

UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Union Electric Company (dba Ameren Missouri)

Project No. 2277-023

NOTICE OF AVAILABILITY OF DRAFT ENVIRONMENTAL ASSESSMENT

(March 1, 2013)

In accordance with the National Environmental Policy Act of 1969 and the Federal Energy Regulatory Commission (Commission) regulations, 18 CFR Part 380 (Order No. 486, 52 Fed. Reg. 47897), the Office of Energy Projects has reviewed the application for a new license for the Taum Sauk Pumped Storage Project (FERC Project No. 2277), located on the East Fork of the Black River in Reynolds County, Missouri, and prepared a draft environmental assessment (EA).

In the draft EA, Commission staff analyzes the potential environmental effects of licensing the project, and concludes that issuing a new license for the project, with appropriate environmental measures, would not constitute a major federal action significantly affecting the quality of the human environment.

A copy of the draft EA is available for review at the Commission in the Public Reference Room or may be viewed on the Commission's web site at www.ferc.gov using the "eLibrary" link. Enter the docket number, excluding the last three digits, in the docket number field to access the document. For assistance, contact FERC Online Support at FERCOnlineSupport@ferc.gov or toll-free at 1-866-208-3676, or for TTY, 202-502-8659.

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Any comments should be filed within 30 days from the date of this notice. Comments may be filed electronically via the Internet. See 18 CFR 385.2001(a)(1)(iii) and the instructions on the Commission's website www.ferc.gov/docfiling/efiling.asp. Commenters can submit brief comments up to 6,000 characters, without prior registration, using the eComment system at www.ferc.gov/docs-filing/ecomment.asp. You must include your name and contact information at the end of your comments. For assistance, please contact FERC Online Support. Although the Commission strongly encourages electronic filing, documents may also be paper-filed. To paper-file, mail an original and seven copies to: Kimberly D. Bose, Secretary, Federal Energy Regulatory

Project No. 2277-023

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Commission, 888 First Street, NE, Washington, DC 20426. Please affix “Taum Sauk Pumped Storage Project No. 2277-023” to all comments.

For further information, please contact Janet Hutzel by telephone at (202) 502-8675, or by email at janet.hutzel@ferc.gov.

Kimberly D. Bose,
Secretary.

**DRAFT ENVIRONMENTAL ASSESSMENT
FOR HYDROPOWER LICENSE**

Taum Sauk Pumped Storage Project

Project No. 2277-023

Missouri

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
888 First Street, NE
Washington, DC 20426

March 2013

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ACRONYMS AND ABBREVIATIONS

APE	area of potential effects
ATV	all-terrain vehicle
B.P.	Before Present
°C	degrees Celsius
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
DO	dissolved oxygen
DTA	Devine Tarbell & Associates, Inc.
EA	environmental assessment
East Fork Black River	East Fork of the Black River
EPRI	Electric Power Research Institute
ESA	Endangered Species Act
°F	degrees Fahrenheit
FNU	formazin nephelometric units
FPA	Federal Power Act
Forest Service	U.S. Forest Service
FWS	Fish and Wildlife Service
Great Rivers	Great Rivers Environmental Law Center
HPMP	Historic Properties Management Plan
Interior	U.S. Department of the Interior
mg/L	milligrams per liter
MISO	Midwest Independent System Operator
Missouri DNR	Missouri Department of Natural Resources
Missouri DOC	Missouri Department of Conservation
Missouri SHPO	Missouri State Historic Preservation Officer
msl	mean sea level
MW	megawatt
MWh	megawatt-hour
NHPA	National Historic Preservation Act
National Register	National Register of Historic Places
NERC	North American Electric Reliability Corporation
NTU	nephelometric turbidity units
ORV	off-road vehicle
PA	Programmatic Agreement
PGA	peak ground acceleration
ROW	right-of-way
SD1	scoping document 1
SD2	scoping document 2
USGS	U.S. Geological Survey
West Fork Black River	West Fork of the Black River
WQC	water quality certification

EXECUTIVE SUMMARY

Proposed Action

On June 24, 2008, Union Electric Company (doing business as Ameren Missouri) filed an application with the Federal Energy Regulatory Commission (Commission) for a new license to continue to operate and maintain its 408-megawatt (MW) Taum Sauk Pumped Storage Project (Taum Sauk Project). The project is located on the East Fork of the Black River (East Fork Black River) in Reynolds County, Missouri. The project does not occupy federal lands. This draft environmental assessment (EA) evaluates the potential natural resource benefits, environmental effects, and economic costs associated with licensing the project.

Project Description

The project is a reversible pumped storage facility that consists of the following: (1) a 54.5-acre upper reservoir impounded by a roller-compacted concrete dam located on the top of Proffit Mountain; (2) a 700-foot-long emergency overflow release structure at the upper reservoir with a 700-foot-wide by 20-foot-long stilling basin; (3) a 451-foot-long, 27.2-foot-diameter rock- and concrete-lined vertical shaft drawing water from the upper reservoir, transitioning to a 11,260-foot-long, 25 to 18.5-foot-diameter sloped and horizontal rock- and concrete-lined tunnel bifurcating to 9-foot-diameter penstocks just before entering the powerhouse; (4) a pump-generating plant with two reversible pump units and two motor generators with a total installed capacity of 408 MW; (5) an excavated 5,500-foot-long tailrace discharge/intake channel leading to a lower reservoir; (6) a 363-acre lower reservoir impounded by a 390-foot-long, 60-foot-high concrete gravity dam downstream from the confluence of the East Fork Black River and Taum Sauk Creek; (7) a 138-kilovolt switchyard/substation; (8) a gravel and sedimentation trap (bin wall) on the East Fork Black River; and (9) associated ancillary equipment. The project also includes a visitor's center and museum, a picnic pavilion, a campground with 25 primitive campsites and picnic tables, and a one-lane concrete boat ramp.^{1,2} Ameren Missouri proposes no changes to these existing project facilities.

¹ Visitors must make prior arrangements with Ameren Missouri to access the visitor's center, museum, and picnic pavilion.

² Ameren Missouri owns and operates the visitor's center and museum, campground, and picnic pavilion. Ameren Missouri owns the boat ramp, while the Missouri Department of Conservation (Missouri DOC) operates the facility.

Proposed Operation

The Taum Sauk Project operates as a peaking and emergency reserve (i.e., pumped storage facility). Power is generated at the project by releasing water from the upper reservoir during periods of peak power demand to the lower reservoir through reversible pump/generator units. Water is pumped from the lower to the upper reservoir during periods of low power demand.

When the project is in pumping mode, it can be fairly quickly stopped and reversed to generation mode. When not in a pumping mode, it can be brought online even more quickly. These capabilities allow Ameren Missouri to quickly respond to peak power demand or to help replace power lost as a result of an outage at another generating facility. Ameren Missouri proposes to continue current pumped storage operations and proposes no changes to the project's generation facilities as the project was recently rebuilt following a dam failure in 2005.

Proposed Environmental Measures

Ameren Missouri proposes the following environmental measures to protect or enhance aquatic, terrestrial, recreational, and cultural resources:

- finalize, after consultation with Missouri Department of Natural Resources (Missouri DNR), and implement its proposed Gravel and Sedimentation Control Plan which contains procedures and timeframes for cleaning out the gravel and sediment behind the bin wall and truck it to a land-based disposal site under both normal and emergency conditions;
- finalize and implement its proposed Water Management Plan³ for operation of the upper and lower reservoirs, with provisions to: (1) approximately match outflow downstream of the lower reservoir dam to inflow to the lower reservoir under normal conditions to the extent possible; (2) maintain U.S. Geological Survey (USGS) gaging stations upstream (USGS no. 07061270) and downstream (USGS no. 07061290) of the project; (3) provide a minimum discharge of 1.7 cubic feet per second from the lower reservoir to the East Fork Black River; (4) implement ramping rates in the East Fork Black River immediately downstream from the lower reservoir when powerhouse operations or maintenance activities require changes to the withdrawal from or release of flow to the East Fork Black River; (5) evaluate the effectiveness of

³ Ameren Missouri filed the draft Water Management Plan with the Commission on July 22, 2011, and subsequently filed a revised draft of the plan on November 14, 2011.

- the ramping rates; and (6) monitor and maintain water level, volume, and outflow information to document project operation, and publish such information on the internet for use by the agencies and recreating public;
- install upgraded flow release systems at the lower reservoir, including an upgraded slide gate, to implement the provisions of the proposed Water Management Plan, including providing the proposed minimum flow;
 - maintain a "put-and-take" fishery in the lower reservoir for the term of the license, with annual stockings based on a detailed stocking plan developed after consultation with Missouri DOC;
 - relocate fish from the upper reservoir to the lower reservoir whenever the upper reservoir is dewatered for maintenance;
 - finalize, after consultation with the U.S. Fish and Wildlife Service (FWS) and Missouri DOC, and implement an Indiana and Gray Bat Management Plan;
 - continue to provide public access to the lower reservoir;⁴
 - to reduce adverse effects on terrestrial habitat, continue to prohibit public all-terrain vehicle (ATV) use on Ameren Missouri-owned lands (including non-project lands) by installing signs that prohibit ATV use near known access points;
 - allow state agencies to place gates and signs on Ameren Missouri-owned lands (including non-project lands) to discourage ATV use from occurring on adjacent state lands;
 - accommodate scheduled, supervised educational tours of the upper reservoir and powerhouse/tailrace channel area, while prohibiting general public access to the upper reservoir, powerhouse, museum, and picnic pavilion in the interest of project safety and security;

⁴ Recreation facilities at the lower reservoir include a campground with primitive campsites and picnic tables, a one-lane concrete boat ramp, and a parking area for vehicles and trailers; however, Ameren Missouri only proposes to maintain the picnic tables. Ameren Missouri does not propose to operate and maintain the campground, boat ramp, and parking area for vehicles and trailers.

- remove 497.3 acres of land from the existing project boundary that are not necessary for operation and maintenance of the project, or for other project purposes, such as recreation or protection of environmental resources; and
- execute and implement a Programmatic Agreement (PA) that requires Ameren Missouri to initiate consultation under section 106 of the National Historic Preservation Act with the Missouri State Historic Preservation Officer (Missouri SHPO) and the Osage Nation, and to prepare an Historic Properties Management Plan (HPMP) on a case-by-case basis in the event that the project is determined to affect either identified historic properties or as yet unidentified historic properties during the term of any new license.

Alternatives Considered

This EA analyzes the effects of the proposed action and recommends conditions for any new license issued. In addition to Ameren Missouri's proposed action, the EA considers the following alternatives: (1) Ameren Missouri's proposal with staff modifications (staff alternative); (2) a staff alternative that includes all mandatory conditions; and (3) no-action.

Staff Alternative

Under the staff alternative, the project would include Ameren Missouri's proposed measures as outlined above, with the exception of placing gates or signs on non-project, Ameren Missouri-owned lands to prohibit ATV use, and the following additional measures recommended by staff:

- include the following additional provisions in the proposed Gravel and Sedimentation Control Plan: (1) a cleanup and recovery plan to be implemented in the unlikely event that the emergency overflow release structure is overtopped, and (2) transporting the removed gravel and sediment to a disposal site in the East Fork Black River downstream from the lower reservoir dam to enhance aquatic habitat;
- develop, after consultation with Missouri DOC and Missouri DNR, and implement a habitat enhancement plan, to include provisions for installing artificial structures, for the fisheries in the lower reservoir;
- develop, after consultation with Missouri DOC and Missouri DNR, and implement a recreation management plan that includes provisions to maintain existing recreation facilities at the lower reservoir and provide supervised tours of the upper reservoir;

- develop, after consultation with Missouri DNR, and implement a reforestation plan that includes provisions to: (1) extend the existing Upper Reservoir Rebuild Reforestation Plan for a minimum of 5 years,⁵ (2) revegetate the former construction laydown areas at the lower reservoir boat launch parking area and campground, and (3) maintain and monitor the vegetation for both areas for a minimum of 5 years and until the seedlings reach a survival rate of 70 percent and are well established at the project;
- convert existing lighting at the top of upper reservoir and along the upper reservoir access road to infrared and motion-activated lights, respectively, to provide surface night-lighting along roads and at the top of the upper reservoir dam that maintains project safety, while minimizing unnecessary lighting that could adversely effect aesthetic resources important to local residents and recreationists; and
- modify the PA to include a provision that Ameren Missouri evaluate, after consultation with the Missouri SHPO, the Taum Sauk Project's eligibility for the National Register of Historic Places (National Register) when the project is 50 years old, and develop an HPMP if the project is determined to be eligible for the National Register.

Staff Alternative with Mandatory Conditions

The staff alternative with mandatory conditions would include the measures recommended by staff under the staff alternative and would add the following conditions of Missouri DNR's section 401 of the Clean Water Act water quality certification for the project: (1) erosion control measures to address erosion throughout the project (Condition 3.b); (2) support to the Feral Hog Task Force in its efforts to control and eradicate feral hogs in the area (Condition 3.c); (3) maintenance of healthy riparian corridors (Condition 3.d); (4) water quality monitoring of temperature, dissolved oxygen (DO), conductivity, pH, and turbidity (Condition 4); and (5) protection of project lands within the watershed and work to minimize any effects that may result from project activities (Condition 5).

⁵ The Upper Reservoir Rebuild Reforestation Plan requires (under the existing license) that the construction laydown and staging areas near the toe of the upper reservoir that were necessary for the upper reservoir rebuild be revegetated with native trees and vegetation, and that the trees and vegetation be monitored for a 5-year period. The plan was approved by the Commission on March 27, 2009, and modified on September 17, 2010.

No-Action Alternative

Under the no-action alternative, the project would continue to operate under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented.

Public Involvement and Areas of Concern

Before filing its license application for the project, Ameren Missouri conducted pre-filing consultation under the traditional licensing process. The intent of the Commission's pre-filing process is to initiate public involvement early in the project planning process and to encourage citizens, governmental entities, Indian tribes, and other interested parties to identify and resolve issues prior to a license application being formally filed with the Commission. After the license application was filed, we conducted a scoping process to determine what issues and alternatives should be addressed. A scoping document was distributed to interested parties on May 23, 2011. On August 26, 2011, we requested terms, conditions, and recommendations in response to a notice of ready for environmental analysis for the project.

The primary issues associated with licensing the Taum Sauk Project are the effects of operating the project on water quality, aquatic habitat, terrestrial habitat, and nighttime sky lighting.

Environmental Effects

Geologic and Soils Resources – Sediment transport from the upper reaches of the East Fork Black River to the river downstream of the lower reservoir dam is currently interrupted by a bin wall located in the headwaters of the lower reservoir (the bin wall is designed to prevent gravel or sediment from accumulating in the lower reservoir). Implementation of the Gravel and Sedimentation Control Plan containing provisions to periodically remove sediment from behind the bin wall and place it downstream of the lower reservoir dam would improve gravel transport in the East Fork Black River, which would improve aquatic habitat.

Aquatic Resources – The combination of the reservoir level fluctuations of up to 13.5 feet on a weekly basis and existing poor aquatic habitat limits natural fish production in the reservoir. Staff's recommended habitat enhancement plan would contain measures, such as artificial structures within the lower reservoir, to improve habitat for warm-water species in the lower reservoir.

Terrestrial Resources – After the upper reservoir rebuild, Ameren Missouri replanted seedlings at the upper reservoir to improve terrestrial habitat. However, the seedlings did not survive, and Ameren Missouri replanted them a second time. The proposed reforestation plan would ensure that the second attempt at planting new

seedlings at the upper reservoir is monitored and maintained until they reach a survival rate of 70 percent.

Threatened and Endangered Species – Four federally listed species are known to occur in the Taum Sauk Project vicinity: (1) the endangered gray bat (*Myotis grisescens*), the Indiana bat (*Myotis sodalis*), and the Hine's emerald dragonfly (*Somatochlora hineana*); and (2) the threatened Mead's milkweed (*Asclepias meadii*). The project would have no effect on Mead's milkweed or Hine's emerald dragonfly because the species do not occur at the project. However, Indiana bat habitat could be affected by project-related operation or maintenance activities such as vegetation maintenance that occurs within wooded areas. Also, potential gray bat foraging habitat could be affected by alteration of riparian or wooded habitat related to project maintenance. Measures such as limiting tree cutting within the proposed Indiana and Gray Bat Management Plan would minimize any project-related effects.

Recreation and Land Use Resources – Ameren Missouri allows public access to the lower reservoir, but does not maintain the recreation facilities at the lower reservoir, which include a primitive campground, picnic area, parking area, and a concrete boat launch. Staff's recommended recreation management plan would include provisions to ensure that the recreation facilities at the lower reservoir are maintained.

Aesthetic Resources – As part of the upper reservoir rebuild, additional lighting was added along the top of the upper reservoir and along the road to the reservoir; however, the additional project lighting affects nighttime sky lighting for local residents and recreationists. The proposal to convert existing lighting at the upper reservoir and along the access road to lighting types that would ensure project safety while minimizing unnecessary lighting would improve the dark night sky associated with this area.

Cultural Resources – Normal project operation project would not affect either of two eligible properties identified during cultural resource surveys. However, the properties may be affected if a breach of the upper reservoir was to occur. The proposed PA would require consultation with the Missouri SHPO and Osage Nation, on a case-by-case basis, and the development of an HPMP, should the project be determined to affect either of two eligible properties identified during cultural resource surveys, or any new sites or human remains that might be identified over the term of any license issued. Any effects to historic properties would be lessened, avoided, or mitigated through the development and implementation of site-specific HPMPs.

The Taum Sauk Project is the first large-capacity pumped storage project in North America; however, the project has not been evaluated to determine if it is eligible for the National Register because the project is not yet 50 years old. Under the staff alternative, the PA would include a provision for Ameren Missouri to evaluate, after consultation with the Missouri SHPO, the Taum Sauk Project's eligibility for the National Register

when the project is 50 years old, and develop an HPMP if the project is determined to be eligible for the National Register.

Conclusions

Based on our analysis, we recommend licensing the Taum Sauk Project under the staff alternative, as described above.

In section 4.2, *Comparison of Alternatives*, we compare the total project cost to the cost of obtaining power from a likely alternative source of power in the region for each of the alternatives identified above. Our analysis shows that during the first year of operation under the no-action alternative, project power would cost \$27,959,940, or \$56.23/megawatt-hour (MWh), more than the likely alternative cost of power. Under Ameren Missouri's proposal, the project would produce power at a cost of \$28,602,980, or \$57.52/MWh, more than the cost of alternative cost of power. Under the staff alternative, project power would cost \$28,655,410, or \$57.63/MWh, more than the likely alternative cost of power. Under the staff alternative with mandatory conditions, project power would cost \$28,663,380, or \$57.64/MWh, more than the likely alternative cost of power.

We chose the staff alternative as the preferred alternative because under it the project would: (1) provide a dependable source of electrical energy for the region (497,241 MWh annually); and (2) with the recommended environmental measures, protect and enhance environmental resources affected by the project. The overall benefits of the staff alternative would be worth the additional costs of the recommended environmental measures.

We conclude that issuing a new license for the project, with the environmental measures we recommend, would not be a major federal action significantly affecting the quality of the human environment.

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DRAFT ENVIRONMENTAL ASSESSMENT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
Washington, DC

Taum Sauk Pumped Storage Project FERC Project No. 2277-023—Missouri

1.0 INTRODUCTION

1.1 APPLICATION

On June 24, 2008, Union Electric Company (doing business as Ameren Missouri) filed an application for a new license for the Taum Sauk Pumped Storage Project (Taum Sauk Project) with the Federal Energy Regulatory Commission (Commission). The existing 408-megawatt (MW) project is located on the East Fork of the Black River (East Fork Black River) in Reynolds County, Missouri (figure 1). The project does not occupy any federal lands. Ameren Missouri does not propose any changes to project facilities and operation.

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the proposed action is to continue operating the pumped storage facility to store energy during periods of low demand and generate energy during periods of peak demand. Therefore, under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue a new license to Ameren Missouri for the Taum Sauk Project and what conditions should be placed on any license issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project will be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (such as flood control, irrigation, or water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection of, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

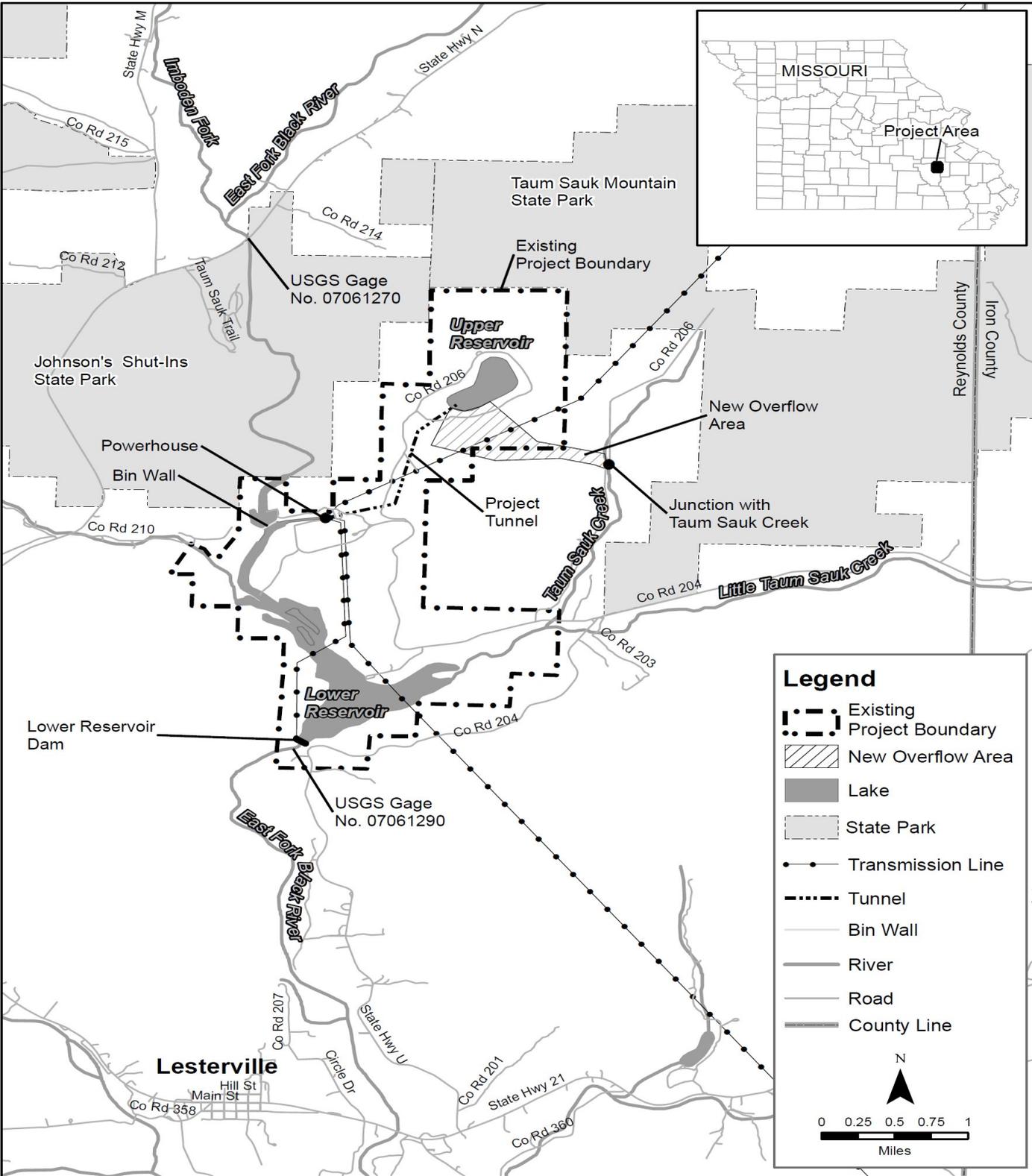


Figure 1. General location and site plan of Taum Sauk Project (Source: Ameren Missouri, 2008, as modified by staff).

Issuing a new license for the Taum Sauk Project would allow Ameren Missouri to continue to store and generate electricity for the term of any new license, making electrical power from a renewable resource available to its customers. This draft environmental assessment (EA) analyzes the environmental and economic effects associated with the operation and maintenance of the project, analyzes alternatives to the project, and makes recommendations to the Commission on whether to issue a license, and if so, the terms and conditions to become part of any license issued.

In this draft EA, we assess the environmental and economic effects of: (1) continued project operation as proposed by Ameren Missouri (proposed action); (2) Ameren Missouri's proposal with staff modifications (staff alternative); and (3) a staff alternative that includes all mandatory conditions. We also consider the effects of the no-action alternative. Important issues that are addressed include effects on aquatic resources, threatened and endangered species, recreation, aesthetics, and cultural resources.

1.2.2 Need for Power

The Taum Sauk Project provides hydroelectric generation to meet part of Ameren Missouri's power requirements, resource diversity, and capacity needs. The project has an installed capacity of 408 MW and generates about 497,241 megawatt-hours (MWh) per year.

The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. For the 2013 to 2022 assessment period, NERC departed from its usual assessment of the eight regional entities and established assessment areas with different boundaries. These boundaries were intended to more accurately reflect the planning and operational properties of the bulk power system. For this assessment period, the Taum Sauk Project is located in the Midwest Independent System Operator (MISO) assessment area. According to NERC's 2012 forecast, total internal demand requirements for the MISO area the 10-year period are projected to grow at a rate of 1.05 percent for summer demand and 1.62 percent for winter demand (NERC, 2012). The summer capacity margins are forecasted to range from 34.24 percent in 2013 and 30.24 percent in 2022, and are not forecasted to fall below a target margin of 16.30 percent throughout the period. The winter capacity margins are forecasted to range from 73.93 percent in the winter of 2013/2014 and 59.04 percent in the winter of 2022/2023, and are not forecasted to fall below target margin of 16.30 percent throughout the period.

The Taum Sauk Project's pumped storage facilities provide ancillary services that include spinning reserve, reduced system minimum loading, voltage and power factor correction, frequency regulations, reduced thermal cycling of base-load units, and improved system operating reliability. The Taum Sauk Project also provides Ameren

Missouri with an energy storage option, which allows the low-cost energy generated by Ameren Missouri's fossil-fired and nuclear plants to be utilized during the low-energy demand periods to pump back water from the lower reservoir to the upper reservoir. The advantage of a pumped storage facility is that the energy becomes available within minutes. Because of this fast start-up capability, it can easily replace power lost to the system when a fossil- or nuclear-fueled plant trips off-line. In addition, the Taum Sauk Project is used to store the energy produced by the project during low demand periods by pumping water into the upper reservoir during those periods so that it can be used for generation during higher demand periods.

We conclude that power from the Taum Sauk Project would help meet a need for power in the MISO assessment area in both the short and long term. The project provides power that displaces generation from non-renewable sources. Displacing the operation of non-renewable facilities may avoid some power plant emissions, thus creating an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

A license for the Taum Sauk Project is subject to various requirements under the FPA and other applicable statutes. We summarize the major statutory and regulatory requirements in table 1 and describe them below.

Table 1. Major statutory and regulatory requirements for the Taum Sauk Pumped Storage Project.

