP is not consumptive in nature. The revised WCP for Wappapello Lake would be expected to have generally positive effects on resources (e.g., potential reduction of damages from flooding). Alternative B, the preferred alternative would not result in irreversible or irretrievable commitments of resources.

Table - 7

Current Plan	Proposed Plan	Impacts
Dates		
Specific Dates	All dates have an allowable variance of +/- 14 days. All elevations have +/- 0.5 ft. except for winter pool.	Often due to wet or dry springs the start of the crop season is adjusted to the benefit of all project purposes through the use of deviations. As a result of the timing of the spring planting season the harvest is often early or delayed. In both cases, the start of the non-crop season is adjusted by the use of temporary deviation. The start of the winter drawdown has also been changed by use of deviation. This change would institutionalize what has been become standard practice and would allow the WMO greater flexibility to react to actual conditions to better provide for all project purposes.
Elevations		
Specific Elevations	All elevations other than winter drawdown have an allowable variance of +/- 0.5 feet.	This flexibility should allow the WMO to respond better to the needs of the stakeholders without the need for a deviation approval from MVD. It is likely that it would be used equally on the plus and minus side and instigated at the request of the stakeholders. No negative impact is anticipated.
Fish Spawn		
Coordinated with MDC to maintain a stable or slightly rising pool during fish spawn according to MDC Fishery Management Plan.	Continue working with MDC to maintain stable or slightly rising pool levels during spring and summer seasons.	Continue to provide for successful fish spawn (i.e. gizzard shad).

Table - 8			
Environmental Factors	Existing Conditions	**Alternative A**: No-Action: Current WCP	**Alternative B**: Revised WCP
4.2.1 Physical	Typical St. Francis River morphology	Potential short term adverse impact	Small beneficial impact
4.2.2 Biological T&E Species	Mussels are located in the St. Francis River Basin.	May adversely affect	No anticipated impact.
4.2.3 Socio-economic Cultural	Possibly some unknown cultural sites	Small adverse impact	Small beneficial impact
4.2.3 Socio-economic Aesthetics	Bank and shoreline erosion are on-going.	Small adverse impact	Small beneficial impact
4.2.3 Socio-Economic Agriculture	Downstream agriculture is integral to regional economics in the region.	Potential small adverse impact	Small beneficial impact
4.2.3 Socio-Economic Recreation	Numerous recreation areas, marinas associated with the lakes which are integral to regional economics.	Potential small adverse impact	Small beneficial impact

5. Agencies, Organizations, and Persons Receiving the Environmental Assessment

See Appendix B for the Distribution List.

6 References

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7. List of Preparers:

Name	**Job Description**	**Area of Expertise**
Mr. Francis Walton	Biologist	23 years Experience, Planning/ Environmental Impact Assessment
Ms. Joan Stemler	Chief, Water Control Operations	25 years, Water Control Management
Mr. Russell Errett	Water Control Manager	8 years, Water Control Management
Mr. James Barnes	Archeologist	15 years, District Archeologist

DRAFT FINDING OF NO SIGNIFICANT IMPACT (FONSI) REVISION OF THE WAPPAPELLO LAKE WATER CONTROL PLAN ST. FRANCIS RIVER BASIN MISSOURI AND ARKANSAS

I. In accordance with the National Environmental Policy Act, I have reviewed and evaluated the documents concerning the Revision of the Wappapello Lake Water Control Plan, St. Francis River Basin, Missouri and Arkansas. As part of this evaluation, I have considered:

a. Existing resources and the No Action Alternative.

b. Impacts to existing resources from the Preferred Alternative.

II. The project alternatives have been studied for physical, biological, cultural, and socioeconomic effects. My evaluation of the project has resulted in the following conclusions:

a. The proposed changes to the Wappapello Lake Water Control Plan would provide needed flexibility in water control management in response to large/rainfall flood events.

b. No significant impacts to natural resources, fish and wildlife resources and federally threatened or endangered species are anticipated from these changes. There would be no appreciable degradation to the physical environment (e.g., river stages and water quality) due to the implementation of the revised plan.

c. The proposed changes would have no significant adverse effect upon historic properties or archaeological resources.

d. The "no action" alternative was evaluated and determined to be unacceptable as repetitive water control management issues would continue with potential adverse impacts to the human environment.