Requirement	Agency	Status
Section 18 of the FPA (fishway prescriptions)	U.S. Department of the Interior (Interior)	No prescriptions were filed.
Section 10(j) of the FPA	Missouri Department of Conservation (Missouri DOC), U.S. Fish and Wildlife Service (FWS)	No recommendations were filed.
Section 401 of the Clean Water Act — water quality certification	Missouri Department of Natural Resources (Missouri DNR)	Application for certification received on September 30, 2011; the certification was issued on September 28, 2012.
Endangered Species Act (ESA)	Interior	Need FWS concurrence on our finding of “not likely to adversely affect” with regard to the Indiana bat and gray bat.

Requirement	Agency	Status
Coastal Zone Management Act Consistency	None	A consistency certification is not required for the project, because Missouri does not have a coastal zone program.
National Historic Preservation Act (NHPA)	Missouri State Historic Preservation Officer (Missouri SHPO)	Ameren Missouri consulted with the Missouri SHPO regarding the area of potential effects (APE) and historic properties. The Missouri SHPO determined, in a letter filed on April 7, 2009, that under normal operation and maintenance, there should be no adverse effect on two historic properties, but recommended an Historic Properties Management Plan (HPMP) be prepared to address effects that could occur during emergencies. We intend to execute a programmatic agreement (PA) with the Missouri SHPO that would provide for HPMPs on a case-by-case basis should the project affect identified and unknown historic properties.

1.3.1 Federal Power Act

1.3.1.1 Section 18 Fishway Prescriptions

Section 18 of the FPA states that the Commission is to require the construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of Commerce or Interior. Neither the Secretaries of Commerce nor Interior filed fishway prescriptions or reservations of authority to prescribe fishways.

1.3.1.2 Section 10(j) Recommendations

Under section 10(j) of the FPA, each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency. No section 10(j) recommendations have been filed.

1.3.2 Clean Water Act

Under section 401 of the Clean Water Act (CWA),⁶ a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the Clean Water Act. On September 30, 2011, Ameren Missouri applied to the Missouri Department of Natural Resources (Missouri DNR) for 401 water quality certification (WQC) for the Taum Sauk Project. Missouri DNR received this request on September 30, 2011, and issued the 401 WQC on September 28, 2012.

1.3.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA)⁷ requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. Four federally listed species are known to occur in the Taum Sauk Project vicinity: (1) the endangered gray bat (*Myotis grisescens*); (2) the endangered Indiana bat (*Myotis sodalis*); (3) the endangered Hine's emerald dragonfly (*Somatochlora hineana*);⁸ and (4) the threatened Mead's milkweed (*Asclepias meadii*).

We conclude that relicensing the Taum Sauk Project under the staff alternative would have no effect on Mead's milkweed or Hine's emerald dragonfly. However, project-related operation or maintenance activities under the staff alternative, such as vegetation maintenance in wooded habitats, would have the potential to affect the Indiana bat. In addition, alteration of riparian or wooded habitat within the project boundary

⁶ 33 U.S.C. § 1341(a)(1) (2006).

⁷ 16 U.S.C. § 1536(a) (2006).

⁸ Reynolds County has been designated as critical habitat for the Hine's emerald dragonfly, but there is no critical habitat for it in the project boundary.

could affect gray bat foraging habitat. Under the staff alternative, Ameren Missouri would consult with FWS to finalize and implement its proposed Indiana and Gray Bat Management Plan. Therefore, we conclude the project is not likely to adversely affect the Indiana bat and gray bat. We will seek concurrence with FWS on our conclusions regarding our findings on the Indiana bat and gray bat. Our analyses of project effects on threatened and endangered species are presented in section 3.3.4, *Threatened and Endangered Species*.

1.3.4 Coastal Zone Management Act

The Coastal Zone Management Act of 1972, as amended, requires review of the project's consistency with a state's Coastal Management Program for projects within or that would affect the coastal zone. Under section 307(c)(3)(A) of the Coastal Zone Management Act, 16 U.S.C. §1456(c)(3)(A) (2006), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state coastal zone management agency concurs with the license applicant's certification of consistency with the state's coastal zone management program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

The state of Missouri does not have a coastal management program. Therefore, a consistency certification is not required for the Taum Sauk Project.

1.3.5 National Historic Preservation Act

Section 106 of the National Historic Preservation Act⁹ (NHPA) requires that every federal agency "take into account" how each of its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register).

Ameren Missouri consulted with the Missouri SHPO and 13 Indian tribes on the APE, study plan, and study report findings. The Missouri SHPO concurred with the APE and a combined Phase I and Phase II study plan on July 13, 2007. Ameren Missouri provided the Phase I and Phase II study report to the Missouri SHPO and Indian tribes on April 15, 2008. In response, the Missouri SHPO, in a letter dated May 23, 2008 and included in the final license application filed June 24, 2008, concurred with the recommendation that two sites identified in the study report are eligible for inclusion in the National Register and that six sites are not eligible. Among the 13 Indian tribes, only

⁹ 16 U.S.C. §470f (2006).

the Osage Nation commented, requesting that they be involved in any decisions about when to resume work in an area where human remains have been discovered.

In a letter filed on April 7, 2009, the Missouri SHPO concurred, that under normal operation and maintenance of the project, there should be no adverse effect on the two archaeological sites that have been determined to be eligible for inclusion in the National Register. The Missouri SHPO, however, recommended the development of an HPMP that contains an analysis of potential effects on the historic properties, and recommendations for monitoring and mitigation. The Missouri SHPO stated that it is concerned that measures to address emergency situations may adversely affect historic properties.

To meet the requirements of section 106, and to address the concerns of the Missouri SHPO and the Osage Nation, we intend to execute a PA for the protection of historic properties from the effects of the operation of the Taum Sauk Project. The terms of the PA would require Ameren Missouri to initiate consultation under section 106 of the NHPA with the Missouri SHPO and Osage Nation and prepare an HPMP on a case-by-case basis in the event that the project is determined to affect either identified archaeological sites, or as yet unidentified historic properties or human remains during the term of the license.

Given that the project, which came on line in 1963, would achieve 50 years of service during the term of any new license, the PA would also require that Ameren Missouri evaluate the project, after consultation with the Missouri SHPO, to determine if the project is eligible for listing on the National Register. If the property is eligible for listing, then the PA would require Ameren Missouri to prepare an HPMP to avoid, lessen, or mitigate for any adverse effects on project facilities.

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 C.F.R. §16.8 [2012]) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, ESA, NHPA, and other federal statutes. Pre-filing consultation must be completed and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing this draft EA, we conducted scoping to determine what issues and alternatives should be addressed. A scoping document (SD1) was distributed to interested agencies and others on May 23, 2011. Two scoping meetings were held on June 22, 2011, in Lesterville, Missouri, and on June 23, 2011, in Jefferson City, Missouri, to request oral comments on the project. A court reporter recorded all comments and

statements made at the scoping meetings, and these are part of the Commission's public record for the project. In addition to comments provided at the scoping meetings, the following entities provided written comments:

<u>Commenting Entity</u>	<u>Date Filed</u>
Missouri Department of Conservation	July 19, 2011
Ameren Missouri	July 20, 2011
International Dark Sky Association	July 25, 2011
Great Rivers Environmental Law Center and Missouri Coalition for the Environment	July 25, 2011
Missouri DNR	July 25, 2011
Susan Hagan and Michael Sutton, East Ozarks Audubon Society Conservation Committee	July 25, 2011
Missouri Parks Association	July 25, 2011

Ameren Missouri filed comments in response to scoping comments on August 19, 2011. The Commission issued a revised scoping document (SD2) addressing these comments on August 29, 2011.

1.4.2 Interventions

On June 14, 2011, the Commission issued a notice that the Taum Sauk Project license application had been accepted and solicited motions to intervene and protest. The notice set August 15, 2011, as the deadline for filing protests and motions to intervene. No entity filed a motion to intervene or protest in response to the notice.

1.4.3 Comments on the License Application

A notice requesting terms, conditions, recommendations, and prescriptions was issued on August 26, 2011. The following entities commented:

<u>Commenting Agency and Other Entity</u>	<u>Date Filed</u>
Interior	October 20, 2011
Missouri Department of Conservation	October 24, 2011
Missouri Parks Association and Great Rivers Environmental Law Center	October 25, 2011
East Ozarks Audubon Society	October 25, 2011
L-A-D Foundation	October 25, 2011
Missouri DNR	October 25, 2011

Ameren Missouri filed reply comments on December 8, 2011.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

The no-action alternative is the baseline from which to compare the proposed action and all action alternatives that are assessed in the environmental document. Under the no-action alternative, for relicensing, the project would continue to operate under the terms and conditions of the current license. Thus the no-action alternative would include the existing facilities and current project operation.

2.1.1 Existing Project Facilities

The project is a reversible, pumped-storage project used to supplement the generation and transmission facilities of Ameren Missouri. The project was the first large-capacity, pumped-storage project to begin operation in the United States.

The existing Taum Sauk Project consists of a 54.5-acre upper reservoir on top of Proffit Mountain, with a useable volume of 4,360 acre-feet at a maximum elevation of 1,597.0 feet mean sea level (msl). A 120-foot-high, continuous, roller-compacted concrete structure forms the reservoir. The roller-compacted concrete structure also includes a 700-foot-long emergency overflow release structure with a 700-foot-wide by 20-foot-long stilling basin. Flow from the upper reservoir passes through the bottom of the impoundment through a “glory hole” intake structure and then into a 27.2-foot-diameter vertical rock- and concrete-lined shaft that is 451 feet long. The shaft transitions to a sloped or horizontal rock and concrete-lined tunnel that varies from 25 to 18.5 feet in diameter and is 11,260 feet long. The tunnel transitions to a bifurcated penstock at the powerhouse, with each side 9 feet in diameter. The concrete powerhouse is located at the lower reservoir and houses two reversible pump units and two motor generators with a total installed capacity of 408 MW. The hydraulic capacity of each of the reversible pump units in the pumping mode is about 2,679 cubic feet per second (cfs) at 861 feet of net head and about 3,100 cfs at 790 feet of net head. The hydraulic capacity of each of the units in the generation mode is about 3,500 cfs at 861 feet of net head and about 3,200 cfs at 780 feet of net head. Thus, the maximum hydraulic capacity of the project is 6,200 cfs in the pumping mode and 7,000 cfs in the generation mode.¹⁰ There is an excavated, 5,500-foot-long tailrace discharge/intake channel leading to the lower reservoir.

¹⁰ In its April 29, 2011, response in reply to the Commission staff’s request for additional information, Ameren Missouri indicated that the emergency overflow release structure is designed for a maximum potential overtopping flow of 5,358 cfs, which is equivalent to the combined capacity of the two pumps that fill the upper reservoir at maximum water level elevation.

The 363-acre lower reservoir has a gross storage volume of 5,781 acre-feet and a useable volume of 3,869 acre-feet at a maximum elevation of 749.5 feet msl. The lower reservoir, located on the East Fork Black River, is impounded by a 390-foot-long, 60-foot-high concrete gravity dam. The project also includes a 138-kilovolt switchyard/substation, a gravel and sediment trap (bin wall) on the East Fork Black River, and associated ancillary equipment. Figure 2 shows a site plan of the project.

The existing project boundary includes 2,381.2 acres (figure 2), and Ameren Missouri owns all of the project lands within the current project boundary.

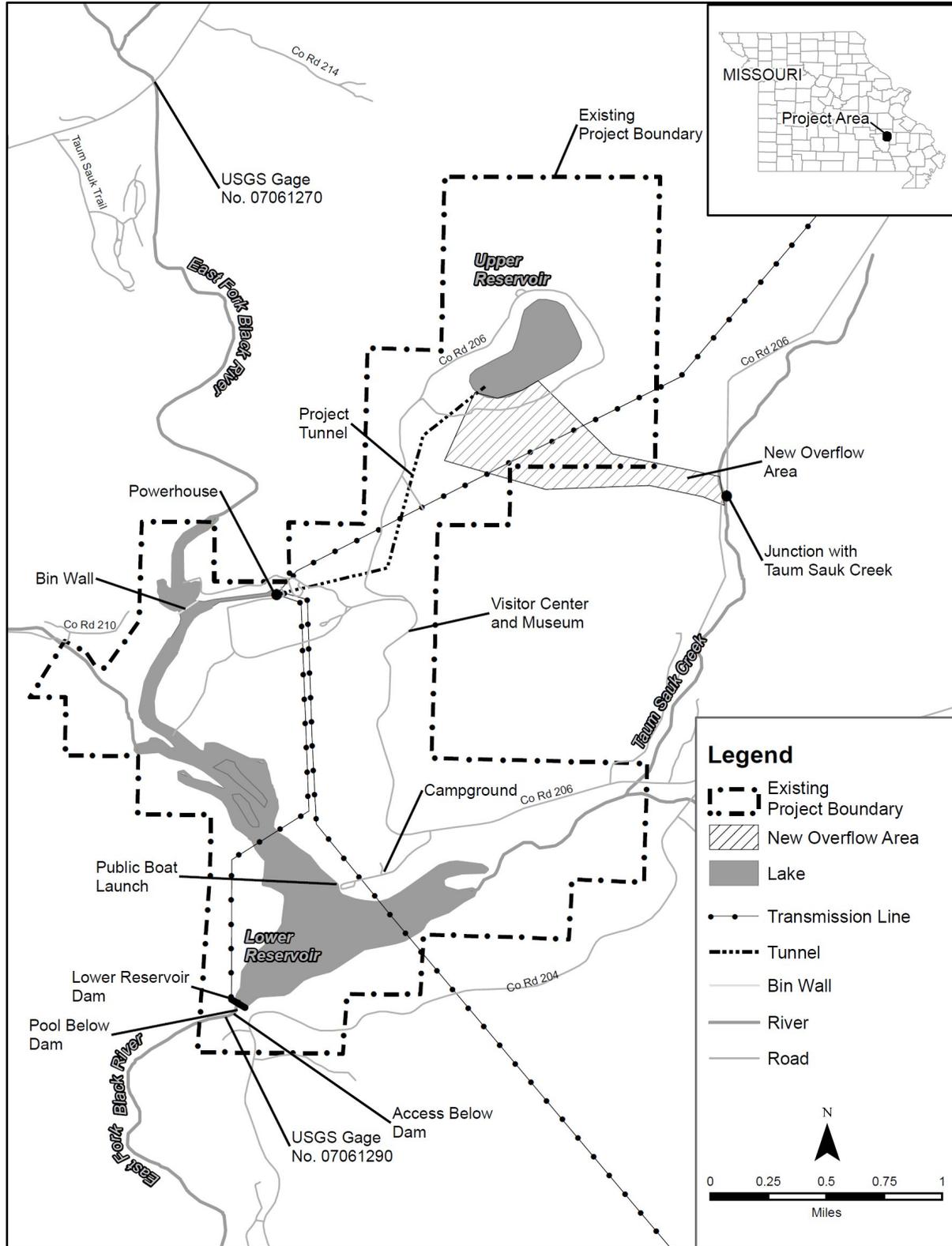


Figure 2. Ameren Missouri site plan (Source: Ameren Missouri, 2011a, as modified by staff).

2.1.2 Project Safety

The project has been operating since 1963.¹¹ The existing license, which was issued in 1965, expired in 2010, and Ameren Missouri has been operating the project under annual licenses since then. During this time, Commission staff has conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, the project has been inspected and evaluated every 5 years by an independent consultant, and a consultant's safety report has been submitted for Commission review.

During the early morning hours of December 14, 2005, the northwestern corner of the upper reservoir dike breached over a width of about 700 feet, causing an uncontrolled, rapid release of water down the west slope of Proffit Mountain and into the East Fork Black River. Ameren Missouri subsequently rebuilt the upper reservoir and placed the project back in operation in April 2010. As part of the rebuild, redundant safety measures, including an emergency overflow release structure, were installed to safeguard against future failures.

As part of the relicensing process, the Commission staff evaluates the adequacy of the proposed project facilities under a new license. Special articles would be included in any license issued, as appropriate. Commission staff would continue to inspect the project during a new license term to ensure continued adherence to Commission-approved plans and specifications, special license articles relating to construction (if any), license requirements for operation and maintenance, and accepted engineering practices and procedures.

2.1.3 Existing Project Operation

The Taum Sauk Project is operated as a peaking and emergency reserve (i.e., pumped storage) facility for Ameren Missouri's electrical system. As a pumped storage facility, all power is generated at the project by releasing water at rates up to 7,000 cfs from the off-stream¹² upper reservoir through reversible pump/generator units.

Water to be used for generation is pumped to the upper reservoir from the lower reservoir, which is created by a lower reservoir dam on the East Fork Black River.

¹¹ The Commission issued a license for the project on August 26, 1965 (34 FPC 598), after the Supreme Court affirmed the Commission's jurisdiction to require a license for the project. *Union Electric Co. v. FPC*, 281 U.S. 90 (1965).

¹² The upper reservoir is on top of Proffit Mountain and not hydrologically connected to the East Fork Black River or any other stream via a natural drainage.

Pumping to the upper reservoir occurs at rates between 5,358 and 6,200 cfs during periods of low energy demand. When the project is in pumping mode, it can be fairly quickly stopped and reversed to generation mode. When not in a pumping mode, it can be brought online even more quickly. These pumped storage capabilities allow Ameren Missouri to quickly respond to peak power demand or to help replace power lost as a result of an outage at another generating facility.

Project generation occurs on a flexible schedule, as the start and duration of generation is determined by system demands. Ameren Missouri is required to provide a continuous flow release at the lower reservoir dam at a rate approximately equal to the combined natural inflow to the lower reservoir from the East Fork Black River and Taum Sauk Creek.

After the failure in December 2005, the upper reservoir was redesigned to include an emergency overflow release structure to provide a safe, controlled discharge point for reservoir overfill in the unlikely event of failure of all other water level monitoring devices and pump shutdown switches. The spillway is designed to pass flows into a stilling basin at the base of the dam, then through a ravine to an upland tributary to Taum Sauk Creek, which flows into the lower reservoir.

2.2 APPLICANT'S PROPOSAL

2.2.1 Proposed Project Facilities and Operations

Ameren Missouri does not propose any changes to the existing project facilities and operations.

Ameren Missouri proposes to remove 497.3 acres of land from the existing project boundary, contending that the lands are not necessary for operation and maintenance of the project, or for other project purposes such as recreation, shoreline control, or protection of environmental resources (figure 3).

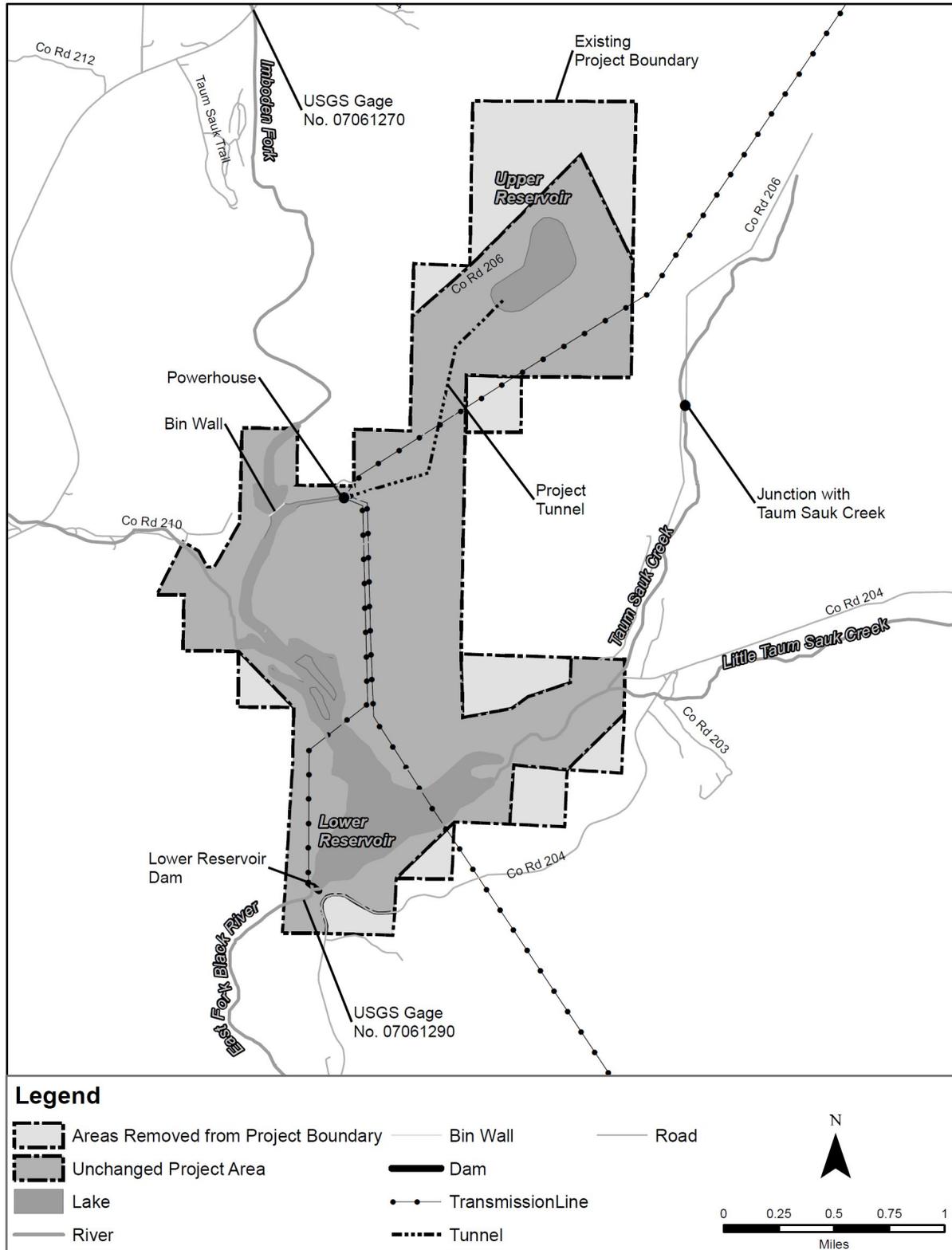


Figure 3. Proposed project boundary for Taum Sauk Project (Source: Ameren Missouri, 2009, as modified by staff).

2.2.2 Proposed Environmental Enhancement Measures

Ameren Missouri proposes to operate the Taum Sauk Project with the following environmental protection and enhancement measures:¹³

- finalize, after consultation with Missouri Department of Natural Resources (Missouri DNR), and implement its proposed Gravel and Sedimentation Control Plan which contains procedures and timeframes for cleaning out the gravel and sediment behind the bin wall and truck it to a land-based disposal site under both normal and emergency conditions;
- finalize and implement its proposed Water Management Plan¹⁴ for operation of the upper and lower reservoirs, with provisions to: (1) approximately match outflow downstream of the lower reservoir dam to inflow to the lower reservoir under normal conditions to the extent possible; (2) maintain U.S. Geological Survey (USGS) gaging stations upstream (USGS no. 07061270) and downstream (USGS no. 07061290) of the project; (3) provide a minimum discharge of 1.7 cfs from the lower reservoir to the East Fork Black River; (4) implement ramping rates in the East Fork Black River immediately downstream from the lower reservoir when powerhouse operations or maintenance activities require changes to the withdrawal from or release of flow to the East Fork Black River; (5) evaluate the effectiveness of the ramping rates; and (6) monitor and maintain water level, volume, and outflow information to document project operation, and publish such information on the internet for use by the agencies and recreating public;
- install upgraded flow release systems at the lower reservoir, including an upgraded slide gate, to implement the provisions of the Water Management Plan, including providing the proposed minimum flow;
- maintain a "put-and-take" fishery in the lower reservoir for the term of the license, with annual stockings based on a detailed stocking plan developed after consultation with Missouri DOC;¹⁵

¹³ This list of proposed measures includes new or revised measures proposed in the study reports filed by Ameren Missouri on May 2, 2011.

¹⁴ Ameren Missouri filed the draft Water Management Plan with the Commission on July 22, 2011, and subsequently filed a revised draft of the plan on November 14, 2011.

¹⁵ The stocking plan would be based on fish sampling Missouri DOC conducts in the lower reservoir each year.

- relocate fish from the upper reservoir to the lower reservoir whenever the upper reservoir is dewatered for maintenance;
- finalize, after consultation with FWS and Missouri DOC, and implement an Indiana and Gray Bat Management Plan;
- continue to provide public access to the lower reservoir;¹⁶
- to reduce adverse effects on terrestrial habitat, continue to prohibit public all-terrain vehicle (ATV) use on Ameren Missouri-owned lands (including non-project lands) by installing signs that prohibit ATV use near known access points;
- allow state agencies to place gates and signs on Ameren Missouri-owned lands (including non-project lands) to discourage ATV use from occurring on adjacent state lands;
- accommodate scheduled, supervised educational tours of the upper reservoir and powerhouse/tailrace channel area, while prohibiting general public access to the upper reservoir, powerhouse, museum, and picnic pavilion in the interest of project safety and security;
- remove 497.3 acres of land from the existing project boundary that are not necessary for operation and maintenance of the project, or for other project purposes, such as recreation or protection of environmental resources; and
- execute and implement a PA that requires Ameren Missouri to initiate consultation under section 106 of the National Historic Preservation Act with the Missouri SHPO and the Osage Nation, and to prepare an HPMP on a case-by-case basis in the event that the project is determined to affect either identified historic properties or as yet unidentified historic properties during the term of any new license.

¹⁶ Recreation facilities at the lower reservoir include a campground with primitive campsites and picnic tables, a one-lane concrete boat ramp, and a parking area for vehicles and trailers; however, Ameren Missouri only proposes to maintain the picnic tables. Ameren Missouri does not propose to operate and maintain the campground, boat ramp, and parking area for vehicles and trailers.

2.2.3 Modifications to Applicant's Proposal – Mandatory Condition

This section includes a description of mandatory WQC conditions provided under section 401 of the CWA. The following mandatory conditions are evaluated as part of the applicant's proposal:

Water Quality Certification Conditions

The conditions of the WQC (see appendix A) specify that Ameren Missouri shall do the following:

1. operate the project in accordance with the Water Management Plan developed by the applicant, Missouri DNR, and Missouri DOC and follow the prescribed reporting requirements of the Water Management Plan;
2. not cause violation of applicable water quality standards through measures to ensure clean up and recovery if the overflow relief structure is operated, design and implement erosion control measures necessary to address erosion resulting from use the project lands that causes turbidity or otherwise compromises water quality, continue to allow access to the project lands for the agencies to trap and/or kill feral hogs, ensure maintenance of healthy riparian corridors with the project area, support protection of threatened and endangered plant and animal species identified on the applicant's lands, support agency efforts to control non-native species, and continue to support efforts to improve aquatic habitat in the lower reservoir;
3. operate and maintain the two existing East Fork Black River gages and continuously monitor water quality parameters including, but limited to, dissolved oxygen (DO), turbidity, pH, conductivity, temperature, and discharge throughout the license period;
4. ensure continued protection of project lands within the watershed and work to minimize any effects that may result from activities on project lands to public lands that surround the project; and
5. operate the project using best management practices to clean up and dispose of any petroleum spills in the water or on the banks where material may enter waters of the state.

2.3 STAFF ALTERNATIVE

Under the staff alternative, the project would be operated and maintained as proposed by Ameren Missouri, with the exception of placing gates or signs on non-project, Ameren Missouri-owned lands to prohibit ATV use, and with the modifications

and additional environmental measures described below. Our recommended modifications and measures include, or are based in part on, recommendations made by the federal and state resource agencies that have an interest in resources that may be affected by the continued operation and maintenance of the project. The following are our modifications and additional measures:

- include the following additional provisions in the proposed Gravel and Sedimentation Control Plan: (1) a cleanup and recovery plan to be implemented in the unlikely event that the emergency overflow release structure is overtopped, and (2) transporting the removed gravel and sediment to a disposal site in the East Fork Black River downstream from the lower reservoir dam to enhance aquatic habitat;
- develop, after consultation with Missouri DOC and Missouri DNR, and implement a habitat enhancement plan, to include provisions for installing artificial structures, for the fisheries in the lower reservoir;
- develop, after consultation with Missouri DOC and Missouri DNR, and implement a recreation management plan that includes provisions to maintain existing recreation facilities at the lower reservoir and provide supervised tours of the upper reservoir;
- develop, after consultation with Missouri DNR, and implement a reforestation plan that includes provisions to: (1) extend the existing Upper Reservoir Rebuild Reforestation Plan for a minimum of 5 years,¹⁷ (2) revegetate the former construction laydown areas at the lower reservoir boat launch parking area and campground, and (3) maintain and monitor the vegetation for both areas for a minimum of 5 years and until the seedlings reach a survival rate of 70 percent and are well established at the project
- convert existing lighting at the top of upper reservoir and along the upper reservoir access road to infrared and motion-activated lights, respectively, to provide surface night-lighting along roads and at the top of the upper reservoir dam that maintains project safety, while minimizing unnecessary lighting that

¹⁷ The Upper Reservoir Rebuild Reforestation Plan requires (under the existing license) that the construction laydown and staging areas near the toe of the upper reservoir that were necessary for the upper reservoir rebuild be revegetated with native trees and vegetation, and that the trees and vegetation be monitored for a 5-year period. The plan was approved by the Commission on March 27, 2009, and modified on September 17, 2010.

could adversely effect aesthetic resources important to local residents and recreationists; and

- modify the PA to include a provision that Ameren Missouri evaluate, after consultation with the Missouri SHPO, the Taum Sauk Project's eligibility for the National Register when the project is 50 years old, and develop an HPMP if the project is determined to be eligible for the National Register.

Proposed and recommended measures are discussed under the appropriate resources areas in section 3, *Environmental Analysis*, and summarized in section 5, *Conclusions and Recommendations*.

2.4 STAFF ALTERNATIVE WITH MANDATORY CONDITIONS

We recognize that the Commission is required to include valid section 401 WQC conditions in any license issued for the project. The staff alternative with mandatory conditions would include the measures recommended by staff under the staff alternative and would add the following conditions of Missouri DNR's section 401 of the Clean Water Act water quality certification for the project: (1) erosion control measures to address erosion throughout the project (Condition 3.b); (2) support to the Feral Hog Task Force in its efforts to control and eradicate feral hogs in the area (Condition 3.c); (3) maintenance of healthy riparian corridors (Condition 3.d); (4) water quality monitoring of temperature, DO, conductivity, pH, and turbidity (Condition 4); and (5) protection of project lands within the watershed and work to minimize any effects that may result from project activities (Condition 5).

Our justifications for not recommending these measures under the staff alternative are discussed in section 5, *Conclusions and Recommendations*.

2.5 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

We considered several alternatives to Ameren Missouri's proposal, but eliminated them from further analysis because they are not reasonable in the circumstances of this case. They are: (1) issuing a non-power license; (2) federal government takeover of the project; and (3) retiring the project.

2.5.1 Issuing a Non-power License

A non-power license is a temporary license that the Commission will terminate when it determines that another governmental agency will assume regulatory authority and supervision over the lands and facilities covered by the non-power license. At this point, no agency has suggested a willingness or ability to do so. No party has sought a non-power license, and we have no basis for concluding that the project should no longer

be used to produce power. Thus, we do not consider issuing a non-power license a realistic alternative to relicensing in this circumstance.

2.5.2 Federal Government Takeover of the Project

We do not consider federal takeover to be a reasonable alternative. Federal takeover and operation of the project would require Congressional approval. While that fact alone would not preclude further consideration of this alternative, there is no evidence to indicate that federal takeover should be recommended to Congress. No party has suggested federal takeover would be appropriate, and no federal agency has expressed an interest in operating the project.

2.5.3 Retiring the Project

Project retirement could be accomplished with or without dam removal. Either alternative would involve denial of the relicense application and surrender or termination of the existing license with appropriate conditions.

On December 14, 2005, the upper reservoir of the Taum Sauk Project breached, rendering it inoperable. The project remained inoperable until April 2010. Under section 10(c) of the FPA, a licensee is required to maintain the project in good operating condition, and has the right to operate the project in a manner consistent with the terms and conditions of the project license. Ameren Missouri proposed to rebuild the upper reservoir in the same footprint to allow the project to once again operate under the terms of its current license to provide needed energy storage for periods when demand is high or when energy is needed in emergency circumstances. The final EA, issued in August 2007, concluded that the rebuilding of the upper reservoir would not have any significant effects on the environment and recommended that the rebuild proceed. The Commission issued an order authorizing the commencement of reconstruction on August 15, 2007.

The final EA considered the environmental effects of decommissioning and dam removal under the No-action Alternative. The No-Action Alternative (decommissioning the project) was not selected as the preferred alternative under that proceeding because: (1) rebuilding the upper reservoir was necessary for the Taum Sauk Project to resume operation which it had authorization to do under the existing license; (2) the construction activities would occur in the same location as the previous upper reservoir, retaining a similar shape and volume of water; (3) no operational changes were proposed; (4) operation of the project provides needed energy storage for periods when demand is high or when energy is needed in emergency circumstances; and (5) Ameren Missouri's and staff's recommended mitigation measures would reduce, to the extent possible, effects associated with the construction activities.

Under this relicensing proceeding, operation of the project continues to provide needed energy storage for periods of high demand or when energy is needed in emergency circumstances. Further, no party to the relicensing proceeding has advocated

decommissioning of the project, only that we consider a decommissioning alternative in our environmental assessment. Because the project provides important storage and energy during peak demand periods, we do not consider decommissioning with dam removal to be a reasonable alternative to relicensing the project with appropriate protection, mitigation and enhancement measures.

The second project retirement alternative would involve retaining the dam and disabling or removing equipment used to generate power. Project works would remain in place and could be used for historic or other purposes. This alternative would require us to identify another government agency with authority to assume regulatory control and supervision of the remaining facilities. No agency has stepped forward, and no participant has advocated this alternative. Nor have we any basis for recommending it. Because the ability of the project to provide power during periods of highest demand is needed, a source of replacement power during peak periods would have to be identified. In these circumstances, we do not consider removal of the electric generating equipment to be a reasonable alternative.

3.0 ENVIRONMENTAL ANALYSIS

In this section, we present: (1) a general description of the project vicinity; (2) an explanation of the scope of our cumulative effects analysis; and (3) our analysis of the proposed action and other recommended environmental measures. Sections are organized by resource area. Under each resource area, we first describe the historic and current conditions. The existing condition is the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed mitigation, protection, and enhancement measures, and any potential cumulative effects of the proposed action and alternatives. Staff conclusions and recommended measures are discussed in section 5.2, *Comprehensive Development and Recommended Alternative* of the draft EA.¹⁸

On December 14, 2005, the northwestern corner of the upper reservoir dike breached over a width of about 700 feet, causing an uncontrolled, rapid release of water down the west slope of Proffit Mountain and into the East Fork Black River. Flood waters from the upper reservoir flowed downstream through Johnson's Shut-Ins State Park and into the lower reservoir of the East Fork Black River. The USGS estimated a peak discharge of 289,000 cfs along Proffit Mountain and 95,000 cfs along the East Fork Black River (Rydlund, 2006). The magnitude of the flood along the East Fork Black River was about four times greater than the 100-year flood frequency and about three times greater than the 500-year flood frequency estimate. The lower reservoir dam stored most of the flood waters and had a peak spillway discharge of about 1,600 cfs and about 1.1 feet over the spillway crest. The incremental rise in the river level at the Lesterville gage (USGS gage no. 07061300) was about 2 feet, and this remained within the banks of the river. Water from the breach event joined the Black River in Lesterville and continued downstream.

Many relicensing studies conducted prior to the breach were redone as necessary to address the changes to the project area that resulted from the breach. Our analysis of existing conditions as presented below is informed by these more recent studies.

3.1 GENERAL DESCRIPTION OF THE EAST FORK BLACK RIVER BASIN

The project is located in southeastern Missouri, in the heavily forested St. Francois Mountains on the East Fork Black River at its confluence with Taum Sauk Creek. The project is situated about 8 miles north of the town of Lesterville, Missouri, in Reynolds

¹⁸ Unless otherwise indicated, our information is taken from the application for license for this project (Ameren Missouri, 2008) and additional information filed by Ameren Missouri on April 7, 2009; May 7, 2009; July 9, 2009; September 3, 2009; May 2, 2011; and November 10, 2011.

County, which is about 90 miles south of St. Louis, Missouri. Taum Sauk Creek forms on the eastern slopes of Taum Sauk Mountain, just north of the project in Iron County, and flows generally in a southerly direction into Reynolds County and its confluence with the East Fork Black River at the lower reservoir. The East Fork Black River at the lower reservoir has a drainage area of about 87.4 square miles. From the lower reservoir dam, the East Fork Black River flows south downstream of the project about 8 miles where it reaches Lesterville and flows into the Black River, which continues flowing south for about 25 miles to Clearwater Lake, a U.S. Army Corps of Engineers' project. The Black River then flows into northeastern Arkansas to its eventual confluence with the White River, which then flows into the Mississippi River.

The project is located within the Ozarks Mountains, and the surrounding area is characterized by deeply dissected topography with narrow rolling ridge tops that break sharply to steep side slopes. Elevations in this area typically range from 500 feet msl in the valleys, to the highest point of land in Missouri at an elevation of 1,772 feet msl at the top of Taum Sauk Mountain. Valleys in this region are narrow and have steep gradients. Most of the watershed of the East Fork Black River in the project area consists primarily of forested lands, much of it preserved by the 7,448-acre Taum Sauk Mountain State Park and the 8,670-acre Johnson's Shut-ins State Park. In addition, the Mark Twain National Forest, Ketcherside State Forest, Bell Mountain Wilderness, Elephant Rocks State Park, and the Fort Davidson State Historic Site all are nearby the project.

The Taum Sauk Project area has a continental climate with cool to cold winters and hot summers, although long periods of very cold or very hot weather do not usually occur. Mild periods with temperatures above freezing occur almost every winter, and during the height of summer, periods of dry, cool weather can punctuate more prevalent stretches of hot humid weather. Mean temperatures in July, the warmest month, average about 75 degrees Fahrenheit (°F) (about 24° Celsius [°C]) and near 30°F (about -1°C) in January, which is the coldest month. Daily high temperatures average in the upper 80s°F (about 31°C) in July and near 40°F (about 4°C) in January. The months of March through May are generally the wettest of the year, and rains often continue through June. Average annual rainfall totals in the area are about 46 inches.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (40 C.F.R. §1508.7), a cumulative effect is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative effects can result from individually minor but collectively significant actions taking place over time, including hydropower and other land and water development activities. Through scoping, agency consultation, and our independent

analysis we have not identified any resources that would be cumulatively affected by continuing to operate the Taum Sauk Project. The project is located in an area with very little existing or planned future developmental activity other than the existing hydroelectric project.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the effect of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure effects. We then discuss and analyze the site-specific and cumulative environmental issues.

Only the resources that would be affected, or about which comments have been received, are addressed in detail. We have not identified any substantive issues related to socioeconomics associated with the proposed action, and, therefore, we do not assess socioeconomics in this EA. We present our recommendations in section 5.2, *Comprehensive Development and Recommended Alternative*.

3.3.1 Geologic and Soils Resources

3.3.1.1 Affected Environment

Physiography

The project area is located within the Ozark Plateau physiographic province, which is characterized by high and deeply dissected topography. The Ozark Plateau covers much of the southern half of Missouri and a large portion of northwestern and north-central Arkansas. Elevations within the province range from typically 500 feet msl in the valleys to 1,772 feet msl at the top of Taum Sauk Mountain, the highest point in Missouri. Most project area features are within the St. Francois Mountains that were formed by volcanic activity during a period of continental collision of two plates in Precambrian times.

Geology

The St. Francois Mountains consist of Precambrian granites and rhyolites. During the early Paleozoic, the Cambrian Lamotte Sandstone and the overlying Bonne Terre Dolomite were deposited around the edges of the granitic and rhyolitic highs. Extensive

erosion of the area has resulted in rhyolitic knobs as high points and exposed granitic plutons.¹⁹

The upper reservoir is underlain by rhyolite porphyry.²⁰ This hard rock exhibits high compressive strength characteristics and is moderately to abundantly jointed. Two narrow faults, or significant shear zones, cross the knob as observed during construction. The tunnel connecting the upper reservoir with the pump-generating plant was excavated into hard granite porphyry. The lower reservoir dam is located in a narrow, steep-sided gorge that has been eroded into dense rhyolite porphyry. The foundation of the dam was constructed on top of fresh (unweathered) rock that is moderately but tightly jointed. The regional bedrock has been characterized as a competent formation that is not prone to major weathered zones that might make it vulnerable to mass movements or landslides.

The nearest major fault zone, the New Madrid fault system, located about 100 miles southeast of the project, is considered a remnant of the past continental collision. The fault system consists of a series of faults beneath the continental crust in a weak spot known as the Reelfoot Rift. In total, the New Madrid fault system crosses five state lines and generally follows the Mississippi River valley. The fault system extends 150 miles southward from Illinois through New Madrid and Caruthersville, Missouri, down through Arkansas, and it dips into Kentucky and Tennessee.

Soils

The project site is located about 100 miles south of the southern limit of continental glaciation. Overburden in the project area generally consists of shallow soil derived from decomposition of the underlying regional bedrock (granite and rhyolite). Generally, these residual soils have a silt-based matrix but contain a large percentage of sand, gravel, and cobble, resulting in moderate to high strength characteristics. These soils are found in parts of the project area that exhibit greater vertical relief. Because the residual soils are very granular and heavily vegetated by forest, the potential for mass landslides of this material is considered remote.

Along the floodplains for the East Fork Black River and Taum Sauk Creek, soils are of alluvial origin, including silt, clean sand, gravel and cobbles of varying quantities depending on flow velocities. The coarse-grained sediments are transported as bedload during high flow events.

¹⁹ Granitic plutons are igneous rock that crystallized from magma slowly cooling below the surface of the earth.

²⁰ Porphyry is an igneous rock with large crystals in a fine-grained matrix, or associated mineral deposit.

3.3.1.2 Environmental Effects

Sediment Transport in the East Fork Black River

To stop the majority of coarse-grained sediments in the East Fork Black River from entering the lower reservoir, and thereby reducing its storage capacity, the project includes a bin wall at the upper end of the lower reservoir (see figure 1). The bin wall is constructed of two rows of sheet piles driven into the river bed, and rocks are filled into the space between the sheet pile rows. The top elevation of the bin wall is about 748 feet msl, which is 1.5 feet beneath the surface of the water under normal maximum operating level of the lower reservoir. The bin wall is also designed to allow passage of water (leakage) through the wall at lower reservoir elevations.

Bedload sediment carried in the East Fork Black River is trapped behind the bin wall. Over the last 30 years, trapped sediment has been cleaned out five times (FERC, 2007). Each time, about 30,000 cubic yards of sediment were removed. Sediments that accumulated after the breach event were removed in 2006. Ameren Missouri proposes to finalize and implement the draft Gravel and Sedimentation Control Plan, which includes procedures regarding the frequency of cleaning out the sediment behind the bin wall and disposal of excavated sediment under both normal and emergency conditions. Missouri DOC states that the lower reservoir has interrupted the bedload transport and recommends that Ameren Missouri investigate a means to provide for the movement of bedload through the system.

Our Analysis

Sedimentation

Streams in the project area can carry heavy bedload, as reflected in the coarse grain size distribution of the streambed deposits. While fine-grained sediment may be transported through the lower reservoir into the lower East Fork Black River during high flow events by remaining in suspension, more of the coarser-grained sediment would settle out at the upper end of the lower reservoir if it was not trapped by the bin wall. Therefore, trapping and removing the sediment at the bin wall, as proposed in Ameren Missouri's draft Gravel and Sedimentation Control Plan, would continue to be an effective approach for slowing the process of sediment accumulation in the lower reservoir.

Bedload Transportation and Erosion in the Lower East Fork Black River

The only effective means of transporting coarser grained sediment through the system (i.e., from the upper East Fork Black River into the lower East Fork Black River) would be by trucking it to a location downstream of the lower reservoir dam after removal at the bin wall. There would be some benefits to aquatic habitat if bedload

material from upstream of the bin wall, which would require disposal anyway, was trucked to and released downstream of the lower reservoir dam. Modifying the draft Gravel and Sedimentation Control Plan to include moving the coarse sediment from its current disposal site to the reach downstream of the lower reservoir dam would be a reasonable approach to addressing the sediment transport issue at the project. See further discussion in section 3.3.2, *Aquatic Resources*.

Suspended sediments that were transported during the breach event to areas downstream of the lower reservoir have probably been flushed out of the East Fork Black River. The breach event resulted in a comparatively low peak flow of 1,600 cfs in the lower East Fork Black River downstream of the lower reservoir. Since installation of USGS gage no. 07061290 downstream of the lower reservoir dam in March 2008, there were 14 days with a mean daily flow exceeding 1,600 cfs, 4 days above 5,000 cfs, and the peak instantaneous flow was 23,300 cfs on October 30, 2009.

The maximum generation capacity of the project is about 7,000 cfs, and the release of this amount of flow to the lower reservoir at a full reservoir level at or near the spillway elevation could cause an atypical high flow event in the lower East Fork Black River, especially under existing low inflow conditions. However, under the proposed Water Management Plan, flows released from the lower reservoir dam would be about the same as flows entering the lower reservoir, as discussed in more detail in section 3.3.2, *Aquatic Resources, Environmental Effects*. Potential erosion in the East Fork Black River downstream of the lower reservoir dam would be related to natural high flows from storm events, rather than project operations.

Erosion and Slope Stability of the Flood Scar

During the breach event, water eroded more than 10 feet of surficial material on the face of Proffit Mountain along the course of an intermittent unnamed tributary. The width of the flood scar ranged from about 50 to 350 yards (FERC, 2006). Some of the eroded materials and rock fill from the embankment of the upper dam was deposited below a break in the slope along the flood scar. Most of the remaining material, ranging from boulders several feet in diameter to sand and fine silts, was deposited on the floodplain of the East Fork Black River and in the lower reservoir. In the area of the Johnson's Shut-in Park, the eroded material from the upper reservoir embankment and flood scar created a depositional layer several feet thick (Rydlund, 2006).

Our Analysis

Soil and other material deposited within the flood scar appear to be stable. During the environmental site review on June 22, 2011, we observed that the lower section of the scar contains considerable new growth of vegetation (grass, bushes, and young trees). The substantial coarse-grained deposits in the mid-section of the scar were still largely unvegetated, but the risk of mass movement is considered small due to the absence of

abundant flowing water on the slope and insufficient gradient. Furthermore, over time, the mid- and lower sections would become increasingly revegetated, further stabilizing the deposits of the flood scar. The bedrock in the upper section of the flood scar is expected to remain exposed for a long time, and would serve as a visual reminder of the breach event and provide a rare view of the subsurface geology of the area.

Erosion and Slope Stability from Overtopping of Upper Reservoir

As part of the reconstruction of the upper reservoir, Ameren Missouri constructed an emergency overflow release structure to control discharges in the unlikely event of overtopping of the upper reservoir. Details of an overtopping event are discussed in section 3.3.2, *Aquatic Resources*. The maximum potential flow of an overtopping event would be 5,358 cfs, which is equivalent to the combined capacity of the two pumps that fill the upper reservoir.²¹ In an unlikely overtopping event, water would flow over the weir within the rim of the upper reservoir, down the stair-steps of the dam, through a stilling basin at the base of the dam, then for about 0.6 mile through a ravine on the forested slope of Proffit Mountain into Taum Sauk Creek, and ultimately for about 1.2 miles along the creek bed into the lower reservoir (see figure 1).

Taum Sauk Creek is an intermittent stream, and its streambed habitat consists of riffle-pool sequences with bed materials ranging from coarse sands and gravels to small boulders and cobble. The Missouri Parks Association and Great Rivers Environmental Law Center (Great Rivers) stated that they were concerned about the vulnerability of Taum Sauk Creek as a result of potential overflows from the upper reservoir. The condition 3.a of the WQC would require a cleanup and recovery plan to address any effects in the event the overflow relief structure is operated.

Our Analysis

In an unlikely overtopping event, discharges from the upper reservoir would potentially affect the hillside downstream of the upper reservoir dam as well as Taum Sauk Creek. The extent of the effect would depend on the volume, flow rate, and duration of the released water. Potential effects include removal of unarmored topsoil and subsoil along the mountain slope proportional to the flow event, erosion along the Taum Sauk Creek channel, and deposition of eroded material in the creek channel and the lower reservoir. Vegetation along the slope and creek would initially slow down the flow, but could also cause hydraulic jumps and turbulent flows (HDR/DTA, 2011a). As described further in section 3.3.2, *Aquatic Resources*, peak flows from a two-pump overtopping event (5,358 cfs) would correspond to natural flows with a 14-year

²¹ Typically toward the end of filling of the upper reservoir, only one pump is used, slowing the inflow to 2,679 cfs.

recurrence interval; a one-pump event (2,679 cfs) would correspond to a 3.6-year recurrence interval. However, an overtopping flow event would carry higher loads of sediment and debris compared to natural flow events as a result of erosion of the slope of Proffit Mountain. Preparation of a cleanup and recovery plan in consultation with resource agencies would be used to address any effects of such an event.

Reservoir Shoreline Erosion

Reservoir water level fluctuations, high flows, and wind- and boat-induced waves have been known to cause erosion along lake and reservoir shorelines. In the specific case of the Taum Sauk Project, photographs taken in 2005 prior to the breach when the pond was near its normal minimum operating level of 735 feet msl,²² did not show active erosion along the lower reservoir shoreline. Rather, the photographs showed unvegetated exposed soil and bedrock between the normal minimum operating level (736 feet msl) and the normal maximum operating level (749.5 feet msl). The banks, submerged at maximum pond, appeared to be stable and seemed to have self-armored themselves, generally consisting of stony residual soil. The banks were generally sloped at a gradient flatter than 2H:1V (horizontal to vertical). Ameren Missouri does not propose specific erosion control measures. Condition 3.b of the WQC would require the design and implementation, upon request from Missouri DNR, of erosion control measures as necessary to address erosion resulting from the use of project lands that cause turbidity or otherwise compromises water quality.

Our Analysis

The reservoir has been in existence since 1963, thus the shoreline has had time to adjust and stabilize to project operation. Benson (1980) cites several references that indicate that reservoir bank slopes achieve relative stability within about 20 to 25 years of first filling. The primary cause for shoreline erosion in the narrow upgradient section of the lower reservoir would be from high flow storm events. The lower sections of the lower reservoir may be more exposed to erosion from waves. However, the comparatively small surface area of the lower reservoir results in limited fetch for waves to build up, and therefore, limits the extent of potential wave-induced erosion. Boating on the lower reservoir is allowed, but boats with motors larger than 10 horsepower are required to operate without wake. In addition, neither substantial erosion along the shore nor extensive boating activity was observed during the environmental site review on June 22, 2011. Therefore, shoreline erosion in the lower reservoir would likely be minimal over the term of any new license, and erosion control measures would not be necessary.

²² Water level elevations at or near elevation 749.5 feet msl (the normal maximum operating level) since March 2007, have prevented Ameren Missouri from visually inspecting the reservoir rim below the normal maximum operating level.

Seismic Activity

Between December 1811 and February 1812, three major earthquakes occurred followed by aftershocks for several years thereafter. The epicenters of the earthquakes were close together, extending from northeastern Arkansas to the town of New Madrid, Missouri. These earthquakes probably reached magnitudes of 7.7 on the Richter scale and intensities of XII, the maximum on the Modified Mercalli scale. The earthquakes were felt over an area of at least 2 million square miles, even in places such as Boston, Massachusetts, more than 1,100 miles away. Since then, there have been 88 earthquakes of magnitude 4 (equivalent to intensities of IV or greater on the Modified Mercalli scale) recorded within 250 miles of the project site. Most of these seismic events were concentrated near the southeastern corner of Missouri within 250 miles of the project site.

Our Analysis

Rizzo (2006) conducted a comprehensive geological and seismic analysis of the project site, in preparation for reconstruction of the upper reservoir. Although the project was exposed to two seismic events in 1968 and 1996, these earthquakes did not have visible effects on project facilities. The USGS (2008) assessed the probabilistic seismicity of the project area with about 0.30 g peak ground acceleration (PGA),²³ which has a 10 percent chance of being exceeded in 250 years (a recurrence interval of 2,500 years). A PGA of 0.30 g corresponds to an intensity of VII on the Modified Mercalli scale, and a magnitude of about 6 on the Richter scale; effects include very strong perceived shaking and moderate damage (USGS, 2011a).

During the original construction of the upper reservoir, the faults crossing the knob were plugged with concrete, and the floor was leveled with fine-grained material from a quarry and sealed by paving it with asphalt. During reconstruction of the upper reservoir after the breach event, Ameren Missouri removed the pre-breach asphalt floor, re-contoured the floor using cement fill (instead of fine-grained material), and constructed a new asphalt floor. In addition to the seismic hazard analysis (Rizzo, 2006), the Commission required Ameren Missouri to convene an independent Board of Consultants consisting of four preeminent safety experts in the country, to oversee and advise Ameren Missouri on the design and reconstruction of the upper reservoir and

²³ Earthquake energy is dispersed in waves from the epicenter, causing ground movement horizontally (in two directions) and vertically. The PGA records the acceleration (rate of change of speed) of these movements. The PGA depends on factors such as fault length, earthquake depth and magnitude, distance from the epicenter, duration, and regional geology. One measure for PGA is g (the acceleration due to Earth's gravity, equivalent to g-force; $1g = 9.81$ meters per second²).

thereby ensure that the upper reservoir would be constructed in a safe manner and meet current engineering design standards (FERC, 2007).

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

Water Quantity

The project uses the waters of an upper reservoir, lower reservoir, Taum Sauk Creek (a tributary to the lower reservoir), and the East Fork Black River upstream from the lower reservoir (figure 1) to generate electricity. The upper East Fork Black River, which flows into the lower reservoir, is separated from the lower reservoir by a bin wall (see figure 1). The lower reservoir was formed by impounding the East Fork Black River at the lower reservoir dam.