III. Based on the evaluation and disclosure of impacts contained within the Environmental Assessment, I find no significant impacts to the human environment are likely to occur as a result of the proposed action. Therefore, an Environmental Impact Statement will not be prepared prior to proceeding with the proposed Revision of the Wappapello Lake Water Control Plan, St. Francis River Basin, Missouri and Arkansas.

_____ _____

(Date) CHRISTOPHER G. HALL
COL, EN Commanding

Appendix A – Agency Comments

MISSOURI DEPARTMENT OF CONSERVATION

Headquarters

2901 West Truman Boulevard, P.O. Box 180, Jefferson City, Missouri 65102-0180
Telephone: (573) 751-4115 ▲ www.MissouriConservation.org

ROBERT L. ZIEHMER, Director

May 11, 2012

Mr. Russell Errett
U.S. Army Corps of Engineers
St. Louis District
1222 Spruce Street
St. Louis, MO 63013

Dear Mr. Errett

The Department of Conservation (Department) thanks you for the opportunity to provide input to the Wappapello Dam and Lake Water Control Plan (Plan). As you know, the Department has a long-standing partnership with the Corps staff at the Project and at the St. Louis headquarters to help manage the fisheries of Wappapello Lake and the St. Francis River and to manage the fish and wildlife resources of the adjacent Wappapello Lake Management Lands that are licensed to the Department. We value this important partnership and thank you for requesting our input.

Department staff attended two of the public meetings to learn more about the update and to listen to stakeholder interests and concerns with regards to water level management at the Project. Proposed changes will be further evaluated by the Corps to determine if the primary purpose of flood risk management is affected by the action and also how it would affect other existing users and interests in and around the Project.

We offer the following comments to identify potential changes to the existing Plan that would benefit fish resources. In addition to understanding how the proposed modifications may affect other stakeholders, the Department is also very interested to learn how water elevations on surrounding lands would be affected by our proposed actions, including the lands managed by the Department and Sam A. Baker State Park. Because we do not know how, or if, our proposed actions would affect water levels in the area and flood risk management, we await evaluation information before making a final recommendation.

If you require additional information on our suggestions as you begin modeling and evaluating the proposed changes, please feel free to contact Dave Knuth, fisheries management biologist (573-290-5858, ext. 239; Dave.Knuth@mdc.mo.gov) or myself (573-522-4115, ext. 3372; janet.sternburg@mdc.mo.gov). We look forward to further

COMMISSION

DON C. BEDELL
Sikeston

JAMES T. BLAIR, IV
St. Louis

DON R. JOHNSON
Festus

BECKY L. PLATTNER
Grand Pass

App. A cont'd

Mr. Russell Errett
May 11, 2012
Page 2

discussions on possible changes in water level management that would enhance the Lake's fisheries.

Sincerely,

JANET E. STERNBURG
POLICY COORDINATOR

c: Ms. Cindy Jackson, Ms. Joan Stemler – USACE
Mr. Chris Kennedy, Ms. Harriet Weger, Mr. Dave Knuth, Mr. Mark McLain - MDC

App. A cont'd

Missouri Department of Conservation Comments for Possible Revision of the Lake Wappapello Water Control Management Plan – Fisheries Management Opportunities May 2012

Lake Wappapello was completed in 1941 for the sole purpose of flood control. However, in addition to flood control the lake generates a significant amount of revenue from recreational activities. According to the U.S Army Corps of Engineers, the lake's recreational economic value is approximately 40 million dollars within a 30 mile radius of the lake. Through best management practices and collaboration the Missouri Department of Conservation believes that alterations to the water control plan can be made to benefit future recreational activities, while preserving the lake's sole purpose of flood control. One of the best tools we have to improve the value of recreational activities and create good fisheries is water level management. From a fisheries perspective, water level management can greatly influence fish recruitment and also influence prey availability, which ultimately affects fish growth in large reservoirs. Water levels in the spring should be manipulated to benefit the early life stages of both predator and prey fish species in Wappapello Lake. Water level management practices should be focused to benefit Largemouth Bass, White Crappie, and Gizzard shad recruitment. Any practices focused on these species will likely benefit other species of fish that exist in the lake.