The upper reservoir has an operating range of 72 feet with a maximum elevation of 1,597 feet msl and a minimum elevation of 1,525 feet msl. The 364-acre lower reservoir (at full pool) has an operating range of 13.5 feet, with a maximum elevation of 749.5 feet msl and a minimum elevation of 736 feet msl. The current operation volume between these elevations is from 6,240 to 6,548 acre-feet (based on bathymetry data collected in 2008 and 2010). The maximum hydraulic capacity of the project in generation mode is about 7,000 cfs at maximum hydraulic head. Ameren Missouri is required to provide a continuous flow release at the lower reservoir dam at a rate approximately equal to the natural inflow to the lower reservoir. There is no ability to store water beyond the project design volumes. Inflows above the amounts needed to maintain the operational storage volumes are passed downstream as guided by a computer control system. Discharges from the lower reservoir pass through one, or a combination of, the following points:

- through a 20-inch-diameter opening controlled by a metal gate on the upstream side that tapers down to a 16-inch-diameter, spiral-welded pipe that passes through the dam and has a capacity of about 25 cfs;
- through an 8-by-10-foot steel-lined conduit controlled by a steel slide gate at its upstream end, with a capacity of about 2,500 cfs; and
- over the spillway.

The USGS maintained a flow gage (no. 07061300) on the East Fork Black River at the Highway 21 bridge in Lesterville, Missouri, about 8 miles downstream of the lower

reservoir from January 1, 1960, until December 7, 2009.²⁴ Beginning on October 1, 2001, the USGS began monitoring flow and water quality parameters upstream of the lower reservoir at the State Highway N Bridge at USGS gage no. 07061270 (see figure 1). In 2008, flow and water quality monitoring started at USGS gage no. 07061290, just downstream of the lower reservoir (see figure 1). Both of these gages are currently active, real-time gages with data available online. Highest stream flows normally occur in the spring, and during low flow periods in the summer and early fall, stream flows often fall to very low levels. Tables 2 and 3 summarize monthly flow data from these three gages.

²⁴ Monitoring for water quality parameters continued until January 2010.

Table 2. Monthly flow (cfs) data for USGS gage nos. 07061270 and 07061300 (Source: Ameren Missouri, 2008; USGS, 2011b).

USGS gage no. 07061270 East Fork Black River at Lesterville, MO (upstream of the project at Highway N), October 1, 2001, to June 5, 2011, not including October 2001 to September 30, 2003. Drainage area: 52.2 square miles.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Median	33	46	63	78	51	11	7.6	4.7	6.8	6.4	18	36	24
Max	1,370	1,830	3,820	4,440	6,080	671	49	109	935	6,000	2,310	1,680	6,080
Min	6.6	9.4	18	21	10	2.3	0.9	0.4	1.1	1.5	4.5	6.8	0.4
10% Exceed.	109	171	251	271	252	37	13	12	37	55	152	122	140
90% Exceed.	10	23	24	32	19	4.9	2.1	1.1	1.6	3.3	5.6	11	4.3

USGS gage no. 07061300 East Fork Black River at Lesterville, MO (downstream of the project at Highway 21), January 1, 1964, to December 31, 2007, not including January 16, 1991, to January 21, 2006. Drainage area: 93.8 square miles. Prorated to the lower reservoir by 87.4/93.8.

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Median	37	62	93	108	42	15	3.7	2.6	4.7	8.4	25	57	27
Max	2,904	3,789	5,753	4,329	4,612	3,165	1,862	4,310	2,039	1,908	12,288	5,827	12,288
Min	0.8	3	3.7	5.4	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.9	0.0
10% Exceed.	198	281	451	435	250	103	36	33	59	50	296	435	220
90% Exceed.	6.3	12	20	31	8.0	2.3	1.2	0.7	0.9	1.7	2.1	4.4	1.9

Table 3. Monthly flow (cfs) data for USGS gage no. 07061290 East Fork Black River, immediately below the lower reservoir dam (Source: USGS, 2011b).

Month	Min	Median	Mean	Max
Jan	9.8	38	62	692
Feb	15	92	181	2,040
Mar	22	124	305	5,980
Apr	37	172	464	6,470
May	20	93	208	1,170
Jun	4.0	22	113	1,740
Jul	2.2	11	12	59
Aug	0.5	5.7	10	117
Sep	2.4	44	81	777
Oct	7	11	236	8,960
Nov	3.9	8.4	89	869
Dec	4.9	32	109	1,650

Note: Period of approved record is March 13, 2008, to June 6, 2011.

Primary inflow to the lower reservoir is from the East Fork Black River, but other smaller tributaries that flow into the lower reservoir include Walker Branch, Taum Sauk Creek, and Little Taum Sauk Creek. The total drainage area at the lower reservoir is about 87.4 square miles. The Taum Sauk Creek arm of the lower reservoir is fed by Taum Sauk Creek and Little Taum Sauk Creek, with a combined drainage area of 23.5 square miles. The Taum Sauk Creek drainage area is about 13 square miles. Taum Sauk Creek is a mountain creek, about 7.7 miles long from Taum Sauk Mountain to the edge of the lower reservoir, falling about 950 feet over that distance at an average grade of 3 percent. Flows in Taum Sauk Creek vary from at or near zero during dry periods to high flood flows following heavy precipitation.

The East Fork Black River downstream from the lower reservoir dam is controlled by flow releases from the dam. Based on data from USGS gage no. 07061300, located about 4 miles downstream from the dam, flows may range from a low of less than 1 cfs (often approaching zero) to a high of over 12,000 cfs (see table 2) on an annual basis. Ameren Missouri currently does not release a specified minimum instream flow from the dam, but operates the reservoir as essentially run-of-river with outflow approximating

inflow. Typical releases from the dam during low-flow periods of the year are in the range of 1 to 3 cfs.

Table 4 shows flood recurrence intervals for Taum Sauk Creek and for the East Fork Black River downstream from the lower reservoir dam.

Table 4. Flood recurrence intervals and flows (cfs) for Taum Sauk Creek and the East Fork Black River downstream from the lower reservoir dam (Source: Ameren Missouri, 2008; HDR/DTA, 2011a).

Recurrence interval (years)	Taum Sauk Creek	Lower East Fork Black River
2	1,591	4,450
5	3,231	8,370
10	4,635	11,600
25	6,669	16,390
50	8,184	20,470
100	9,821	24,960
500	13,803	37,220

Emergency Overflow Release Structure

During the rebuild of the upper reservoir following the breach event, Ameren Missouri constructed an emergency overflow release structure (see figure 1) to provide a safe, controlled discharge point in the unlikely event of overfilling of the upper reservoir. This structure has an invert at elevation 1,599 feet msl, a length of about 700 feet, and a capacity of 5,358 cfs, which is the capacity of both pumps that are used to supply water to the upper reservoir.

Water Use

In addition to power generation, the project's lower reservoir is used for public recreational boating and fishing. Due to the extreme fluctuations associated with the operation of this pumped storage facility, swimming in the lower reservoir is not permitted. Fishing and boating are prohibited in the upper reach of the lower reservoir near the tailrace of the powerhouse for safety reasons. The lower reservoir is not used for water supply. Ameren Missouri prohibits any recreational or other uses of the upper reservoir.

Groundwater

The surficial aquifer in the project area, including the lower reservoir, is the Ozark aquifer, which consists of dolomite and overlies the St Francois confining unit. The Ozark aquifer capacity is limited to supplying numerous local shallow domestic wells.

Groundwater levels near the lower reservoir are estimated to be about 30 feet below the ground surface with an average gradient of 0.005 foot per foot towards the south-southwest.

Surface Water Quality

Water quality in the East Fork Black River and in the project's lower reservoir has historically met state standards, as the river basin is mostly undeveloped and has no major sources of water pollution. State standards for the project area waters for parameters that may be affected by hydropower operations include:

- a maximum water temperature of 32.2°C (90°F), and not changed by more than 2.8°C (5°F);
- a minimum DO of 5.0 milligrams per liter (mg/L), although the criteria allow “natural and unavoidable chemical and physical changes that occur in the hypolimnion of lakes”; and
- turbidity levels that shall not be in substantial visible contrast with the natural appearance of stream/lake or interfere with beneficial uses.

There are several sources of existing water quality data for the East Fork Black River and the project area, including: USGS gage nos. 07061270 (upstream of the project) and 07061290 (downstream of the project); water quality surveys conducted prior to relicensing studies; and relicensing studies conducted by Ameren Missouri. USGS data show the overall water quality conditions in the basin upstream and downstream of the project, while the more-recent surveys conducted by Ameren Missouri show the project-specific water quality conditions.

Figures 4, 5, and 6 depict USGS data for water temperature, DO, and turbidity over similar time periods, and these parameters typically meet state standards at both stations. For water temperature, standards were met at all times except for short periods in mid-summer 2010 and 2011, likely as a reflection of drought or low-flow conditions and warm summer weather conditions. For DO, standards were met or exceeded at all times upstream of the project (gage no. 07061270). Downstream of the project, DO fell below the 5 mg/L standard a few days per year in mid-summer, particularly in 2009 and 2011. Turbidity levels remained low at both stations during most of the reporting period; they were generally less than 10 formazin nephelometric units (FNU), except for spikes of high turbidity (200 to 700 FNU) at times, likely related to high-flow events in the basin. There appeared, however, to be minimal correlation in the spikes between the two stations, probably reflecting localized rainfall events. The station downstream of the project reservoir showed generally lower spikes in FNU than upstream, indicating the possible storage effect of the reservoir, which may dampen the effects of high flow events in the upper basin.

Figure 4. USGS data for water temperature at USGS gage nos. 07061270 (upstream of the project) and 07061290 (downstream of the project), East Fork Black River (Source: <http://waterdata.usgs.gov/nwis/rt>, accessed April 6, 2012, as modified by staff).

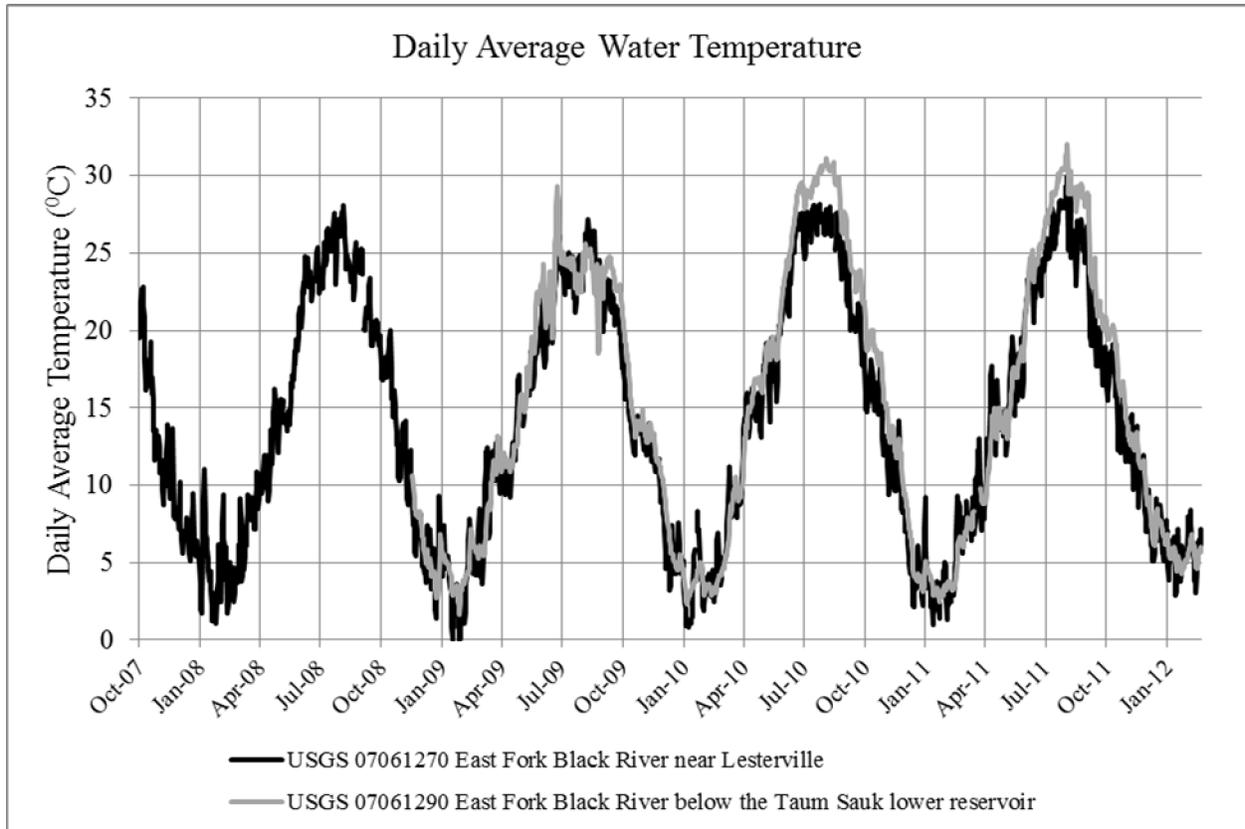


Figure 5. USGS data for DO at USGS gage nos. 07061270 (upstream of the project) and 07061290 (downstream of the project), East Fork Black River (Source: <http://waterdata.usgs.gov/nwis/rt>, accessed April 6, 2012, as modified by staff).

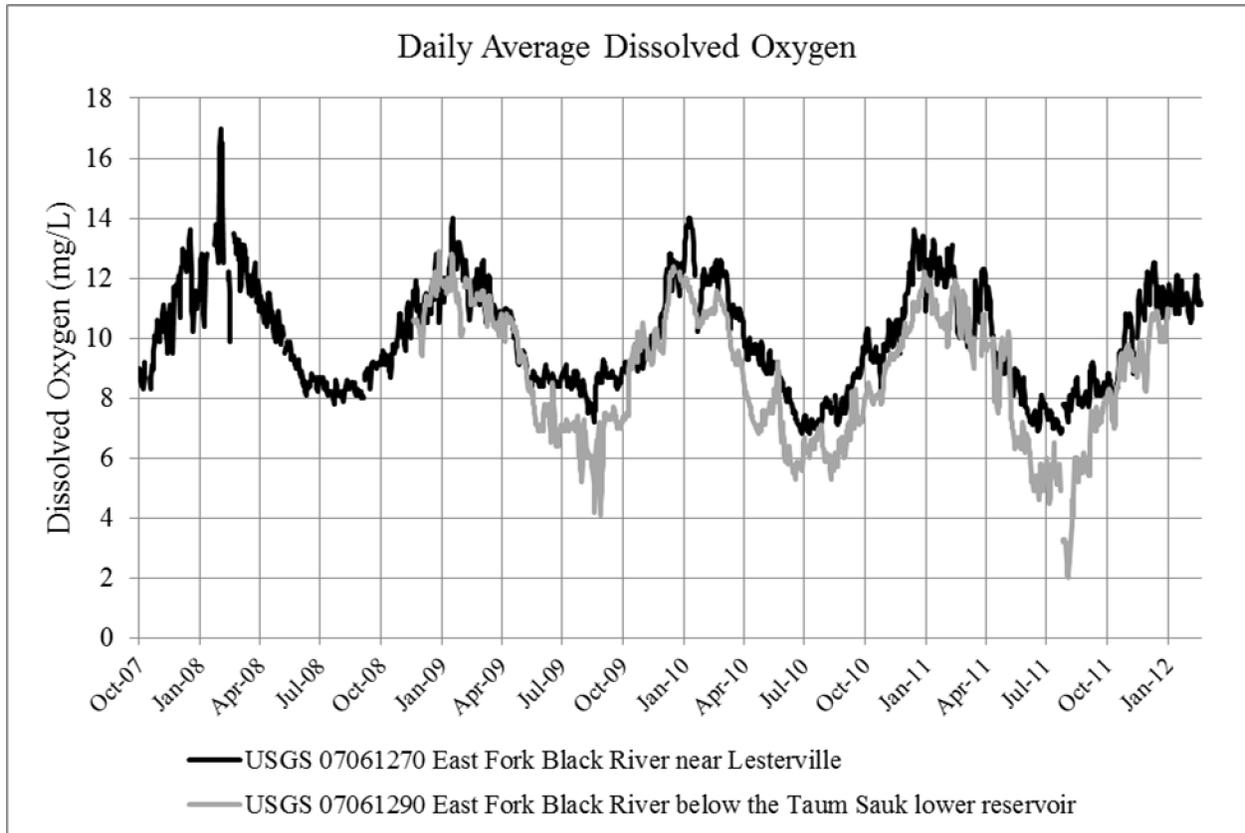
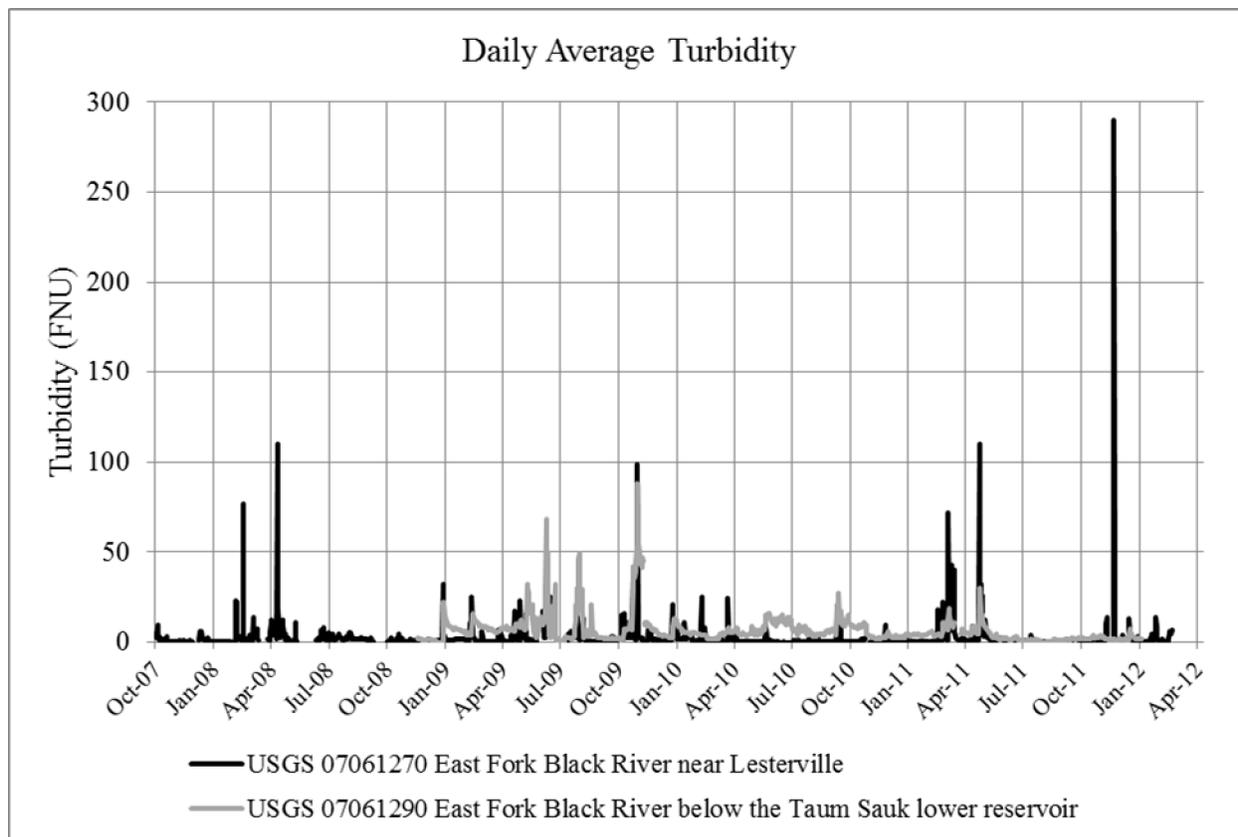


Figure 6. USGS data for turbidity at USGS gage nos. 07061270 (upstream of the project) and 07061290 (downstream of the project), East Fork Black River (Source: <http://waterdata.usgs.gov/nwis/rt>, accessed April 6, 2012, as modified by staff).



Earlier sampling by Ameren Missouri in 2005 (prior to the breach event) and in 2007 (after the breach event) collected data from the lower reservoir and from the East Fork Black River. Table 5 summarizes the data collected in 2005 at the minimum reservoir operating level, which showed lower DO levels than at higher reservoir operating levels, representing “worse-case” conditions. These data indicate that state standards were met most of the time, except at one of the reservoir stations (TS3) where DO readings less than 5 mg/L were recorded twice. Ameren Missouri (2008) also reported that DO profiles taken at the deepest location immediately upstream of the dam showed temperature and DO stratification during the warmest part of the summer, with DO levels lower than 5 mg/L near the bottom where maximum depths range from 36 to 39 feet. At the station located immediately downstream from the dam, the DO concentrations were consistently higher, indicating an aeration effect from spillage over the dam. Turbidity levels were consistent among stations and were generally low.

Table 5. Summary of water quality data collected at a depth of about 1.6 feet at normal minimum reservoir level, June through October, 2005 (Source: Ameren Missouri, 2008).

Station^a	Mean DO (mg/L)	Range DO (mg/L)	Mean Water Temp. (°C)	Range Water Temp. (°C)	Mean Turbidity (NTU)^b	Range Turbidity (NTU)
TS1	6.3	5.6-7.2	27.1	20.4-29.2	2.3	1.5-3.9
TS2	6.4	5.5-7.9	26.6	17.1-29.3	2.5	1.5-4.4
TS3	5.8	4.8-7.8	26.1	16.5-28.8	2.7	1.5-4.0
TS4	6.5	5.4-8.0	26.6	16.7-29.3	2.3	1.8-3.1
BR	7.4	6.6-9.3	26.1	15.7-28.8	2.4	1.7-3.7

^a TS stations are in lower reservoir. BR is immediately downstream of lower reservoir dam.

^b Data were reported in nephelometric turbidity units (NTU), which are similar to FNU reported by USGS, in that both units measure scattered light at 90 degrees from the incident light beam, but the FNU is measured with an infrared light source and the NTU is measured with a white light (<http://or.water.usgs.gov/grapher/fnu.html>, accessed February 21, 2013).

Water quality monitoring after the breach event, but before completion of the project re-construction and return to operation, showed similar results, and state standards were maintained most of the time. Results for turbidity, however, showed differences from pre-event data. From June through August 2007, turbidity in the East Fork Black River downstream of the dam was still elevated relative to 2005 pre-breach conditions, with a mean turbidity of 10.2 NTU, ranging from 5.4 to 14.8 NTU (MACTEC, 2008). However, more recent data reported above in figure 6 shows that turbidity levels have essentially recovered from the breach event and generally returned to pre-event levels, except for occasional peaks likely related to high-flow events.

Aquatic Habitat

The lower reservoir, Taum Sauk Creek, and the East Fork Black River downstream from the lower reservoir dam all contain aquatic habitat supporting fishery resources that may be affected by the project. The upper East Fork Black River flows into the lower reservoir, but it is separated from the lower reservoir by the bin wall (see figure 1), except under the highest reservoir levels. The upper reservoir, which is an artificial reservoir entirely enclosed within a roller-compacted concrete dam, contains

limited fishery habitat. The primary source of fish in the upper reservoir is via pumping from the lower reservoir.

Ameren Missouri's habitat surveys of the lower reservoir found minimal suitable littoral habitat at the minimum pool level (elevation 736 feet msl), but abundant cover in many parts of the reservoir at the full reservoir level, as shoreline terrestrial habitat is temporarily flooded at this level. The drawdown zone is largest in the Taum Sauk Creek arm of the reservoir and in backwater areas in the East Fork Black River arm, where the slope is more gradual compared to other steeper sloped sections. The lower reservoir was affected by the 2005 upper reservoir breach event, which deposited significant debris and sediment into it. Ameren Missouri restored the lower reservoir after the event by removing sediment and debris and rescuing and removing more than 8,000 fish of 12 species. Ameren Missouri also maintained the lower reservoir at a constant level from 2007 through April 2010, when the project returned to operation and normal fluctuations were restored. Some effects of the breach event and three major flood events in 2008 and 2009, however, remain (additional sediment and woody debris deposition), and the reservoir habitat is different from its condition prior to the 2005 breach event.²⁵

Taum Sauk Creek is a relatively small intermittent stream, and often it has no surface flow during the summer low-flow months. The creek consists of a series of riffle-pool complexes, with some glide habitat and a substrate of mostly gravel and cobble. The stream has a "flashy" hydrograph, ranging from high, channel-forming and eroding flows during and immediately after rain events, to very low or no surface flows during dry periods. Several of the pools remain wetted during dry periods, providing habitat for macroinvertebrates, amphibians, and small fish. A 5.5-mile reach of Taum Sauk Creek upstream of the lower reservoir, and outside of the project influence, is listed as an Outstanding State Resource Water. The Taum Sauk Creek was minimally affected by the 2005 breach event.

The 5-mile reach of the East Fork Black River from the lower reservoir dam downstream to the confluence with the West Fork of the Black River (West Fork Black River) can be characterized as having a variety of habitat types, including riffle, run, pool, and glide. Pool is the most common habitat type, followed by riffle, riffle complex, and glide complex. Beaver and debris dams were observed within the reach, and the substrate of primarily gravel and cobble reflects the flashy nature of the hydrograph. Although this reach of the river may have been affected by the 2005 breach event

²⁵ Although Ameren Missouri made its best efforts in removing sediment and debris from the lower reservoir, these efforts were unable to duplicate pre-breach conditions. In addition, the subsequent flood events would have deposited additional sediment and flood debris.

(additional sedimentation), three high-flow, channel-forming events have occurred since then (2008 and 2009) and likely have obscured any breach event effects.

Ameren Missouri surveyed the upper reach of the East Fork Black River upstream of the lower reservoir and found a predominance of pool, glide/run, and riffle habitat, with the pool habitat concentrated immediately upstream of the bin wall. This reach of the river may be inundated by the backwater from the lower reservoir at the highest reservoir elevations. The bin wall has a crest elevation of about 748 feet msl, so whenever the lower reservoir exceeds that elevation, the reach upstream of the bin wall essentially becomes part of the lower reservoir. At the maximum reservoir elevation of 749.5 feet msl, about 625 feet of the East Fork Black River upstream of the bin wall is backwatered. This reach of the East Fork Black River received extensive damage during the 2005 breach event, but restoration of the reach (sediment and debris removal) and the three channel-forming high-flow events since then have eliminated much of the evidence of the 2005 breach event.

The upper reservoir is an entirely “artificial” structure formed by the roller-compacted concrete dam, and the habitat within the structure was not surveyed. The upper reservoir is a relatively deep reservoir-type habitat with steep walls, and a large drawdown and water level fluctuations due to pumped-storage operations.

Fish Community

The fish community in the project area is a warmwater species assemblage dominated by centrarchids (bass and sunfish), with at least 57 species reported, including a number of minnows and chubs, stonerollers, suckers, darters, and catfishes. The lower reservoir has the greatest amount and duration of fisheries habitat in the project area because of its size and depth compared to the East Fork Black River and Taum Sauk Creek, which both experience very low to no flow during dry periods of the year. Missouri DOC has stocked the reservoir since the 1960s with several species, including striped bass, muskellunge, threadfin shad, and channel catfish, which has been the primary species stocked since the 1990s. Reservoir sampling and fish rescue efforts after the 2005 breach event indicate that largemouth bass and several species of sunfish (bluegill, longear sunfish, and redear sunfish) are the most common gamefish species, although fair numbers of channel catfish and a few muskellunge are also present. Sampling by Ameren Missouri and the Missouri DOC in Taum Sauk Creek and the East Fork Black River found good species diversity in both streams, but the catch was dominated by smaller cyprinid species (minnows and chubs), darters, and some sunfish. This domination was expected, given the limited habitat that occurs in both streams during dry periods when streamflows approach or reach zero, and the primary habitat remaining consists of shallow, isolated pools.

The 2005 breach event had a significant effect on lower reservoir fish populations because of high sedimentation, turbidity, and debris loading that occurred during the event, and during the recovery efforts, when much of the sediment and debris was removed from the reservoir. More than 8,000 fish were also removed from the reservoir as a rescue effort to remove fish that were stranded in isolated pools and in danger of experiencing mortality. Since the breach, Missouri DOC has reported that largemouth bass have re-populated the reservoir. In 2008, Ameren Missouri and Missouri DOC initiated a stocking program for the reservoir. Species stocked include bluegill, redear sunfish, fathead minnows, black crappie, and channel catfish.

The upper East Fork Black River was also affected by the breach event and experienced recovery operations in the reach upstream of the bin wall; however, no fish stocking has occurred in this reach.

3.3.2.2 Environmental Effects

Water Management Plan/Operations

Project operation results in a daily exchange of about 6,500 acre-feet of water between the lower and upper reservoirs, with a maximum flow during generation of about 7,000 cfs and 6,200 cfs during pumping. Project operation can fluctuate the water level of the lower reservoir by up to 13.5 feet and affect a wide range of resources, including discharges from the lower reservoir to the lower East Fork Black River.

Ameren Missouri proposes to implement the Water Management Plan that outlines how the flow in the East Fork Black River (and other tributaries) would be used to support project operation and to limit the effect of discharges from the lower reservoir. The plan would protect downstream aquatic habitat by matching outflow from the lower reservoir to the variable inflow to the extent practicable, while recognizing the reasonable beneficial uses of the river for recreation. As part of the upper reservoir rebuild, Ameren Missouri replaced the sluice gate, sluice gate seals, and associated motorized equipment, which allows for more precise releases at the lower reservoir, which would be needed for adherence to the Water Management Plan.

The proposed Water Management Plan was developed in cooperation with Missouri DNR and Missouri DOC, and filed with the Commission on July 22, 2011. Revision 1 of the plan, dated September 16, 2011, was filed in November 2011. Key aspects of the plan include:

- operate and maintain the upstream and downstream USGS gage stations, which would be needed to ensure that the performance criteria defined in the Water Management Plan would be met;
- methodology for the calculation of discharges from the project;

- a minimum discharge of 1.7 cfs from the lower reservoir dam;
- ramping rates for return from off-normal operation and ramping rates associated with project maintenance activities, to minimize the potential effects on aquatic resources downstream of the lower reservoir dam;
- an 18-month adaptive management process to identify potential additional improvements; and
- monitor and publish water level, volume, and outflow information on the internet, as well as maintain the information for documenting the operation of the project.

The plan includes performance criteria calling for project outflow from the lower reservoir to approximate the inflow to the lower reservoir. This flow discharge is calculated by a 3-hour rolling average outflow, as measured at the downstream gage (USGS gage no. 07061290), equaling or exceeding the minimum flow multiplier times the three-hour rolling average of the upstream gage (USGS gage no. 07061270) with a one-hour lag. Other than the 1.7-cfs minimum discharge requirement, the ramping rates and matching outflow with inflow would not be required when:

- extreme low flow conditions exist and volume recovery for the project would be needed;
- rapidly increasing flows, greater than 30 cfs per hour, would occur at the inflow gage; and
- the inflow as measured at the upstream gage would be greater than 500 cfs.

Missouri DOC and Missouri DNR recommend that the proposed Water Management Plan be incorporated into any new license, if issued for the project. Condition 2 of the WQC requires Ameren Missouri operate the project in accordance with the proposed Water Management Plan.

Our Analysis

Project operation, which involves pumping large volumes of water to the upper reservoir and in turn releasing large volumes of generation flows to the lower reservoir, would result in major hydraulic effects in the lower reservoir, potentially affecting flow releases from the reservoir, as compared to natural inflows from the East Fork Black River and Taum Sauk Creek. Typical natural inflow from Taum Sauk Creek is a small percentage of the project pumping and generating flow rates (see table 2). The lower reservoir does not have the storage capacity to substantially decrease high natural inflows or to store water for later releases during drought conditions.

The Water Management Plan was developed to specify and record how the project would manage and affect the inflow and outflow of the East Fork Black River at the lower reservoir. Specific performance criteria were developed (table 6), and during the development and testing of the Water Management Plan in 2011, Ameren Missouri submitted monthly water management reports including a summary of project operation, analysis of the data, and discussion of proposed changes. Our analysis of these reports finds that Ameren Missouri met the proposed performance criteria of the draft Water Management Plan for the majority of time in 2011 (table 6). For example, these reports show that the a minimum project outflow of 1.7 cfs from the lower reservoir was not met for a total of only 3 hours over the period from January 1 through September 30, 2011.

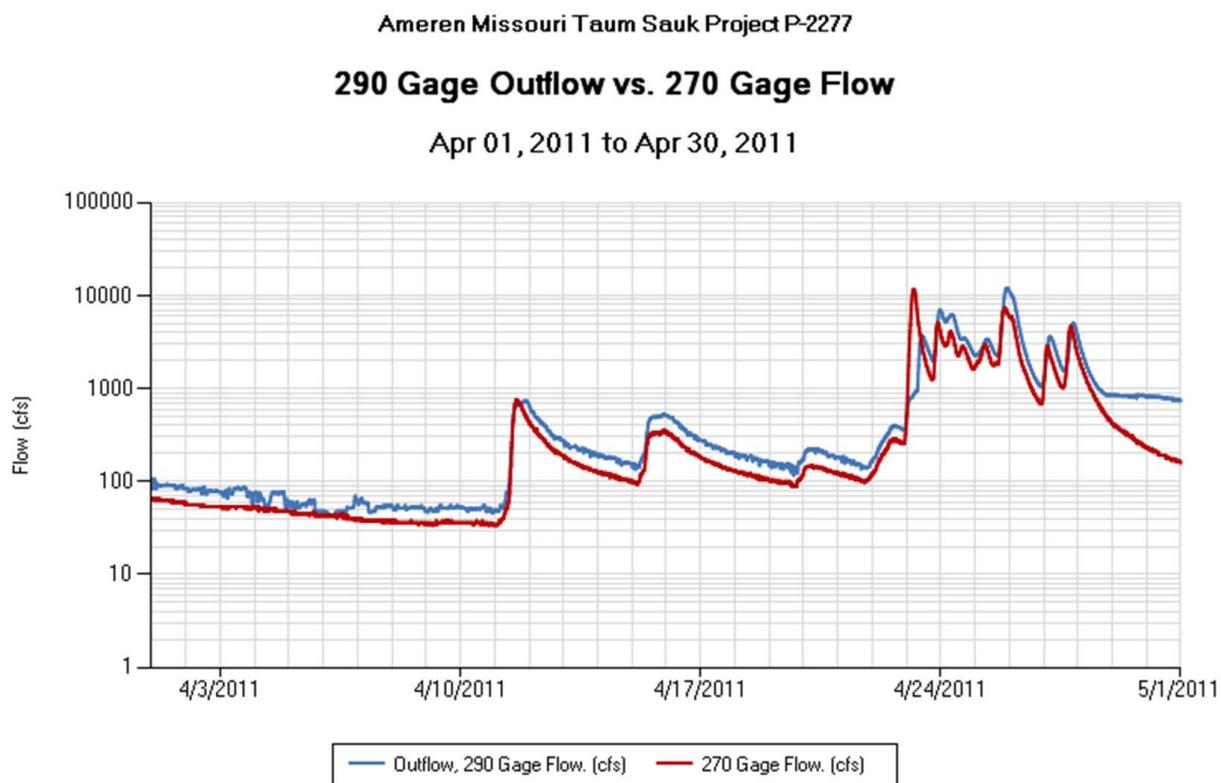
Table 6. Water Management Plan performance criteria summary for 2011 (Source: Ameren Missouri, September 2011 Monthly Report on the Water Management Plan).

Criteria	Parameter	Result
1	A minimum project outflow of 1.7 cfs from the lower reservoir	Not met for 3 hours (about 0.05 percent of the time)
2	Outflow from the lower reservoir not less than 1.4 times the 3-hour rolling average of the inflow gage for more than 12 consecutive hours	Not met for 96 hours, number of events longer than 12 hours: 13
3	At least 85 percent of the time the 3-hour rolling average outflow equals or exceeds 1.4 times the 3-hour rolling average of the inflow gage with a 1-hour lag	Met (92.5 percent of the time)
4	At least 90 percent of the time, the outflow is greater than or equal to 85 percent of the 3-hour rolling average of the outflow	Met (98.6 percent of the time)
5	Instantaneous outflow is greater than or equal to inflow 99 percent of the time	Met (about 99.5 percent of the time)

As described above, one of the major objectives of the Water Management Plan is that the instantaneous outflow from the lower reservoir is equal to or greater than the inflow, to ensure approximate natural flow conditions in the basin. We assessed whether that primary objective was met in the test year of 2011, and figures 7 and 8 provide the results of our analysis. Figure 7 shows that, during the April 2011 study period, outflow from the lower reservoir was normally higher than the inflow, except during a period of rapidly increasing inflow on April 23. These results were expected due to operational constraints and rapidly changing conditions, and because the upstream gage captures only about 60 percent of the natural inflow to the lower reservoir. Although the Water Management Plan accommodates the smaller portion of the basin represented by this gage, by including the criteria for 1.4 times the rolling average of inflow, there are some

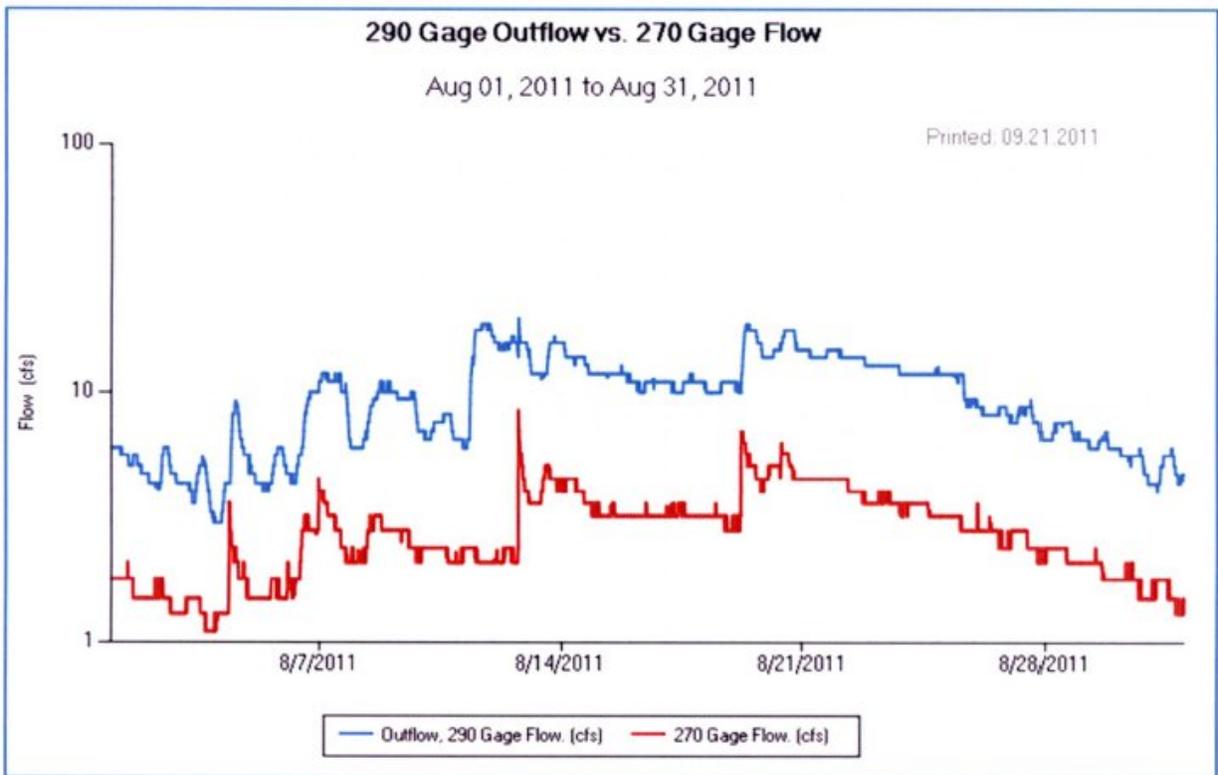
conditions (although limited) when these criteria may not always be met. Rapidly changing inflow conditions, especially during short duration high intensity rainfall events create rapidly changing flow conditions that may not allow Ameren Missouri sufficient lead time to make flow adjustments, particular for the lower reservoir with its limited storage capacity. During the lower flow period of August 2011, however (figure 8), the lower reservoir outflow equaled or exceeded inflow at all times. Table 6 shows that the performance criteria were met most of the time in 2011, indicating that the Water Management Plan would be a good tool to manage flows in the project area.

Figure 7. April 2011 water management graph inflow versus outflow (Source: Ameren Missouri, June 2011 Monthly Report on the Water Management Plan, 20110729-5253).



Note: Gage no 270 is the inflow gage (USGS gage no. 07061270), and gage no. 290 is the outflow gage below the lower reservoir (USGS gage no. 07061290).

Figure 8. August 2011 water management graph inflow vs. outflow (Source: Ameren Missouri; August 2011 Monthly Report on the Water Management Plan).



The Water Management Plan has detailed reporting requirements for all conditions. For example, when the instantaneous or daily performance criteria are not met, Ameren Missouri would notify Missouri DNR, Missouri DOC, and the Commission within 2 days. If any performance criteria are not met for a period longer than 48 hours, Ameren Missouri would document the event, including the length of the event and steps taken to resolve the conditions, in a written report to be filed with the Commission within 30 days. The Water Management Plan would also require Ameren Missouri to notify Missouri DNR and Missouri DOC during extreme low-flow conditions and during times when maintenance or study activities might result in not meeting the performance criteria, to limit effects on natural resources. Annual reports, which include the data and a statistical analysis of the performance criteria, would be submitted to Missouri DNR, Missouri DOC, and the Commission by April 15 of the following year.

Continued implementation, operation, and reporting of project operations to meet the proposed Water Management Plan criteria would help Ameren Missouri manage project operations, and ensure outflow from the lower reservoir approximates inflow to benefit downstream habitat and recreational uses. The most difficult current criteria standard to meet would be the requirement that outflow from the lower reservoir is not

less than 1.4 times the 3-hour rolling average of the inflow gage for more than 12 consecutive hours, although a similar criterion was met in 2011 for more than 90 percent of the time. Localized precipitation patterns and inflows that would not always be accurately estimated by a single upstream gage make this criterion difficult to meet. Regardless, the proposed Water Management Plan represents a mechanism by which Ameren Missouri could limit the effects of project operation on releases to the East Fork Black River from the lower reservoir and the associated effects on aquatic and recreational resources.

Monitoring Flow and Water Levels

Ameren Missouri currently provides funding for two USGS streamflow gages in the area. Both gages are real-time USGS gages with values recorded at 15-minute intervals and with data available on the internet. Table 7 describes these gages; see figure 1 for locations.

Table 7. Ameren Missouri-funded USGS gages in the project area (Source: USGS, 2011b).

Gage	Name	Parameters Currently Monitored
07061270	East Fork Black River near Lesterville, MO (upstream of the project at State Highway N)	Discharge, temperature, specific conductivity, DO, turbidity, and pH
07061290	East Fork Black River below Lower Taum Sauk Reservoir	Discharge, temperature, specific conductivity, DO, turbidity, and pH

Ameren Missouri proposes to maintain both USGS gage nos. 07061270 and 07061290. Ameren Missouri also proposes to maintain detailed water levels recorders at the lower and upper reservoirs as part of its proposed Water Management Plan and for operational and dam safety requirements.

Missouri DNR recommends that Ameren Missouri include funding for the USGS gages as part of the proposed Water Management Plan. Condition 4.a of the WQC requires that Ameren Missouri operate and maintain both USGS gages for the term of any license issued.

Our Analysis

Existing real-time USGS gaging stations, currently supported by Ameren Missouri, monitor project inflow and outflow, as well as certain water quality

parameters.²⁶ Continuing the existing 15-minute monitoring for the reservoir discharges would be sufficient to measure compliance with the proposed discharge measures in the Water Management Plan. The upstream gage provides key estimates of inflow to the project during especially low and high flow conditions and plays a key role in the monitoring that would be conducted as part of the Water Management Plan.

Continued use of current USGS gages in the immediate project area would also be sufficient to measure compliance with ramping rates and the other parameters in the Water Management Plan, and ensure compliance with water quality.

Groundwater Effects

Water level in the lower reservoir influences the groundwater level in the surrounding area. Daily reservoir-level fluctuations can vary up to 13.5 feet depending on project operation and streamflow.

Ameren Missouri conducted a hydrological study to assess the effects of project-related water-level fluctuation in the lower reservoir on groundwater conditions (Ameren Missouri, 2011a). This analysis focused on modeling the effects of reservoir-level variations on nearby groundwater withdrawal wells. Ameren Missouri also replaced a residential well in March 2011; however, it did not propose any specific measures to address effects on the well except to replace it. None of the commenting agencies recommended any specific measures, but homeowners Mr. Michael Sutton and Ms. Sue Hagen, who live about 1 mile from the shoreline, expressed concerns about effects on groundwater and their well.

Our Analysis

Water levels in reservoirs can affect groundwater in nearby areas by influencing both the groundwater level, and to a lesser extent, the water quality. In addition, fluctuating reservoir levels may affect groundwater levels at distances away from the reservoir based on site-specific characteristics such as the vertical extent of reservoir fluctuation, the rate of fluctuation, the proximity of other sources of recharge such as rainfall and streams, the lake bed conductivity, and local geology.

We reviewed Ameren Missouri's hydrogeological study (Ameren Missouri, 2011a), which summarizes the investigation of the wells and geological conditions surrounding the lower reservoir, including hydrogeology and groundwater modeling completed to evaluate the effects of fluctuating water levels of the lower reservoir. The

²⁶ The gaging stations can be accessed on the Internet at: <http://waterdata.usgs.gov/mo/nwis/current/?type=flow>.

report concluded that the effects on the groundwater level may extend as far as about 0.66 mile from the shoreline of the lower reservoir, but that the extent of influence would be minor in most wells. To allow for uncertainty associated with the modeling and hydrogeology, a zone of influence around the lower reservoir was estimated to be a maximum of 1.25 miles. Ameren Missouri identified six privately owned wells (table 8) within this area; however, the owners of only one well (0217675A) indicated that their well had problems with sediment or water quality, or had noticed any changes in their well since reservoir operations were shut down for the upper reservoir rebuild.

Table 8. Residential wells within 1.25 miles of the Taum Sauk Project lower reservoir (Source: Ameren Missouri, 2011a).

Well ID	Date of Installation	Owner Last Name	Owner First Name	Depth
0003481A	12/2/1987	Adcox	Robert	75
0158078A	7/1/1996	Roessler	John	340
0217675A	1/25/2001	Sutton	Michael	325
0331017A	5/10/2004	Kory	Don	210
4182218	1962	Ameren	Taum Sauk Plant	446
Lee-1	1987	Lee	Ken	220
Lee-2	Unknown	Lee	Ken	65

Note: The Sutton well (ID 0217675A) is co-owned by Michael Sutton and Sue Hagen.

Ameren Missouri's groundwater modeling indicated that it would be unlikely that project operations would affect the Sutton well, located about 0.8 mile from the nearest shoreline of the lower reservoir. In addition, a well owner adjacent to the Sutton well indicated to Ameren Missouri that he had not observed any changes with the operation of his well between the operation and shut-down period of the project. Ameren Missouri did, however, in spring 2011, replace the Sutton well with a new well. There have been no reports of problems with sediments or water quality with the new well.

Upper Reservoir Leakage

Following the upper reservoir rebuild and the resumption of normal operation, leakage was noticed between the joints of the upper reservoir dam. Ameren Missouri stated that it installed an upper reservoir leakage collection system that collects and returns leakage water related to the dam gallery back to the upper reservoir, eliminating leakage discharges.

Our Analysis

Based on Ameren Missouri's filings as part of its dam safety program, upper reservoir leakage ranges from about 3.7 cfs in December to 0.2 cfs in the summer

months. Normal temperature-based expansion and contraction associated with the upper reservoir would likely be the cause for this difference. During our environmental site review, all the drainage swales for the leakage flow appeared to be properly stabilized. This type of leakage would not likely affect the water balance associated with the project; however, leakage flows could affect slope stability. Ameren Missouri's installation of the leakage collection system to capture and return leakage to the upper reservoir would ensure that the leakage does not flow onto land and cause soil erosion.

Operation of the Emergency Overflow Relief Structure

Discharges from the upper reservoir in the unlikely event of an overflow have the potential to affect the stability of the hillside downstream of the stilling basin. Moreover, when the flow reaches Taum Sauk Creek, the flows could cause high water levels, increased velocity, and erosion in the existing natural stream channel.

Missouri Parks Association and Great Rivers commented that they were concerned about the vulnerability of Taum Sauk Creek in the unlikely event of an overflow from the upper reservoir.

Our Analysis

As part of the upper reservoir rebuild, Ameren Missouri constructed an emergency overflow relief structure to control discharges in the unlikely event that all of the water level monitoring and pump shutdown switches failed to operate as planned, and an overtopping of the upper reservoir would occur. This overflow structure would direct flow southeasterly towards Taum Sauk Creek (see figure 1), a tributary to the lower reservoir. The overflow structure was designed to safely convey the released water away from the toe of the dam without affecting its structural integrity. Discharge from the emergency overflow relief structure would be down the concrete steps of the structure into a stilling basin at the bottom of the structure, which would provide additional energy dissipation and prevent scour at the toe of the dam. Water would then flow over the stilling basin weir and discharge down the slope of Proffit Mountain, through a ravine to Taum Sauk Creek and ultimately to the lower reservoir. Design of the structure was a key issue during the rebuild process; its design, as related to the stability of the upper reservoir, has been reviewed and approved in detail by the Commission's Division of Dam Safety and Inspections and other resource and regulatory agencies.

Ameren Missouri provided a report that summarized the emergency overflow release structure and the effects that an overflow event would have on Taum Sauk Creek based on the comparison of the overflow event to natural flood events (Ameren Missouri, 2011a). According to flood flow frequency data shown in table 4, the estimated natural flood recurrence event for a flow equal to a two-pump flow rate discharge (5,358 cfs) is

about 13.7 years and a flow equal to a one-pump flow rate (2,679 cfs) is about 3.6 years.²⁷ The hydraulic analysis conducted by Ameren Missouri used the HEC-RAS modeling that was initially created to model a dam break discharge for the project's emergency action plan associated with the rebuild of the upper reservoir. Ameren Missouri revised and updated this model for the flow rates associated with flow over the structure to model the water surface elevations and velocities along the projected pathway of the discharge.

The depth of the discharge for a two pump overflow event over the 810-foot-long stilling basin would be about 1 foot deep with shallow 'sheet' flow, with velocities up to 5 feet per second downstream on the highly vegetated steep (between 10 and 45 percent) slopes of Proffit Mountain. The extent of erosion in this section along the Proffit Mountain pathway would be related to not only the discharge rate, but also the duration of the event. The modeling conducted by Ameren Missouri shows that velocities in Taum Sauk Creek could reach over 10 feet per second and would result in stream bank and bed erosion. However, in Taum Sauk Creek, the flows and velocities associated with an emergency overflow release would be less than the 25-year flood events in the creek.

Effects on Surface Water Quality

Continued operation of the project would result in the ongoing exchange of water between the upper and lower project reservoirs, which would result in continuous mixing within much of the lower reservoir. This mixing would be one of the reasons that pre-breach water quality sampling showed that project waters were generally consistent with state standards when the project was in operation. The breach event had a major effect on the lower reservoir as a result of the influx of debris and sediment, but much of this debris and sediment has been removed by Ameren Missouri as part of the recovery efforts. Based on 2007 and more recent sampling, water quality may have returned to near pre-breach conditions. Recent water quality data have shown that DO levels have not been consistent with state standards at all times downstream from the lower reservoir dam at the USGS gage, but it is likely a result of drought or low-flow conditions and high summer water temperatures. Ameren Missouri's sampling in the lower reservoir has also shown DO stratification in the reservoir with DO levels lower than 5 mg/L near the bottom in areas of maximum depth, which is typical for stratified reservoirs in the Midwest. Recently recorded turbidity levels at USGS gages both upstream and downstream of the project have shown some spikes of higher levels, but have likely been in response to high rainfall events.

²⁷ This data does not mean that an actual upper reservoir over-topping would be expected to occur on that frequency.

Missouri DOC recommends that DO and turbidity continue to be monitored at the project. Condition 3 of the WQC requires Ameren Missouri to ensure that operation of the project does not “cause state water quality standards to be violated,” and conditions 4 and 4.b of the WQC requires Ameren Missouri to continuously monitor critical water quality parameters upstream and downstream from the project for the life of the license. These parameters include DO, turbidity, pH, conductivity, and water temperature.

Our Analysis

Water quality data collected since the post-breach recovery of the lower reservoir indicate that overall water quality conditions may now be similar to pre-breach conditions when water quality was consistent with state standards most of the time. Although post-breach sampling has indicated occasional higher turbidity levels in the lower reservoir (short-term spikes), those events are unlikely the direct result of project operations. Missouri DOC commented that, when the reservoir is low, shallows are subjected to wave action on windy days, resulting in increases in near-shore turbidity. If that occurs, that would be considered as part of the baseline conditions within the lower reservoir, which may still contain some sediment deposits as a result of the upper reservoir breach or recent major floods.

Based on available data, there appears to be little indication that continued project operation would result in an increase in the frequency of water quality conditions not consistent with state standards. Therefore, there is no project-related basis for implementing a turbidity and DO monitoring program in the lower reservoir and in the East Fork Black River downstream from the dam, as recommended by Missouri DOC and required by the WQC.

The WQC requires monitoring during the term of any license issued, and, as part of the monitoring program, a mechanism to periodically evaluate the results of the monitoring to assist Ameren Missouri and the agencies in determining necessary future actions that may be needed to address any issues detected. Because we conclude that water quality monitoring is not needed, there would be no need for periodic evaluation of results.

In addition to monitoring DO and turbidity, the WQC also requires Ameren Missouri to monitor pH, conductivity, and water temperature. There is also no basis for requiring the monitoring of pH, conductivity, and water temperature, which are parameters more indicative of general watershed conditions or weather conditions, and are generally not affected by hydroelectric project operations.

Other WQC Requirements

The WQC contains several conditions for water quality, aquatic, and terrestrial resources. Condition 3.d of the WQC requires Ameren Missouri to maintain healthy

riparian corridors in the project area for the protection of water quality, and condition 5 requires continued protection of project lands within the watershed to minimize effects on adjacent public lands and to protect the quality of state waters. Condition 6 of the WQC requires the cleanup and reporting of any petroleum spills into waters of the state.

Our Analysis

The proposed project boundary includes all of the lower reservoir, lower Taum Sauk Creek, and short reaches of the East Fork Black River upstream of and downstream from the lower reservoir. Thus, Ameren Missouri controls the riparian corridors associated with these water bodies. Ameren Missouri has not proposed any development or activities that would adversely affect riparian corridors or the watersheds within the project. Conditions 3.d and 5 of the WQC lack specific measures for Ameren Missouri to implement to protect the riparian corridor and watersheds that border adjacent public lands. Therefore, the measures required by the WQC may not minimize any project-related effects that could occur to aquatic and terrestrial resources. As for introducing contaminants to waters of the state, condition 6 would ensure that in the unlikely event of a petroleum spill, the spill would be cleaned up and reported to Missouri DNR in a timely manner. This requirement would help minimize any adverse effects on water quality.