White Crappie populations exhibit variable recruitment that is generally boom-or-bust in nature, occurring cyclical every three to five years. Many factors including hydrology can influence crappie recruitment. Several studies have examined hydrologic effects on crappie year-class strength. Soballe and Kimmel (1987) found that primary production was reduced with low retention time in reservoirs possibly affecting growth and survival of young crappies. Low retention times or high flushing rates can also affect crappie recruitment by directly removing fry from the impoundment (Maceina and Stimpert 1998). Water level manipulation during the spawning period is probably the most critical. High water levels and low discharge during and after the spawn have been shown to positively affect year-class abundance (Bream 1983; Mitzner 1991). Water levels prior to the spawning season have also been shown to influence year-class strength in crappie. Macenia and Stimpert (1998) showed in three different reservoirs that fluctuated 1.8 meters or more per year, greater year-class abundance associated with short winter retention and high water levels in the winter (January-March) before crappie spawning. The spawning period for crappie in Wappapello Lake is from April to early June with water temperatures ranging from 56-70°F.

Gizzard Shad are the primary food source for all predatory fish in Wappapello Lake, therefore water levels should be managed to promote successful spawns and high survival of Gizzard Shad. Growth of Largemouth Bass and crappie in Wappapello Lake is positively affected by age 0 Gizzard Shad densities. Shad typically spawn from May through June (66-84°F) in Missouri where they broadcast their eggs in shallow water habitat. Kemble (1989) captured higher densities of larval shad in Wappapello Lake during two consecutive years from mid-May to mid-June using ichthyoplankton nets. Kemble (1989) suggested there were lower survival rates in 1987 than in 1986 as a result of higher discharge rates in 1987, causing a greater number of larval shad to be exported from the lake. He also hypothesized low lake levels in the spring also contributed to declines in year-class size. Larval shad catch rates were higher in 1986 when the lake was approximately 3 meters higher than in 1987, increasing the amount of shallow habitat utilized for spawning.

Water Level Management Suggestions to Promote Healthy Fisheries

The following actions are suggested recognizing that changes to existing water level management operations require modeling to understand how the changes would affect flood control requirements, boat ramps and other facilities, marinas, other lake users and downstream interests. Information on how these changes might affect water levels on adjacent lands, such as the state park and lands managed by the Missouri Department of Conservation is also needed prior to the Department making final recommendations for changes in water management operations at the lake. Comments provided below on the benefits or risks of any action taken only address the lake's fisheries. These suggested actions are to assist with the evaluation of possible enhancements to the lake's fisheries and are not meant to be the Department's final recommendations. We recognize there may be impacts to the primary purpose of the project or users of the lake and that these impacts must be identified and evaluated during modeling and then considered in the final decision.

If feasible, reduce magnitude or eliminate winter drawdown (359.74 ft to 354.74 ft NGVD) from mid-December to late-March. Higher water levels pre-spawn has been shown to positively increase crappie year-class strength. High discharge rates are necessary to maintain conservation pool or avoid flood stages during this time period, will not negatively affect the fishery.

If a step increase is still required from 354.74 ft to 356.74 ft in early spring, we suggest starting a gradual rise in mid-March, instead of late March. This will allow a more gradual rise in water levels to recreation pool and more water available during the spawning period.

From April through June is probably the most critical period when spawning occurs for Largemouth Bass, crappie, and Gizzard Shad. A gradual rise (356.74 ft to 359.74 ft) during this time period (probably no more than 2 inches a day) is critical and the slower the rise the better. Releases during this time period should be conducted using low discharge rates. We suggest retention times of no less than 11 days. Low flushing rates are critical not only to promote successful nesting, but also avoid flushing zooplankton and larval fish, but also allow for more primary productivity.