Fisheries Enhancement

Ameren Missouri proposes to continue a “put-and-take” fishery in the lower reservoir, with annual stockings based on a detailed stocking plan developed in consultation with Missouri DOC. Missouri DOC supports a stocking program as a means to provide a recreational fishery in the lower reservoir.

Our Analysis

As previously discussed, the East Fork Black River and the lower reservoir experienced significant effects during the 2005 breach event, and subsequent recovery efforts have occurred. For example, Missouri DOC and Ameren Missouri have already initiated a fish stocking program for the lower reservoir. Ameren Missouri proposes to formalize and continue this measure as an annual effort to maintain and enhance the lower reservoir fishery.

Ameren Missouri’s proposal to continue stocking in the lower reservoir would continue to benefit the fishery of the lower reservoir. The species that would be stocked would be species that now occur in the lower reservoir; however, the full details of this measure have yet to be developed, such as species and number to be stocked and the criteria for changing the species stocked. Therefore, Ameren Missouri should further consult with Missouri DOC in the development of a stocking plan that is based on the agency’s ongoing fisheries monitoring in the lower reservoir. Such a plan could be

evaluated on a periodic basis, such as every 5 years, to determine whether there is a need to update the plan, based on Missouri DOC's monitoring and the success of the fishery.

Fish Entrainment and Passage

Operation of the project results in the entrainment of some fish into the project powerhouse, causing some fish to be transported to the upper reservoir during pumping operations. Fish that survive pumping may reside in the upper reservoir for a period of time, but eventually are likely entrained again during the generating cycle and passed to the lower reservoir. Thus, some fish may be entrained twice and exposed to injury and mortality twice during project operations, reducing the probability that any entrained fish would survive and contribute to the fishery.²⁸

Ameren Missouri conducted a desktop entrainment analysis to assess the potential effects of project operation on fishery resources in the project area (HDR/DTA, 2011b). The analysis focused on entrainment and pumping of fish from the lower reservoir, and concluded that the project layout would act to reduce fish entrainment (a pumped storage project with a long intake canal with little fish habitat, off the main reservoir), that the potential for entrainment would be low to moderate, and the potential for fish injury and mortality would be moderate.²⁹ Ameren Missouri does not propose any specific measures to mitigate any entrainment effects, except to rescue fish from the upper reservoir whenever that reservoir is dewatered for maintenance. Although none of the commenting agencies recommended specific measures, Missouri DOC stated that the effects of entrainment should be assessed in the EA.

Our Analysis

Fish entrainment can be a major source of fish mortality at hydroelectric projects where downstream passage of large numbers of outmigrants occurs, and is typically associated with anadromous species but sometimes involves resident fish populations. We reviewed Ameren Missouri's desktop analysis and the Electric Power Research Institute (EPRI) (1997) summary of fish entrainment studies, which is a database of the results of 43 fish entrainment studies conducted at hydroelectric projects located primarily in the northeast, southeast, and midwestern United States in the early to mid-1990s. Our review indicates that many of the warmwater species occurring in the Taum

²⁸ There is the potential for some fish to be entrained more than twice if they survive the first pump/generating cycle, but those numbers would likely be low.

²⁹ Ameren Missouri's fish entrainment analysis was based on the configuration of the project and the turbine equipment, compared to other projects where fish entrainment and mortality studies were conducted. Thus, the terms "low" and "moderate" are relative terms, meaning in comparison to documented entrainment and mortality at other projects.

Sauk lower reservoir were susceptible to entrainment at other hydroelectric projects that were part of the study, although the extent of entrainment varied among species and from project to project. Most of the other projects studied were conventional hydropower projects and not pumped storage, and most of the fish entrained were typically less than 100 millimeters (4 inches) long and were often juvenile fish or forage species such as minnows that never exceed a length of 3 or 4 inches.³⁰ Assuming that findings at other projects would be indicative of fish that would be entrained at Taum Sauk, most of the fish subjected to passage through the turbines would be young-of-the-year or juvenile life stages, as well as forage species such as gizzard shad or minnow species. The Taum Sauk intakes have a trashrack spacing of 5.87 inches, which would allow all but the largest of fish to pass through the trashracks and enter the pump/generating units. As discussed below, a portion of the fish passing through the turbines would be killed. Similarly, Ameren Missouri's review concluded that the potential for fish injury and mortality would be moderate.

The percentage of entrained fish that would experience mortality cannot be predicted with certainty, although review of the EPRI (1997) database does allow a general estimate of likely mortality. Fish mortality through hydroelectric turbine generators depends on a number of factors, including type of unit, head, hydraulic capacity, runner speed, runner diameter, peripheral runner velocity, number of runner blades, number of wicket gates, number of stay vanes, and clearances inside the unit. In general, Francis units, such as those installed at the Taum Sauk Project, may have higher mortality rates than Kaplan units because of higher runner speeds, smaller clearances within the unit, a higher number of blades, and higher number of wicket gates. Our review of the survival data in EPRI (1997) indicates that, while there is a wide range in survival rates among studies and species (and whether survival is measured immediately or after 24 or 48 hours), survival rates of 70 to 90 percent (mortality rates of 10 to 30 percent) can be achieved with Francis units.

With a pumped storage project, any fish that survive pumping to the upper reservoir would again be exposed to potential injury and mortality if they entered the units during the generating cycle. Any fish that may survive the first pump/generating cycle and that remain in the project tailrace in an area susceptible to entrainment during a subsequent pump/generating cycle would have diminishing chances of survival with each cycle. Actual survival rates would vary among species and fish sizes, but with overall survival rates of 70 to 90 percent, the probability of fish surviving multiple cycles would be low. For example, at a 70-percent survival rate, fish would only have a 24-percent probability of surviving two pump/generating cycles, where fish would pass through the

³⁰ EPRI found that overall, 90 percent of the fish entrained in the 43 studies were less than 4 inches long.

pump turbines four times. At a 90-percent survival rate, this probability would increase to about 66 percent.

Our review of the potential for entrainment at the project indicates that entrainment would be lower here than at conventional hydro projects located at a mainstem dam on a major river, or a pumped storage project located on the main portion of a water body where fisheries habitat would be suitable and fish would be more likely to congregate near the intake. At the project, there is less likelihood that fish would be congregating near the project intake because of the lack of suitable habitat in that area. Undoubtedly, some fish would be found in the vicinity of the intake and could be entrained and killed, or removed from the lower reservoir and become “residents” to the upper reservoir for a time. Those fish would be unavailable for harvest by anglers, and could be exposed to entrainment mortality a second time if they exit the upper reservoir during generation (the only option for leaving the reservoir). However, if most of the fish entrained and killed are in a size range of less than 4 inches (EPRI, 1997), the loss of individual fish of this size range (which may include juvenile life stages or forage species) would be unlikely to affect the overall fish populations in the lower reservoir. For most of the species present at the project, this size class typically experiences high natural mortality rates, even in river systems unaffected by hydro operations.

Ameren Missouri proposes to rescue fish that become trapped in the upper reservoir during a maintenance drawdown. This measure would help save fish that may otherwise be lost, but the success of this rescue effort would depend on the depth and duration of the drawdown.

Flow Releases

The lower reservoir dam controls flows into the East Fork Black River. The existing license does not require a minimum flow; however, Ameren Missouri is operating the project to be consistent with the proposed Water Management Plan, which stipulates a minimum flow of 1.7 cfs. Ameren Missouri would also operate the lower reservoir as essentially run-of-river with outflow approximating inflow. Flows may range from a low of less than 1 cfs to as high as 9,000 cfs on an annual basis, but typical releases from the dam during low-flow periods of the year range from 1 to 3 cfs (see table 3). These flows affect aquatic habitat in the river, resulting in a range of available habitat during the year.

Ameren Missouri does not propose to change current operations, and no entity recommends any changes to this operation. However, the East Ozarks Audubon Society recommends an assessment of the effects of this operation on the river ecology. In addition, Missouri DOC recommends that: (1) moderate flood events be passed over the lower reservoir dam, to maintain the stream channel downstream of the dam; and (2)

means other than flow be considered to provide for the movement of bedload through the system.

Our Analysis

Ameren Missouri conducted studies on the East Fork Black River from the lower reservoir dam to the confluence with the West Fork Black River, assessing the aquatic habitat that would be available at a range of flow releases from the dam (HDR/DTA, 2010). Flows investigated included 1.9 and 7.6 cfs, which represented a range of typical flows during low-flow months. Parameters recorded included wetted width, depth, velocity, habitat type, temperature, and DO. A third flow (17 cfs) was also selected for observation because it approximated the flow in the river during a 2008 habitat study. This study did not attempt to apply species habitat criteria to the physical data to estimate an aquatic habitat index by species, as would occur with an Instream Flow Incremental Methodology study.

This study found only a minimal gain in wetted area and essentially no change in habitat types when the flow was increased from 1.9 to 7.6 cfs (table 9). For the entire reach, the gain in wetted area totaled less than 1 acre (0.79 acre), or about 2.5 percent. Wetted width and depth were also measured on 36 habitat transects within the study area. The average increase in wetted width between the 1.9- and 7.6-cfs flow at the 36 transects was 4.8 feet or about 16 percent (table 5 in HDR/DTA, 2010). The increase in wetted width between the 7.6- and 17-cfs flows was about 4 percent. The change in depth between the 1.9- and 7.6-cfs flows ranged from 0.05 to 0.33 foot (0.6 to 4 inches) at the 36 transects, with most transects showing an increase in depth of less than 0.2 foot (2.4 inches). At the 17-cfs flow, water depths generally remained within the same range as observed at the 7.6-cfs flow, although a few transects showed an increase of less than 1 inch (HDR/DTA, 2010). Increases in water velocity were observed at some habitat transects as flow was increased from 1.9 to 7.6 cfs, and then to 17 cfs, although not in all habitat types, such as pools. Overall water quality was consistent with state standards at all flow levels, although DO levels less than 5 mg/L were observed in a few shallow pool/glide habitat locations at the 1.9-cfs flow. Water temperatures were generally 2 to 6°C (about 4 to 11°F) cooler at the 7.6-cfs flow, and fewer low-DO readings were observed. The study area is a dynamic reach of river, often affected by high, channel-forming flows, resulting in shifting sands and gravels, while at the lowest discharges, subsurface flow occurs in some areas. The reach is also affected by beaver activity, which in turn affects aquatic habitat because beaver dams are constructed and then breached by high-flow events.

Table 9. Wetted area by dominant habitat type at 1.9 and 7.6 cfs, East Fork Black River
(Source: HDR/DTA, 2010).

Habitat Type	No. of Types Mapped	Area at 1.9 cfs (Acres)	Area at 7.6 cfs (Acres)	Wetted Area Gained
Run complex	2	1.10	1.12	0.02
Run	2	0.90	0.86	0.07
Riffle complex	8	2.82	3.00	0.18
Riffle	11	1.67	1.75	0.08
Rapid	1	0.12	0.12	<0.01
Pool	23	19.24	19.59	0.36
Glide complex	7	2.01	2.02	0.01
Glide	4	2.65	2.72	0.08
TOTAL	58	30.40	31.18	0.79

The results of Ameren Missouri's habitat survey indicates that increased flows in the East Fork Black River downstream from the lower reservoir dam (from 1.9 to 7.6 and 17 cfs) would have little effect on physical habitat in the reach. Gains in wetted area, wetted width, and depth would not be substantial. Some small improvements in water quality (water temperature and DO) were observed at the higher flow levels (7.6 and 17 cfs). Available fish community information from Ameren Missouri and Missouri DOC in the East Fork Black River indicates good species diversity under existing conditions, although the community is dominated by smaller cyprinid species (minnows and chubs), darters, and some sunfish. These observations indicate that this reach would not require a specified minimum flow release from the dam higher than 1.7 cfs, as provided for in the Water Management Plan. The minimum flow of 1.7 cfs would adequately protect aquatic resources in the East Fork Black River downstream from the lower reservoir dam.

The draft Water Management Plan includes a provision that would allow Ameren Missouri to make adjustments to the plan (see section 3.3.2, *Aquatic Resources, Water Quantity*). This provision would allow Ameren Missouri and the resource agencies to consider new monitoring data and address operational and environmental changes over the course of any new license for the project. If any such adjustments lead to a change in

run-of-river operation or minimum flows, Ameren Missouri would need to file a license amendment application with the Commission to change any aspect of operation.

With regard to Missouri DOC's recommendation that moderate flood events be passed over the lower reservoir dam, under the proposed action, the lower East Fork Black River would continue to receive channel-forming flows during storm-related high-flow periods, because the lower reservoir dam has minimal flood-control capability and would have no ability to control moderate to large flood events. These flows would continue to affect aquatic habitat by eroding the stream banks and re-distributing woody debris, gravel, sand, and finer substrate in the reach.

While high flows would continue to shape the geomorphology of the lower East Fork Black River, the lower reservoir dam and bin wall located at the headwaters of the lower reservoir likely has limited bedload movement and diminished gravel recruitment to the river downstream from the dam. Missouri DOC is interested in reestablishing bedload movement through the system; however, Ameren Missouri proposes only to periodically clean out and dispose of the bedload material from behind the bin wall.

The material removed from behind the bin wall would require disposal. The gravel and other bedload is natural material from the upper reaches of the East Fork Black River. Therefore, the removed material would be a good source of bedload material for placement in the river downstream from the dam, and thus would restore at least some bedload movement that has been interrupted by the presence of the dam. As reported by HDR/DTA (2010), this section of the river is a dynamic reach with constantly shifting habitat, and adding coarse grained sediment via trucking may provide at least some short-term benefits to aquatic habitat downstream from the dam. For the aforementioned reasons, modifying the draft Gravel and Sedimentation Control Plan to include a provision for trucking coarse grained sediment from upstream of the bin wall to a location(s) downstream from the lower reservoir dam would be a reasonable approach to addressing the issue of bedload movement within the East Fork Black River. To enhance the effectiveness of such a measure, the plan would need to be modified to include a description of: (1) the proposed frequency of trucking (e.g., whenever the bin wall is cleaned out); (2) the proposed location(s) for release of the bedload material;³¹ (3) the proposed grain sizes of bedload material to be released; and (4) a monitoring program to ensure that the trucked bedload material is not exceeding the capacity of the East Fork Black River to distribute the material, or is causing secondary adverse effects

³¹ For example, gravel should be placed in locations where aquatic habitat can be improved, but should not be placed in a location that would affect the hydraulic conditions or accuracy of the USGS gage no. 07061290, located immediately downstream from the lower reservoir dam. In addition, locations should be where trucks could easily access the river without having to construct extensive access roads.

such as increasing the potential for downstream flooding. Additional discussion of the effects of the project on sediment transport can be found in section 3.3.1, *Geologic and Soils Resources*.

Lower Reservoir Woody Debris and Habitat

As previously described, large volumes of sediment and woody debris were removed from the lower reservoir as part of the recovery efforts associated with the 2005 breach event. Missouri DOC comments that almost all significant habitat features were removed from the lower reservoir after the breach, and that daily water level fluctuations associated with project operation affect habitat availability for reservoir fish species and these effects should be considered. Missouri DOC also comments that: (1) fisheries management in the reservoir depends on natural recruitment of largemouth bass and bluegill; (2) reservoir-level fluctuations affect when habitat is available to those species; and (3) the effects of removing the woody and other habitat should be analyzed. Ameren Missouri does not propose any specific habitat enhancement measures for the lower reservoir, although it does propose a long-term fish stocking program, as previously discussed. Condition 3.g of the WQC requires that Ameren Missouri must continue to support efforts to improve aquatic habitat in the lower reservoir.

Our Analysis

Operation of the lower reservoir involves a fluctuation of up to 13.5 feet on a weekly basis, with somewhat lower fluctuations on a daily basis. The recovery efforts following the breach event had a major effect on aquatic habitat in the reservoir, but those effects have not been quantified. Ameren Missouri surveyed habitat in the lower reservoir, but primarily within the reservoir drawdown zone or immediately below the minimum reservoir level, and found that habitat was limited within this zone, except at the highest reservoir levels when shoreline terrestrial habitat is inundated (HDR/DTA, 2011a). The combination of the reservoir level fluctuations and existing poor habitat limits natural fish production in the reservoir, and may also limit the measures that can be taken to improve habitat and fish production. Missouri DOC reports that the largemouth bass population has reestablished itself in the reservoir after the breach event and recovery efforts, likely a result of the 3 years that the lower reservoir was held at a constant elevation during the reconstruction of the upper reservoir.

Maintaining a constant reservoir level would allow some species to successfully spawn, but such a measure would not allow the pumped storage project to operate as designed, and thus would not be operationally feasible. However, placement of artificial structures within the lower reservoir could enhance fish habitat. Structures have long been used as a fishery management tool in reservoirs to improve habitat for reservoir species by providing shelter and cover for adult and juvenile fish and enhancing conditions for spawning. Structures may take many forms, including log cribs, tires,

anchored logs/woody debris/brush piles, rock piles or rubble, and even used Christmas trees. For the lower reservoir, placement of structures at different elevations would need to occur within the reservoir, so that structures would be available to fish at all reservoir levels. Structures, however, would need to be designed so that fish are not stranded as water levels recede during project operation. Ameren Missouri reports that the maximum rate for water level change within the lower reservoir is 2 feet per hour (0.4 inch per minute), which should allow fish sufficient time to withdraw from appropriately designed structures.

Missouri DOC comments that the natural recruitment of largemouth bass and bluegill to provide a fishery for bass is a fisheries management objective for the lower reservoir. Missouri DOC's published management objectives for the Black River Basin include: "GOAL III. Maintain diversity of native aquatic organisms and improve the quality of fishing" (<http://mdc.mo.gov/landwater-care/stream-and-watershed-management/missouri-watersheds/black-river>, accessed November 23, 2011). Improving habitat through artificial structures within the lower reservoir would enhance fish production in the lower reservoir, and be consistent with Missouri DOC's management goals. In addition, such a measure would protect and enhance fish and wildlife resources within the project area.

Ameren Missouri does not propose any habitat enhancements for the lower reservoir. While Missouri DOC recommends habitat enhancement, it did not provide specific recommendations for such measure. Therefore, any habitat enhancements installed in the reservoir would need to be preceded by preparation of a habitat enhancement plan. That plan would be prepared after consultation with Missouri DOC and Missouri DNR, and, at a minimum, include: (1) specific objectives of the habitat enhancement program for largemouth bass, bluegill, and any other target species; (2) the proposed locations for the habitat enhancement structures to be placed in the Taum Sauk Creek and East Fork Black River arms of the lower reservoir, including the elevations of the proposed structures within the reservoir; (3) the design(s) of habitat enhancement structures chosen (e.g., log cribs, tire reefs, anchored woody debris, rock piles, anchored used Christmas trees, or any other alternative designs that may be identified during consultation with the agencies); (4) a schedule for the placement of the structures; and (5) a 5-year monitoring program to assess fish usage of the structures, and any effects the structures have on fish production in the reservoir. This plan would be consistent with condition 3.g of the WQC, which requires Ameren Missouri to support efforts to improve aquatic habitat in the lower reservoir.

3.3.3 Terrestrial Resources

3.3.3.1 Affected Environment

Vegetation

Ameren Missouri completed a vegetation cover type mapping and invasive weed survey study (2011b) as part of the relicensing process. The study identified deciduous forest, bare exposed rock, barren/sparsely vegetated, grass/forb, developed/project facilities, conifer forest, mixed forest, glade habitat/rock outcrop, right-of-way (ROW)/shrub, gravel wash/gravel bar, riparian forest, high-water channel, riverine, and open water as cover types within the project boundary. Within the entire study area, deciduous forest is the most prevalent cover type (1,842 acres, or nearly 67 percent), with dominant vegetation consisting of mature oak-hickory trees, and in some areas, a park-like understory with small tree saplings and seedlings. About 218 acres of the study area support vegetation within the mixed forest cover type. Stands of mixed forest are botanically more diverse than deciduous stands.

About 93 acres of the project boundary consist of the developed/project facilities and barren/sparsely vegetated cover types. These areas, such as roads, roadsides, old clearings, operation and maintenance areas, road embankments, and graveled parking/staging areas, are generally disturbed and developed and primarily support only weedy species. Developed and project facility areas are characterized by forest edges, meadow-like openings, and maintained areas (e.g., visitor center and museum) that transition into forest edges.

About 50 acres of the project boundary are composed of the grass/forb cover type, which is defined as non-forested areas where grass and forbs are dominant with little bare ground (less than 30 percent). About 4 acres of the project boundary are composed of glade habitat/rock outcrop areas, generally restricted to the north and northeast of the upper reservoir and some scattered areas to the south of the Ameren Missouri radio tower. About 45 acres of the project boundary support vegetation within the ROW/shrub cover type. Most of the remaining vegetation in the project boundary is identified as riparian forest (18.3 acres), which is associated with streams and rivers, occurring in the transition zone between aquatic and upland areas. Gravel wash/gravel bar areas, which consist of recently formed gravel bars and older gravel bar terraces (4 acres), are also present, and conifer forests (7 acres), which consist of mature short-leaf pine with eastern red cedar in the overstory, comprise the remainder of the study area.

Wetlands

Ameren Missouri's vegetation cover type mapping and invasive weed survey study identified the following wetland types within the project area:

- *palustrine emergent wetlands* - characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens. These wetlands mostly occur in areas along the shorelines of the lower reservoir or in some cases within topographic depressions separate from the lower reservoir. A total of 17 acres of palustrine emergent wetland are present in the study area;
- *scrub-shrub wetlands* - these wetlands generally support woody vegetation that is less than 20 feet tall, and are often seasonally flooded and saturated to the surface throughout the growing season. Shrub-dominated wetlands are relatively common in the study area; are also represented in the riparian zone associated with Taum Sauk Creek, Little Taum Sauk Creek, and Walker Branch; and comprise about 9 acres of the study area;
- *forested wetlands* - these wetlands generally support woody vegetation that is 20 feet tall or taller and typically possess an overstory of trees, an understory of young trees or shrubs, and an herbaceous layer. Forested wetlands occupy a total of 45 acres of the project study area; and
- *lacustrine unconsolidated bottom wetlands* - these wetlands account for 53 acres of the study area. This cover type consists of wetland and deepwater habitats associated with depressions or dammed channels greater than 19.7 acres, and with less than 30-percent tree, shrub, or emergent vegetation cover.

Wildlife

A variety of wildlife species occur in the diverse habitats surrounding the project. The project area is located near the confluence of several mountains (Proffit, Church, and Lee mountains) and within the St. Francois Knobs and Basins Ecological Subsection, resulting in a diverse mix of flora and fauna.

Big game species known to occur in the project area include white-tailed deer and black bear. Numerous furbearers and other small- to medium-sized mammals are also present in the general project vicinity.

The various habitat areas associated with the project provide breeding, migratory stopover, and wintering habitat for a high diversity of bird species, including Neotropical songbirds, resident species, waterbirds, waterfowl, and raptors. The project is within the Black River Watershed Important Bird Area. According to the National Audubon Society, cerulean warblers are numerous along the Black River during their breeding season, and red-shouldered hawks have nested at Johnson's Shut-Ins State Park. The Black River Watershed Important Bird Area is in the contiguous forest of the Ozark Highlands, which provides suitable nesting habitat for forest-interior songbirds. The river corridor, including the lower reservoir and adjacent wetlands, also attracts a wide variety of waterfowl.

Additionally, several species of birds of prey are known or suspected to use the project area and the adjacent upland areas, especially during migration. Some of these species include the bald eagle, Cooper's hawk, red-tailed hawk, American kestrel, great horned owl, and barred owl. These species use many different habitat types throughout the year including woodland, scrub-shrub or early successional areas, as well as wetland and open water areas. The bald eagle is known to traverse through the project area. However, there are no known nests or occupied territories in the project area.

Reptiles and amphibian species inhabit many different habitats in the project area, such as deciduous, early successional, wetland, and riparian cover types. Use of these areas may shift during different life stages and/or times of year.

Invasive Species

Ameren Missouri's 2010 field surveys for invasive species identified two invasive plant species in the project boundary, lespedeza and multiflora rose. Feral hogs are also known to occur in the project boundary. Information on the occurrence, description, biology, and ecology of these species is provided below.

Lespedeza

Lespedeza is an introduced perennial legume that is not currently designated as a noxious weed in Missouri; however, Missouri DOC considers it to be an invasive exotic plant species. Lespedeza grows in woodlands, thickets, fields, and especially along roadsides. The legume shows great resistance to summer drought and an ability to form a dense stand on sterile, steep, or eroded slopes. Lespedeza dominates several developed sites within the project, particularly along roadsides, trails, older two-track roads, and along the lower reservoir where temporary roads were constructed during restoration activities that involved dredging, which were performed after the breach of the upper reservoir. These stands are robust and provide a source for spreading lespedeza into surrounding habitats.

Multiflora Rose

Missouri designated multiflora rose as a noxious weed in 1983. Multiflora rose is extremely widespread, and is expected to occur in all Missouri counties. Numerous scattered stands of multiflora rose were identified on project lands, particularly along roadsides, trails, streambanks, along the lower reservoir, and old two-track roads. These stands are relatively small, averaging 10 feet long by 10 feet wide, but provide a source for spreading multiflora rose into surrounding areas.

Feral Hogs

Feral hogs are known to occur at the project, but the current size of the population is unknown. Feral hogs have been raised as a concern by Missouri DOC and Missouri DNR because they damaged native habitats. As described by Missouri DOC (2008), feral hogs are very adaptable and prolific, and cause a wide variety of problems for private landowners, fish and wildlife managers, and nature enthusiasts. They are very destructive to sensitive natural areas such as glades, fens, and springs, and their tendency to wallow in wet areas can destroy these types of important habitats. The rooting and feeding behavior of feral hogs also contributes to soil erosion and reduces water quality. They are omnivorous and can consume reptiles and amphibians, eggs of ground-nesting birds, and deer fawns.

Special Status Species

This section addresses information on state-listed and sensitive species. Federally listed species are discussed in section 3.3.4, *Threatened and Endangered Species*.

For the various terrestrial habitats in the project vicinity, Missouri DOC lists seven birds, two amphibians, two insects, and two mammals as state species of concern. The state status of these species varies from widespread and apparently secure (but of long-term concern), to critically imperiled. Table 10 provides a list of sensitive wildlife species observed in or near the project.

Table 10. Sensitive species potentially occurring in the project area (Source: Ameren Missouri, 2008).

Common Name	Scientific Name	State Rank	Global Rank	Preferred Habitat
Cooper's hawk	<i>Accipiter cooperii</i>	S3	G5	Breeds primarily in mature forest, either broadleaf or coniferous, mostly the former; also open woodland and forest edge. Generally is an inhabitant of deep woods, utilizing thick cover both for nesting and hunting (NatureServe, 2011).
Sharp-shinned hawk	<i>Accipiter striatus</i>	S3	G5	Primary habitat is boreal forest with nesting habitat similar to that described above for Cooper's hawk (NatureServe, 2011).
Eastern collared lizard	<i>Crotaphytus collaris</i>	S4	G5	Often observed basking in sun on rocks. In Missouri, the eastern collared lizard lives among rocks on dry, open, south- or southwest-facing limestone, sandstone, and granite glades. Collared lizards require habitat that is open and sparsely covered by prairie grasses and forbs and has an abundance of exposed bedrock and flat rocks for shelter.
Four-toed salamander	<i>Hemidactylium scutatum</i>	S4	G5	Adults live under objects or among mosses in swamps, boggy streams, and wet, wooded or open areas near ponds or quiet, mossy or grassy pools (the larval habitat). Sphagnum moss is commonly abundant in suitable habitat. Eggs are

Common Name	Scientific Name	State Rank	Global Rank	Preferred Habitat
				laid in moss or other protected sites immediately above or next to a pool, into which the larvae drop or wriggle after hatching (NatureServe, 2011).
Black bear	<i>Ursus americanus americanus</i>	S3	G5	Inhabit forests and nearby openings, including forested wetlands. When inactive, they occupy dens under fallen trees, ground-level or above-ground tree cavities or hollow logs, underground cave-like sites, or the ground surface in dense cover. Black bears prefer mixed deciduous-coniferous forests with a thick understory but may occur in various situations (NatureServe, 2011).
Cerulean warbler	<i>Dedroica cerulean</i>	S2/S3	G4	Breeds in bottomland forests, floodplains or other wet habitats with tall, mature deciduous trees. Diet consists primarily of insects found on tree leaves as well as flying insects.

Notes:

■ **State Rank:**

- S2 = Imperiled in the state because of rarity or because of some factors(s) making it very vulnerable to extirpation from the state. (6 to 20 occurrences or few remaining individuals)
- S3 = Rare and uncommon in the state. (21 to 100 occurrences)
- S4 = Widespread, abundant, and apparently secure in state, with many occurrences, but the species is of long-term concern. (usually more than 100 occurrences)

■ **Global Rank:**

- G4 = Uncommon but not rare (although it may be rare in parts of its range, particularly on the periphery), and usually widespread. Apparently not vulnerable in most of its range, but possibly cause for long-term concern. Typically more than 100 occurrences and more than 10,000 individuals.
- G5 = Demonstrably widespread, abundant, and secure globally, though it may be quite rare in parts of its range, especially at the periphery.

3.3.3.2 Environmental Effects

Wildlife and Wetlands

Project operation results in daily water level fluctuations in the lower reservoir, which affects wetlands and riparian vegetation, as well as wildlife species that use the banks and shallow water habitats, such as waterfowl and amphibians. In addition, wetlands and riparian areas in the East Fork Black River downstream of the lower reservoir are also affected by varying water releases.

Ameren Missouri proposes to operate the project with no changes to existing operation. Ameren Missouri also proposes to implement a Water Management Plan to protect downstream aquatic habitat by matching the outflow from the lower reservoir to the variable inflow to the extent possible. Ameren Missouri does not propose any measure directly related to wetlands or wildlife. No comments, measures, or recommendations regarding wetlands or wildlife were filed by any resource agencies or stakeholders.

Our Analysis

Because proposed project operation would be the same as existing operation, current wildlife habitat would be unchanged by project operation.

Under current and proposed project operation, water levels can fluctuate in the lower reservoir between the normal minimum operating elevation of 736 feet msl and the normal maximum operation elevation of 749.5 feet msl. While the lower portion of the fluctuation zone is largely devoid of vegetation, as this area is dewatered daily, wetlands have developed in the upper portions of the fluctuation zone, and are healthy and tolerant of the project's operation (Ameren Missouri, 2011b). Because proposed operations would continue using the existing regime, wetlands in the lower reservoir would not be adversely affected. In addition, wetlands and riparian habitat downstream of the lower reservoir dam in the lower East Fork Black River would continue to not be affected by project operations, because the proposed operating regime in the lower reservoir would mimic natural conditions; that is, the outflow from the lower reservoir would match the variable inflow. The wetlands and riparian habitat in the lower East Fork Black River would continue to be maintained at current levels.

Invasive Species

Vegetation maintenance, ground-disturbing activities, recreation, and project operation resulting in impoundment-level fluctuations could all contribute to the proliferation or establishment of invasive plant species. Feral hogs can cause disturbance in natural habitats.

Ameren Missouri does not propose any measures associated with invasive species, although Ameren Missouri reports that it is collaborating with resource agencies to discuss and implement feral hog management techniques. Missouri DNR recommends that Ameren Missouri contribute to local efforts to control feral hogs by working with Missouri DNR, Missouri DOC, and federal agencies to support comprehensive trapping and other eradication efforts in and near the project area. Missouri Parks Association and Great Rivers state that feral hogs in the areas surrounding the project have caused significant damage to both public and private property. Condition 3.d of the WQC requires Ameren Missouri to continue to allow access to the project lands for the agencies to trap and/or kill feral hogs, and support the Feral Hog Task Force's efforts to control and eradicate feral hogs in the area. Condition 3.f of the WQC requires Ameren Missouri to support agency efforts to control non-native species.

Our Analysis

Ameren Missouri's invasive plant surveys indicate that lespedeza is widespread throughout the project, whereas, multiflora rose is more localized (Ameren Missouri, 2011b). These surveys found that these invasive species occur mainly in disturbed uplands such as near roads, as well as near the riparian/upland interface of the lower reservoir. Past project operation and maintenance activities related to vegetation maintenance, water level fluctuations, and recreation have contributed to the proliferation of these invasive species, and it is likely that these activities would continue to contribute to the continued presence of these species in the future. The spread of these invasive plants also occurs through non-project activities in surrounding areas, as well as from non-project traffic on project roads. Because the lespedeza is so widespread and both invasive species are located adjacent to areas that include non-project activities, efforts to eradicate or significantly control these species would not likely succeed. However, using methods such as revegetating disturbed sites with native species, as was done as part of Ameren Missouri's Upper Reservoir Rebuild Reforestation Plan,³² minimizes the risk of introducing non-native invasive species. Continuing these efforts as part of a

³² The Upper Reservoir Rebuild Reforestation Plan required that the construction laydown and staging areas (62.9 acres) near the toe of the upper reservoir that were necessary for the upper reservoir rebuild be revegetated with native trees and vegetation, and that the trees and vegetation be monitored for a 5-year period. The plan was approved by the Commission on March 27, 2009, and modified on September 17, 2010. On October 2, 2012, Ameren Missouri requested delaying replanting native trees and vegetation until the fall of 2013 because feral hogs and poor weather conditions resulted in poor survival of the previously planted vegetation in the 2012 season. On December 4, 2012, the Commission acknowledged the request, and because Ameren Missouri was taking corrective actions as required in the plan, further action by the Commission was not necessary.

reforestation plan, as discussed below, would help reduce lespedeza and multiflora rose in the areas disturbed by the rebuild construction.

Although feral hogs occur within the project boundary, they are also present throughout Missouri and other states. Because the project does not directly contribute to the proliferation of feral hogs, Ameren Missouri should not be required to implement comprehensive trapping and other eradication efforts in and near the project area or support the Feral Hog Task Force's efforts to control and eradicate feral hogs in the area. However, fertilizer packets, used to promote growth of the trees planted as part of the Upper Reservoir Rebuild Reforestation Plan, have attracted feral hogs to the upper reservoir. Ameren Missouri is cooperating with Missouri DNR in an attempt to control feral hogs on project lands. Ameren Missouri's continued cooperation with Missouri DNR to allow the agency access to the project lands to trap and/or kill feral hogs the project would help ensure that the revegetation survivability goals of the reforestation plan, as discussed below, would be met.

Upper Reservoir Lighting

As part of the reconstruction of the upper reservoir, Ameren Missouri installed safety lighting around the facility. East Ozarks Audubon Society recommends that the effects of the project's upper reservoir structure and lighting on migratory birds and bats be further analyzed.

Our Analysis

Most efforts to minimize light during bird migration periods have occurred in urban areas where attraction to light could cause collision with tall buildings (City of Toronto, 2007; City of Boston, 2011; Oregon Live, 2011; Audubon, 2011). Lighting may disorient migratory birds and bats passing through the project area; however, it is unknown what level of lighting would cause a measurable effect. Neither Audubon, Ameren Missouri, nor any resource agency have documented any known effects on migrating birds at the project. Therefore, there is no substantial evidence that changes in lighting are needed to mitigate effects on migrating birds. We discuss effects of the lighting on aesthetic resources in section 3.3.7, *Aesthetic Resources*.

Rare Species

Although rare plant surveys did not identify any rare plant species in the project area, the collared lizard was observed in the project boundary. Ameren Missouri does not propose any measures related to the collared lizard. Missouri DNR recommends that a protection plan for threatened and endangered plant and animal species, including the Ozark hellbender, be developed because the project area includes a number of sensitive natural communities. Missouri DOC recommends a protection plan be developed for all

threatened or endangered species on Ameren Missouri lands. Neither agency, however, provided any specific recommendations for these plans.

Our Analysis

The Ozark hellbender, a federal candidate species, is not known to occur in Reynolds County. The only rare species known to occur in the project boundary is the eastern collared lizard. Areas where surveyors observed collared lizards and collared lizard habitat, such as slopes near the upper reservoir prior to the location of the breach, as well as downstream of the lower reservoir on southerly ledge faces, do not occur within the project's reservoir fluctuation zones. Also the collared lizard and its habitat are not within project recreation areas, nor are they in any other areas that are affected by project operations. A protection plan, as recommended by Missouri DNR and Missouri DOC, would provide no benefit because the project does not affect the collared lizard or its habitat.

Vegetation Management

As part of the reconstruction efforts of the upper reservoir, Ameren Missouri cleared 62.9 acres near the upper reservoir for construction staging and laydown areas. Ameren Missouri implemented the Upper Reservoir Rebuild Reforestation Plan to mitigate for the loss of forest and forested habitat at the upper reservoir during reconstruction. Ameren Missouri also used the area near the lower reservoir boat ramp and campground for the rebuild efforts. The area near the boat ramp and campground was used as a parking lot for contractors, and as a staging area for materials and equipment.

Missouri DNR recommends Ameren Missouri continue to maintain the trees that were planted as part of the Upper Reservoir Rebuild Reforestation Plan, and address the need for additional tree plantings or appropriate native plants where land is disturbed.

Our Analysis

The reconstruction of the upper dam required the clearing of nearby areas to stage the reconstruction. The development of construction laydown and staging areas resulted in damages to the ground surfaces, vegetation, and terrestrial habitat.

The Upper Reservoir Rebuild Reforestation Plan requires revegetating the construction laydown and staging areas near the toe of the upper reservoir with native trees and vegetation, as well as monitoring the planted trees and vegetation for a minimum of 5 years in order to achieve a 70-percent survival rate. Planting native trees and vegetation in areas disturbed by the upper reservoir rebuild activities would ultimately restore native wildlife habitat. However, Ameren Missouri does not propose to monitor and maintain the previously planted vegetation beyond the initial 5-year

period. The purpose of monitoring is to ensure the planted seedlings reach a level of growth for which they no longer require continued maintenance for survival.

As part of the revegetation efforts, Ameren Missouri first planted tree seedlings and ground cover in fall of 2010. However, results from Ameren's first annual monitoring report indicate that while the young seedlings were surviving, their survival rate was low due to effects from minor erosion, temporary rainwater ponding, wildlife damage, and weather events that lead to broken branches, stems and trunks. At the time of the first report, approximately 25 percent of the trees were found dead. The report also noted that volunteer tree recruitment was not observed anywhere within the designated planting sites.

Since the first report, Ameren Missouri filed an update with the Commission stating that feral hogs moved into the area and uprooted many of the tree seedlings in search of the fertilizer packets that were placed in the planting sites along with the tree. In the spring of 2012, Ameren Missouri cooperated with Missouri DNR in an attempt to control feral hogs on project lands. Ameren Missouri concluded that the combination of an early spring followed by an extended exposure to excessive heat and drought during a long summer with the seedling destruction from feral hogs resulted in the death of most of the newly planted trees. Ameren Missouri reports that as a result, the survival rate in some areas is less than 5 percent, and as a result, plans to plant tree again in the fall of 2013.

Because of the damage to newly planted seedlings from drought, erosion, weather, and feral hogs, replanting and reinitiating monitoring efforts would enable Ameren Missouri to achieve its revegetation goals. Following the existing Upper Reservoir Rebuild Reforestation Plan methods for all areas proposed for revegetation activities, while continuing to cooperate with Missouri DNR in an attempt to control feral hogs on project lands, would allow for more comprehensive and effective management of newly planted seedlings. Monitoring and management of the seedlings for a minimum of 5 years after Ameren Missouri's newly scheduled planting in the fall of 2013 would help to ensure the seedlings reach the initially planned survival rate of 70 percent and are well established at the project. In addition, the benefits from habitat restoration and aesthetic views at the project would be further enhanced by revegetating the staging areas near the lower reservoir boat launch and campground.³³

A reforestation plan that contains the requirements of the existing Upper Reservoir Rebuild Reforestation Plan, while providing for revegetation of the lower reservoir staging area, would enable native vegetation to become re-established and improve terrestrial habitat in areas that would otherwise remain disturbed. In addition, the

³³ The staging areas at the lower reservoir are not required to be revegetated under the Upper Reservoir Rebuild Reforestation Plan.

planting of native species would help deter the establishment and proliferation of invasive species in these areas, and would also improve aesthetic resources (discussed further in section 3.3.7, *Aesthetic Resources*).

3.3.4 Threatened and Endangered Species

3.3.4.1 Affected Environment

Four federally listed species are known to occur in the Taum Sauk Project vicinity; the endangered gray bat (*Myotis grisescens*), Indiana bat (*Myotis sodalis*), and Hine's emerald dragonfly (*Somatochlora hineana*), and the threatened Mead's milkweed (*Asclepias meadii*).

Mead's Milkweed

Mead's milkweed is a federally listed threatened plant species that is known to occur in Reynolds County. Mead's milkweed is a herbaceous perennial that flowers from late May to mid-June, found on moderately wet (mesic) to moderately dry (dry mesic) upland tallgrass prairie or glade/barren habitat. Ameren Missouri conducted surveys for this species within the project boundary in June 2010. The surveys identified about 19 acres of igneous glade habitat on top of Proffit Mountain, which is a similar habitat to areas outside of the project boundary that are known to contain Mead's milkweed; however, no Mead's milkweed plants were found on project lands (Ameren Missouri, 2011c). The 19 acres of habitat are located near the upper reservoir in a fenced area, and are maintained by Ameren Missouri.

Hine's Emerald Dragonfly

The federally endangered Hine's emerald dragonfly can be found in Illinois, Michigan, Missouri, and Wisconsin (FWS, 2001). This species of dragonfly lives in calcareous spring-fed marshes and sedge meadows overlaying dolomite bedrock, and prefers sites with groundwater-fed, shallow, slow-flowing water through vegetation. Habitat loss and degradation are the greatest threats to the Hine's emerald dragonfly (FWS, 2001). Although critical habitat was designated in Reynolds County, none occurs in the project boundary.

Indiana Bat and Gray Bat

The Indiana bat was listed as endangered on March 11, 1967. Although critical habitat was designated on September 23, 1976, none occurs in the project boundary or within Reynolds County. The Indiana bat is a temperate, insectivorous, migratory bat that hibernates colonially in caves and mines in the winter. In spring, reproductive females migrate and form maternity colonies where they bear and raise their young in wooded areas. Summer roosts are typically behind exfoliating bark of large, often dead,

trees. Males and nonreproductive females typically do not roost in colonies and may stay close to their hibernaculum or migrate to summer habitat (FWS, 2007).

According to the draft Indiana bat recovery plan (FWS, 2007), during winter Indiana bats are restricted to suitable underground hibernacula. The vast majority of these sites are caves; however, Indiana bats also hibernate in other cave-like locations, including abandoned mines. As stated, in summer, most reproductive females occupy roost sites under the exfoliating bark of dead trees that retain large, thick slabs of peeling bark. Indiana bats roost in trees that are within canopy gaps in a forest, in a fence line, or along a wooded edge. Habitats in which maternity roosts occur include riparian zones, bottomland and floodplain habitats, wooded wetlands, and upland communities. Indiana bats typically forage in semi-open to closed (open understory) forested habitats, forest edges, and riparian areas.

Threats to the Indiana bat vary during its annual cycle. At the hibernacula, threats include modifications to caves, mines, and surrounding areas that change airflow and alter microclimate in the hibernacula. During summer months, possible threats relate to the loss and degradation of forested habitat (FWS, 2007).

The gray bat was listed as endangered on April 28, 1976. No critical habitat has been designated. Gray bats are true cave bats, using caves for both winter hibernation and summer roosting, migrating between 10 and 325 miles between the two (FWS, 1982). Hibernation can begin as early as the first week of September, with all gray bats hibernating by early October and continuing through April. Following emergence, bats move to different summer roosts (FWS, 1982).

The gray bat is generally associated with streams and wetlands and commonly forages over wooded riparian corridors, often low over the water. Forested areas surrounding caves, flyways, and foraging areas are also important to the survival of gray bats and are routinely used while foraging, particularly by juveniles. Depending upon colony size and available habitat, individuals may travel distances of 12 to 21 miles for foraging (Ameren Missouri, 2011d). Gray bats in Missouri forage over waterways adjacent to forested areas more often than waterways adjacent to pastures. Moreover, bat activity levels in forested riparian areas are higher than in non-forested riparian areas (Ameren Missouri, 2011d).

The gray bat recovery plan (FWS, 1982) indicates that the reasons for the bat's decline include human disturbance and vandalism to caves, particularly maternity caves between late May and mid-July, and hibernating caves between mid-August and April. Additional threats include deforestation, impoundment of waterways, and currently a fungal infection known as white-nose syndrome.

In July 2010, Ameren Missouri conducted mist net surveys, and captured a total of 132 bats, including a single male Indiana bat and 40 gray bats. The surveys did not

reveal evidence of any Indiana bat maternity colonies in the project area, and there are no caves within the project boundary that could be used by gray bats for summer roosting or winter hibernating. The survey did determine that roosting, foraging, and commuting habitat is present in the project boundary for the Indiana bat, and foraging habitat is present for the gray bat.

3.3.4.2 Environmental Effects

Ameren Missouri does not propose any measures for the Mead's milkweed or the Hine's emerald dragonfly.

Ameren Missouri proposes to implement an Indiana and Gray Bat Management Plan. The draft plan, which has been submitted to FWS for comment, establishes vegetation maintenance measures to protect potential Indiana and gray bat habitat, and procedures for routine removal and disposal of vegetation that could interfere with project operations. Vegetation maintenance measures would only occur between September 30 and April 1, and all major clearing and maintenance activities in the transmission line ROW, such as inspections, hazard tree removal, understory clearance, border zone clearance, and herbicide applications, would be limited within the project boundary, as well as standing tree removal elsewhere within the project boundary.³⁴ Also as part of the Indiana and Gray Bat Management Plan, Ameren Missouri proposes to cut trees in a manner that would minimize damage to the trunk and root systems of adjacent trees, which would in turn, minimize any potential effects on roosting, foraging, and commuting habitat.

Missouri DNR and Missouri DOC recommend that a protection plan be developed for threatened and endangered plant and animal species on Ameren Missouri lands because the project area includes a number of sensitive natural communities. Condition 3.e. of the WQC requires Ameren Missouri to continue to support the protection of threatened and endangered species identified on its land in consultation with FWS and Missouri DOC.

Our Analysis

Mead's Milkweed

Although surveyors identified potential Mead's milkweed habitat during 2010 surveys, no Mead's milkweed plants were found. Potential habitat for Mead's milkweed is located near the upper reservoir, within a fenced area that is controlled by Ameren Missouri. Because this area is not open to the public, and Ameren Missouri proposes no

³⁴ During emergency situations, hazard trees could be removed between September 30 and April 1.

vegetation management or construction activities in this location, the potential habitat would not be either directly or indirectly affected. Overall, because the Mead's milkweed does not occur within the project boundary, and its potential habitat is protected from activity, the proposed project would have no effect on this species, and additional protection measures would not be necessary.

Hine's Emerald Dragonfly

The Hine's emerald dragonfly requires calcareous spring-fed marshes and sedge meadows for habitat. Because this habitat has not been reported at the proposed project, we conclude that proposed project maintenance and operation would have no effect on this species. Any additional protection measures in a protection plan for this species would not be necessary.

Indiana Bat and Gray Bat

No Indiana bat maternity colonies or gray bat roost caves are known to occur in the project boundary; however, Indiana bat roosting, foraging, and commuting habitat and gray bat foraging habitat does occur. Wooded habitat is an important component of all these habitat types. Project maintenance, such as tree cutting, may directly affect both Indiana bats and gray bats if the wooded habitat within the proposed project boundary is cut while the bats are actively using these areas, which typically occurs during late spring through early fall. Alteration or removal of riparian woodlands would, in particular, affect gray bats, because they forage in these areas. Removal of trees would also indirectly affect both bat species by reducing the amount of habitat available. Overall, however, indirect effects from loss of habitat would be expected to be minimal because proposed tree removal activities would be minor in scope, and there would be wooded habitat available within and outside of the proposed project boundary.

Ameren Missouri's proposed Indiana and Gray Bat Management Plan includes measures to limit tree cutting between September 30 and April 1 to minimize effects on Indiana bats. Limiting tree cutting during this time period is based on FWS' publication, "Section 7 Consultation: Evaluating Potential Impacts to Indiana Bat (*Myotis sodalis*)" (2009). Although FWS has not commented on the draft Indiana and Gray Bat Management Plan, FWS typically requires cutting of trees greater than 5-inch-diameter at breast height to occur between November 16 and March 31 for the protection of Indiana bats if within 5 miles of a known hibernacula. Ameren Missouri captured a single male Indiana bat during its mist net surveys, but found no evidence of hibernacula. Because tree cutting activities would occur while both the Indiana and gray bat are mainly within caves, and not while using wooded areas, we find that project operations and maintenance would not be likely to adversely affect these two bat species. Also potential effects would be further minimized through the development of an Indiana and Gray Bat Management Plan, after consultation with FWS and Missouri DOC, which would specify

seasonal restrictions and other protection measures for Indiana and gray bats in the project area. This plan would also comply with condition 3.e. of the WQC, which requires Ameren Missouri to support protection of threatened and endangered species on project lands.

3.3.5 Recreation and Land Use

3.3.5.1 Affected Environment

Regional Recreation Resources

The Taum Sauk Project is located in southeastern Missouri in an area surrounded by a network of parks, natural areas, wilderness areas, and trails. Within the region there are 17 state parks and historic sites, including the Johnson's Shut-Ins and Taum Sauk Mountain state parks, two large tracts of the Mark Twain National Forest, Ketcherside State Forest, Bell Mountain Wilderness, Elephant Rocks State Park, and the Fort Davidson State Historic Site, all within a short distance from the project area (figure 9). The project is also in the vicinity of two state-designated wilderness areas (East Fork Wild Area and Goggins Mountain Wild Area) and three Missouri Natural Areas (St. Francois Mountains Natural Area, Johnson's Shut-ins Natural Area, and Johnson's Shut-ins Fen Natural Area). State Highway 21, which runs to the east of the project area and through Lesterville, Missouri, is a state-designated Scenic Highway from the St. Louis area to the Arkansas border. About 25 miles downstream of the Taum Sauk Project is the U.S. Army Corps of Engineers' Clearwater Lake. These wilderness areas and parks are used for hiking, backpacking, climbing, camping, picnicking, boating, horseback riding, cycling, fishing, swimming, and some off-road ATV use. Canoeing, kayaking, and rafting the Black River are some of the area's primary commercial recreational activities.

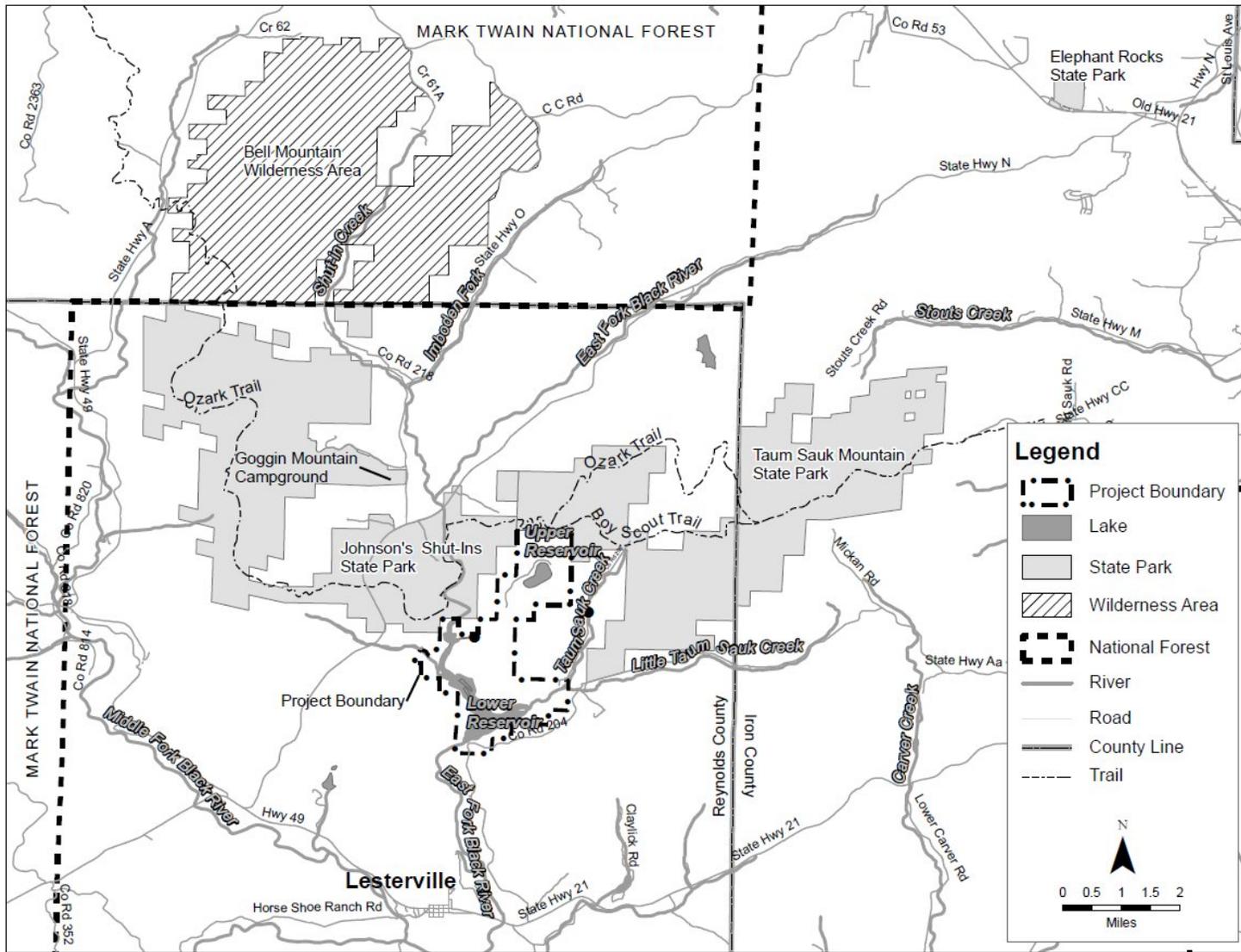


Figure 9. Regional recreational opportunities (Source: Ameren Missouri, 2011e, as modified by staff).