If feasible, allow a gradual rise in water levels from April to June to elevate at least 2 feet above recreation pool (> 361.74 ft) through mid-July. This will provide additional shallow habitat for young crappie, Largemouth Bass, and Gizzard Shad, which will promote better growth and survival of age 0 fish. After mid-July when young of year fish have had sufficient time to grow to less vulnerable sizes, the lake can be drawn back down to recreation pool elevation.

Benefits of reduction or elimination of the winter draw down:

The winter drawdown in the current plan does not benefit vegetation establishment efforts in Lake Wappapello. Long term winter exposure to new plantings can cause significant mortality. More stable water levels will be more conducive to vegetation establishment. Vegetation can play a significant role in bank stability, provide additional fish cover and nesting sites, improve water clarity, and support large numbers of macroinvertebrates, which are an integral part of most fish species diets.

Brush piles put in the lake for fish habitat will have more longevity, reducing the need to refurbish as often. Exposure of brush piles to air for extended periods of time promote rotting, reducing the life of the brush piles.

Increase the capability of providing flooded habitat to spawning and juvenile fish in the spring when drought conditions occur.

More water available to fish during the winter months may reduce the effects of consolidation, which can make fish more susceptible to over-harvest during the winter months.

App A cont'd

Risk associated with the reduction or elimination of winter draw:

Elevated water levels in the winter months or pre-spawn may not allow for high retention rates in the spring when low flushing rates are critical. If it is a wet late-winter or early-spring and high discharge is a necessity to avoid flood stages, the lack of holding capacity during this time frame could negatively affect the fishery.

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Appendix C – Workshop Comments

Wappapello Lake Water Control Plan Alternatives

Doug's (11-APR-2012)

- Guide Curve at 359.74 year round
- Transition from winter drawdown
    - Get rid of the transition period
    - Go from 354.74 to 359.74 starting April 1st
- Change the transition from 356.74 to 358.74
- Free flow transition from winter drawdown (*similar to fish spawn regulation*)
- Increase crop season release restriction???
- Start 10,000 release maximum starting December 1st
    - Plus or minus 14 days
- Exact dates for transitions
    - Plus or minus 14 days

Fisk (11-APR-2012)

- Winter drawdown
    - Lower elevation winter drawdown
- Add plus or minus 14 days on release restriction dates
- Lack of communication from local EMs

Greenville (10-APR-2012)

- Compare previous operating plans
- **Don't build the berm or sandbag the spillway**
- Change the 7,000 cfs restriction during JUL-DEC to 10,000 cfs
- **Preemptive releases based upon water on the ground forecast**
- Delay winter drawdown (duck hunting)
    - January 1st
- If Greenville is going to flood open to greater than 10,000 cfs
    - 15,000 cfs
- Allow for gravel mining from Wappapello Lake to reduce sedimentation
- Change the elevation from 379.74 to 375 when max release is at 10,000 cfs
- Do not increase spillway height
- Do not remove Greenville's berm
- More local control (deviation process)
- Keep gates open at 10,000 cfs when in surcharge
    - Year round

Piggott, AR (*St. Francis, AR*) **(11-APR-2012)**

- Change crop season release restriction from 3800 cfs to 4200 cfs based upon downstream conditions
- Regulate the St. Francis gage 3800 cfs starting early
    - March 1st or 15th
- 12 ft at St. Francis gage is needed to drain fields for planting
    - Starting March 15th thru June 1st
- Change the 7,000 cfs maximum during July thru December to 10,000 cfs

Wappapello Lake (09-APR-2012)

- Raise summer pool elevations 1-2 ft.
- Changing the start of winter drawdown date
    - January 15th-31st
    - Plus or minus 14 days
- Release more when boat launches are impacted
    - Release 10,000 cfs at 370 (Spring-Fall)
- Lower summer lake level by 1-2 ft for vegetation
- Start bringing the lake back up from winter drawdown earlier
    - 2 weeks sooner