Existing Recreation at the Project

Project recreation facilities include: (1) a visitor's center with exhibits explaining pumped-storage; (2) a museum with displays on the area's wildlife, fisheries, and history; (3) 25 picnic areas; (4) a 20-acre campground with 25 primitive campsites; (5) a one-lane concrete boat ramp;³⁵ and (6) a parking area at the lower reservoir. Also there is a scenic overlook at the lower reservoir. Public access to the upper reservoir visitor's center, museum, and picnic pavilion has been restricted since the 2005 breach. Visitors interested in seeing the museum or visitor's center must make arrangements with Ameren Missouri for access beyond the secured area.

Recreation on the East Fork Black River Downstream from the Project

Informal project recreation access is available downstream of the lower reservoir dam on the East Fork Black River (figure 10). In addition to the overlook near the lower reservoir dam, a small network of informal project and non-project roads provide access to the river.

From the lower reservoir dam, the East Fork flows southerly from the project for approximately 3.6 miles to Highway 21 just east of Lesterville (and the take-out). South of Lesterville, the Middle Fork of the Black River and West Fork Black River converge and flow about 1.1 miles to the confluence with the East Fork Black River. This confluence occurs about 1 mile downstream of the Highway 21 bridge over the East Fork Black River and is considered the start of the Black River.

The East Fork Black River segment downstream of the lower reservoir dam provides flow-dependent activities, such as canoeing and kayaking, fishing, and swimming in pools within the reach. Ameren Missouri reports there is some interest in boating in this reach when flows are ample, which is typically between December and June, but notes there are more consistent boating opportunities on other reaches (Middle and West Forks of the Black River) where there are commercial outfitters.

³⁵ During the 2011 environmental site review, while the lower reservoir was drawn down, a section of the concrete boat ramp about 4 feet by 4 feet in size was visibly crushed and missing, requiring users to back their trailers over the broken ramp. In December 2012, Ameren Missouri replaced the boat ramp in-kind.

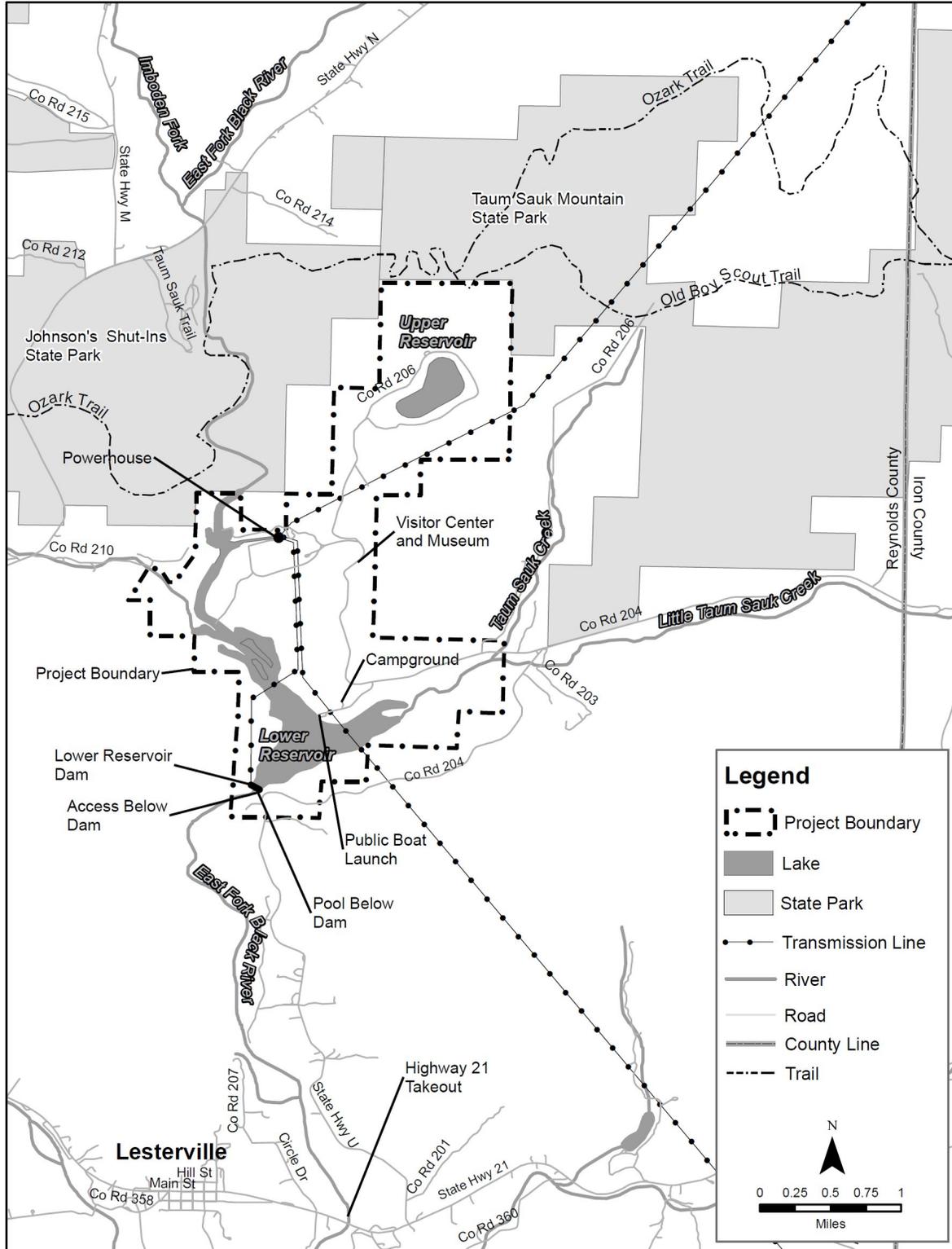


Figure 10. Project recreational opportunities (Source: Ameren Missouri, 2011e, as modified by staff).

Recreation Use at the Project

Ameren Missouri commissioned a study of recreation use in 2005 that included a recreation use and needs assessment (Devine Tarbell & Associates, Inc. [DTA], 2007). Field work occurred between April and November, but was truncated due to the upper reservoir breach in December. The study found that a majority of visitors, about 6,050 per year, visited the upper reservoir, with more than 3,000 visiting the museum. In comparison, only about 650 persons visited recreation areas at the lower reservoir (e.g., campground, reservoir, and boat ramp). Overall, this equates to about 9,700 recreation days at the project during the study.³⁶

Sightseeing was reported as the most common primary reason for visiting. Prior to the breach, a majority of respondents visited the museum/visitor center and the upper reservoir overlook viewing platform (64 percent). The upper reservoir overlook viewing platform was damaged during the breach and has been removed.

Visitors fished along the shoreline of the lower reservoir (24 percent), by boat (20 percent), or along the river/stream (17 percent). A majority of anglers that fished by boat were generally satisfied with their fishing experience (74 percent). Shoreline anglers were also generally satisfied, with 60 percent reporting satisfied to extremely satisfied with their fishing experience.

Overall, respondents were satisfied with their recreation experience at the project study area. The average evaluation rating was 8.5 (based on a 10-point scale) with most respondents identifying views and scenery as elements of their experience they liked best about their visit. Visitor surveys revealed satisfaction (i.e., rating of 7 or higher) with all of the facilities.

The overall average number vehicles per day recorded at the lower reservoir was less than three vehicles during peak season and less than two vehicles during nonpeak season, resulting in only 12 percent of capacity for vehicle parking and less than 4 percent of capacity for vehicles with trailers.

Recreation Use Downstream of the Project

Ameren Missouri commissioned supplemental studies on flows and boat-ability on the East Fork Black River (HDR/DTA, 2010). The goal of the studies was to determine the existing flow-related opportunities (specifically, boating, fishing, tubing, and swimming) and constraints, as well as to determine acceptable flow ranges to better understand the nexus between recreation use, access, information, and project operation.

³⁶ Recreation days are defined as each visit by a person to a development for recreational purposes during any portion of a 24-hour period.

The studies involved a review of existing information, fieldwork (for observation of seasonal recreation opportunities), interviews with key resource experts or outfitters, and analysis. Key findings with regard to flow-sensitive recreation opportunities are summarized as follows.

Flow ranges for boating were developed from professional judgments that took into consideration available information (existing literature descriptions of the reach, interviews, and hydrology). Based on the judgments and information, 75 to 300 cfs was the range for acceptable boating flows. Comparison of this flow range with flow information from the East Fork Black River gage during an average water year (1995) shows that there were 93 days where flows were between 75 and 300 cfs. About 60 days in this range were available in the March through June period, and 89 days in this range in the December through June period.

Ameren Missouri also developed flow ranges for swimming based on fieldwork and discussions with swimmers. Good swimming areas provide a mix of pools and lower gradient runs with nearby beaches or good “sunning rocks.” Good swimming locations also tend to feature pools with sufficient depth to use nearby jumping rocks. At very low flows, a few pool sites may appear stagnant and could be less inviting for swimmers, even in late summer when flows are around 25 cfs, there is adequate water to provide a wading area (even though the deeper jumping and swimming pools may be shallow). Taken together, information suggests that flows from about 20 to 150 cfs offer the best swimming conditions at most locations, although specific site characteristics may be usable outside this range.

Ameren Missouri also developed flow ranges for fishing suitability of the East Fork Black River; however, these were based on flow levels suitable for wading rather than any measure of fishing success. Ameren Missouri identified the acceptable flow range similar to swimming in the 20 to 150 cfs range. Table 11 summarizes the flow ranges identified by Ameren Missouri.

Table 11. Summary of recreation opportunities and flow ranges on the East Fork Black River downstream of the lower reservoir dam (Source: DTA/HDR, 2010, as modified by staff).

Recreation Activity	Acceptable flow range (cfs)
Boating (kayaking/canoeing)	75-300+
Angling	20-100
Swimming	20-100

Land Use

Ameren Missouri owns all land within the project boundary. Excluding project facilities, lands within and adjacent to the project boundary are undeveloped, and land uses in the general area are devoted to small-scale farming and scattered residences interspersed within larger tracts of state and federal lands. The closest commercial establishments are in Lesterville, Arcadia, Ironton, and Pilot Knob, at least 8 miles from the project. The area's primary commercial recreational activity is floating the Black River in canoes, kayaks, and rafts rented by several outfitters in and near the town of Lesterville in Reynolds County. Several of these establishments also offer campsites, rental cabins, outdoor barbecues, and entertainment.

Ameren Missouri owns the 2,334 acres of project lands and 4,822 acres of non-project land contiguous to the project boundary; there are no homes or camps on these adjacent lands. Ameren Missouri also owns the lower reservoir's shorelands, including the boat ramp and campground, and all other areas that are available for public access and use (see figure 10). Ameren Missouri maintains the campground and parking area, as well as the informal overlook, at the lower reservoir.

In 1967, Ameren Missouri leased a portion of the project lands to Missouri DOC for a wildlife management area. The lease was extended in 1992 for a second 25-year term. Either party may terminate the lease at any time with 1 year's notice. The lease allows Missouri DOC to manage the lower reservoir for fishing, while prohibiting public entry to excluded areas in the vicinity of the powerhouse for purposes of public safety. Missouri DOC is authorized by the lease to develop and manage boat launching facilities and wildlife management areas, including construction of permanent facilities, after first receiving Ameren Missouri's written approval. Under the terms of this lease, Missouri DOC has developed and maintained the lower reservoir boat ramp. Public hunting is prohibited on project lands.

3.3.5.2 Environmental Effects

Public Access

Following the upper reservoir breach, Ameren Missouri implemented a number of security measures to restrict public access around the upper reservoir. The Commission approved, by letter issued on July 5, 2011, Ameren Missouri's request to temporarily restrict unsupervised public access to the upper reservoir (including the museum, visitor center, and picnic pavilion areas) until a decision regarding the need for the recreational facilities at the upper reservoir is determined in any new license, if issued. Currently, the Commission requires Ameren Missouri to allow the public access to the facilities associated with the upper reservoir through prearranged and guided tours for educational purposes.

Ameren Missouri proposes to use the museum, visitors' center, and picnic pavilion as tour group staging areas (Ameren Missouri, 2009). Ameren Missouri does not propose to replace the upper reservoir overlook viewing platform that was damaged by the breach event and ultimately removed. The scenic overlook turnaround and parking area for the upper reservoir viewing platform that was in place prior to the breach is still intact, and Ameren Missouri proposes this area be used for viewing by participants in the educational tours. Ameren Missouri also proposes to continue to maintain picnic tables at the lower reservoir in the vicinity of the boat launch and campground. Ameren Missouri does not propose any other changes to the boat launch, primitive camping area, restrooms, or access downstream of the lower reservoir.

Missouri DNR and Missouri DOC recommend development of a comprehensive recreation management plan to address all recreational issues including, but not limited to: (1) the preservation of Church Mountain; (2) development of a new trail network connecting public use areas; and (3) offsetting loss of free access to the museum and overlook area through development of additional public recreation opportunities. The plan would also address: (1) the lease agreement mentioned above for use, maintenance, and repair of public use areas; (2) public access to the East Fork Black River downstream of the dam; (3) recreational fishing and fish stocking in the lower reservoir; (4) lower reservoir facilities; (5) ATV access; (6) feral hogs; (7) and other recreational activities surrounding Ameren Missouri-owned project and adjacent non-project lands. Missouri DNR also recommends increasing recreation opportunities (e.g., additional trail development) on Ameren Missouri-owned property (non-project lands) near Church Mountain as mitigation for the effects of the project on aesthetic resources.

By a combined letter, Missouri Parks Association and Great Rivers note that public access to important trails, including the historic Boy Scout trail, which connects to the Ozark Trail just north of the project boundary near the upper reservoir as shown in figure 10, has been diminished since the reconstruction of the upper reservoir. The letter also notes that other trails associated with Church Mountain were closed to the public following the breach in 2005. Missouri Parks Association, Great Rivers, and East Ozarks Audubon Society recommend Ameren Missouri transfer the title of their Church Mountain and Taum Sauk Creek valley properties, non-project lands, to the state of Missouri to compensate for lost aesthetic and recreation values.

Our Analysis

We address public access and recreation use and facilities from upstream to downstream starting with the upper reservoir. Prior to the 2005 breach, the project supported "sightseeing" to the upper reservoir and museum. The upper reservoir overlook and the museum were the most visited sites within the project area and received the highest levels of visitor satisfaction based upon the findings of the 2005 study. Ameren Missouri reported that visitation was nearly 10 times higher for these areas than

for recreational activities on the lower reservoir and campground, indicating their importance as a recreation resource at the project.

Access to Upper Reservoir and Museum

In discussing the merits of the recreation opportunities provided at the project, Ameren Missouri concluded that due to the project's remote and scenic location, it is an attractive destination for nature-based experiences and for learning about the unique nature of a pumped-storage project located in a rural and natural area of Missouri. Prior to the upper reservoir breach, the museum provided visitors with information on the operation of a pumped-storage project, geology of the area, natural history, and Native American history. Offering guided tours of the upper reservoir for educational purposes, as proposed by Ameren Missouri, would preserve the opportunity to learn about pumped storage and the views afforded by the upper reservoir of the surrounding area; however, the added logistics of setting up appointments beforehand would likely reduce the number of visitors, eliminating the spur of the moment type day-users that were recorded in the 2005 study.

During the environmental site review, Ameren Missouri stated that it has removed the geological exhibits from the museum. Ameren Missouri also stated that many of the remaining exhibits dated back to the 1960s, and these exhibits would need to be updated or refurbished if the museum was to be operational again. The merits of updating and moving the existing exhibits into a new facility within the project boundary may not be warranted because the new visitor's center at Johnson's Shut-Ins State Park provides many of the same amenities and exhibits as those at Ameren Missouri's museum. New exhibits inside the park's visitor's center incorporate audio and video presentations; computers with touch screens to educate the public on the geology, flora, and fauna of the area; and photographs and sculptures. Just outside the visitor's center are interpretive displays, including an electronic kiosk that highlights the pumped storage project, and at dispersed locations throughout the park there are various viewing overlooks that address different aspects of the 2005 event and resulting scour channel. The upper reservoir is also visible from select locations near the visitor's center. The exhibits and viewing areas are free to the public and address similar topics (i.e., natural history, geology of the area, and the Taum Sauk Project) that were addressed in Ameren Missouri's museum. Also, there are a number of other museums, such as the Bollinger County Museum of Natural History and the Iron County Historical Society Museum, that are within the area and provide similar information and opportunities to the public.

The loss of access to the museum and upper reservoir to the general public could displace those potential visitors interested in the upper reservoir overlook and museum; however, there is no demonstrated need for offsetting the loss of the museum with development of additional public recreation areas, as recommended by Missouri DNR and Missouri DOC. The Johnson's Shut-Ins State Park provides many of the same

amenities and exhibits as those at the upper reservoir prior to the breach. Furthermore, the size and quality of the new state park facilities could accommodate any increase in demand due to closure of Ameren Missouri's museum and overlook. Also while Ameren Missouri did not rebuild the upper reservoir overlook viewing platform, it would continue to provide access to the upper reservoir through prearranged tours, and visitors would be afforded panoramic views of the surrounding landscape from the parking area for the former viewing platform.

Ameren Missouri proposes not to disturb the scour channel on Ameren Missouri-owned property, except for stabilization efforts agreed to by the parties of the Consent Agreement between Ameren Missouri and the state of Missouri,³⁷ and has granted an easement of 51 acres to Missouri DNR for public access to that portion of the scour channel for a period of 25 years. Ameren Missouri has installed a security fence about 250 feet from the toe of the upper dam between the upper end of the scour area and the upper reservoir dam to prevent unauthorized access to the upper reservoir dam and ancillary facilities. Preservation of the scour channel provides the public with interesting views of the effects of the historic breach event and the resulting force of its devastating flow. Security fencing at the toe of the upper reservoir limits public access to the very uppermost areas within the channel; however, there are two new viewing platforms along the channel for viewing opportunities to visitors at Johnson's Shut-Ins State Park.

Trails and Church Mountain Lands

Installation of gates across roads may be partly responsible for the restricted access to the old Boy Scout trail in and around the area of Little Taum Sauk Creek; however, there is no evidence that the hiking trail is closed or access from either east or west connections is compromised. Similarly, a portion of the Ozark Trail was closed for a period during reconstruction of the upper reservoir; however, that section has been rerouted, and construction is finished. There is not a demonstrated need to develop new trails, as recommended by Missouri DNR and Missouri DOC, on Church Mountain because the previously closed trails are now open. We discuss the recommendation for trails on Church Mountain for aesthetic reasons in section 3.3.7, *Aesthetic Resources*.

Ameren Missouri's property at Church Mountain is not within the project boundary, and the lands are not necessary for project purposes or for enhancement of environmental resources. Therefore, decisions on allowable public uses of that property

³⁷ There are two consent agreements; one between Ameren Missouri and the Commission and the other between Ameren Missouri and the state of Missouri for the dam breach. The agreements describe each party's responsibilities for repairs after the breach. Both the agreements can be found in Ameren Missouri's license application in Exhibit E (Vol. II of VII, as appendices in the General Description of the Local (Appendices E2-1, E2-2, and E2-3).

are not within the scope of this draft EA. Likewise, the decision to transfer title of Ameren Missouri's property at Church Mountain (to another party or into conservation easement) and in the Taum Sauk Creek valley for recreational and aesthetic values as recommended by Missouri Parks Association, Great Rivers, and the East Ozarks Audubon Society is outside the scope of this draft EA. These lands are not necessary for project operation or maintenance and are not related to the project.

Access to Lower Reservoir and Downstream of the East Fork Black River

The lower reservoir boat launch is the only launch on the lower reservoir. Ameren Missouri reported the site receives modest use and that there would be sufficient capacity in the existing parking lot to accommodate the estimated increases in future demand. A habitat enhancement plan, as described in section 3.3.2, *Aquatic Resources*, would improve the fishery and help long-term health of the fishery, which would have a positive effect on the anglers.

During the 2011 environmental site review, the grass at the lower reservoir campground was overgrown and the lower reservoir boat ramp was damaged.³⁸ Adjacent to the lower reservoir boat ramp, a Missouri DOC fish size regulations sign was noticeably shot out. The site also had a number of 'jersey' concrete traffic control barriers throughout the gravel parking area to direct traffic lending an industrial character to the area. The gravel parking area was in otherwise decent condition. Removal of the concrete barriers, overall site maintenance, and restoration of the vegetation disturbed while the site was used during construction of the upper reservoir would improve the limited amenities at this site. Development of a recreation management plan that addresses maintenance of the lower reservoir recreation facilities would ensure that the that the ramp, informal overlook, and campground would be maintained throughout the term of any license, if issued. Development of a vegetation management plan to address the aesthetics at the lower reservoir recreation sites is described in more detail in section 3.3.7.2, *Aesthetic Resources*.

Access to the East Fork Black River downstream of the lower reservoir dam is available via unpaved roads accessed from County Road 204. This area is the project's informal put-in for canoe or kayak trips and shore-based fishing in the pool downstream of the lower reservoir dam. Recreation study results indicate this area receives very little use; however, recent upgrades to the road have improved access to the site. Ameren Missouri's recreational boating study on the East Fork Black River downstream of the lower dam indicates that the reach receives light use and the variability in flows makes it difficult to plan float trips around. Because of improved road conditions and the

³⁸ In December 2012, Ameren Missouri replaced the lower reservoir boat ramp, and it is now usable.

proposed changes in water management to provide more stable flows downstream of the lower reservoir dam, along with notification of flows via the internet (see section 3.3.2, *Aquatic Resources*), recreation use downstream of the lower reservoir dam could increase.

Feral Hogs

Feral hogs do occur within the project boundary; however, they are also present throughout Missouri (University of Missouri, 2012). As discussed in section 3.3.3, *Terrestrial Resources*, the project does not directly contribute to the proliferation of feral hogs. Therefore, we find no project-related purpose for a license condition requiring Ameren Missouri to implement comprehensive trapping and other eradication efforts in and near the project area as part of any recreation management plan.

Lease Agreements and Stocking

While a licensee may lease operation and maintenance of project-related facilities to a third party, it is ultimately the licensee's responsibility to ensure project facilities, including any recreation facilities, are operated and maintained in accordance with the license. Therefore, we find no project-related purpose to have a recreation management plan "address" a lease agreement between Ameren Missouri and Missouri DOC for lands associated with the lower reservoir's recreation facilities, as recommended by Missouri DOC and Missouri DNR because ultimately Ameren Missouri is responsible for the operation and maintenance.

As to Missouri DOC's and Missouri DNR's fish stocking recommendations, we address the benefits of fish stocking plan at the project in section 3.3.2, *Aquatic Resources*, and do not include a separate analysis here in this section.

All-Terrain Vehicle Use

ATVs are legal for travel on all Reynolds County roads, if the owner obtains a permit. Public ATV use on Ameren Missouri-owned lands, including project and non-project lands, is prohibited; however it does occur at and near the project. Ameren Missouri proposes to continue to prohibit public ATV use on Ameren Missouri-owned lands (including non-project lands) and install/maintain signs to prohibit ATV use near known access points. Ameren Missouri also proposes to allow state agencies to place gates and signs on Ameren Missouri-owned lands to discourage ATV use on adjacent state lands.

Missouri DNR recommends Ameren Missouri address the need to control unauthorized and harmful ATV/off-road vehicle (ORV) use in nearby conservation lands, wilderness, and natural areas. Missouri DNR also recommends that unauthorized and harmful ATV/ORV access be addressed in the portion of the non-project transmission

line managed by Ameren Missouri that crosses these types of sensitive environmental areas.

Missouri Parks Association, Great Rivers, and East Ozarks Audubon Society questioned the adequacy of existing measures to prohibit ATV use at the project. They recommend stronger enforcement by Ameren Missouri on its property.

Our Analysis

Cordell (2008) estimated that 19.6 percent of the people in Missouri participate in ATV recreation, just slightly above the national average of 18.6 percent. At the national level, there has been about an 18-percent increase in the number of ATV participants between 1999 and 2007 (Cordell, 2008).

The state of Missouri and the U.S. Forest Service (Forest Service) maintain and operate two ATV/ORV riding areas in southeastern Missouri:

- Mark Twain National Forest maintains 23 miles of off-road trail that can be accessed via County and Forest Service roads at Sutton Bluff Recreation Area, located about 20 miles west of the project in Reynolds County; and
- St. Joe State Park, located about 40 miles northeast of the project, has set aside 2,000 acres for the state's premier ORV riding area.

Reynolds County roads that pass through the project area and receive authorized ATV use include Reynolds County Roads 204, 205, and 206 (see figure 1). In addition, logging activities and other resource extraction activities that have occurred on federal, state, and private lands in the project vicinity have resulted in trails, and these trails are often used for authorized and unauthorized ATV riding.

Because the area surrounding the project is rural and undeveloped, ATV riders can and do travel off of existing, maintained roads authorized for ATV use to traverse lands and trails across the countryside unauthorized for ATV use. Ameren Missouri identified eight locations adjacent to the project of unauthorized ATV use where it would install gates, other barriers, or signs to discourage ATV use; however, these sites are outside the proposed project boundary. Access to seven of these sites occurs entirely from roads and areas unrelated to the project, and the single location associated with lands within the project is the access road downstream of the lower dam. This gravel road provides ATV users access to an unimproved ford (outside the project boundary) across the river at low flows allowing unrestricted access to lands on the west side of the river. This access road also provides informal recreation access to the river for boating, swimming, and fishing and necessary access to the USGS gage. Ameren Missouri proposes to discourage ATV use in this area through continued use of patrols rather than gates, which would allow for continued access by non-ATV users.

ATV users exploit lands in remote areas with easy trail access from the existing public road network, and although use of project lands for ATV may occur, the use does not occur as a result of the operations of the project. Furthermore, project activities have not contributed to the proliferation of ATV/OHVs on project lands, nor would any proposed project activities. Gates and signs at popular access points on nearby Ameren Missouri non-project lands could help; however, because Commission regulations only apply to lands within the project boundary, and all of the sites where Ameren Missouri proposes to control ATV/OHV access by installing gates, other barriers, or signs are outside the proposed project and would address ATV use occurring outside the project, the benefits of the proposed measures at any of these sites are not discussed in detail in this EA.

Public Safety

Missouri DNR recommends that public safety measures be installed or incorporated into the project's daily operations after the breach, such as enhanced monitors and gages at the upper reservoir, emergency warning devices, and emergency plans should be maintained and updated as necessary by Ameren Missouri throughout the term of any license, if issued.

Our Analysis

Before a project is constructed, the Commission staff reviews and approves the designs, plans, and specifications of the dam, powerhouse, and other structures. During construction, Commission staff engineers frequently inspect a project, and once construction is completed, Commission engineers continue to inspect it on a regular basis.

The Commission implements its responsibilities for dam safety through its regulations at 18 C.F.R. Part 12. The regulations cover general provisions, reporting and record keeping, emergency action plans, inspection by independent consultants, and other licensee responsibilities such as quality control programs, monitoring instruments, warning and safety devices, power and communication lines, and testing of spillway gates. Under Subpart C – Emergency Action Plans, the Commission requires a licensee to develop and file with the regional engineer an emergency action plan and appendices. The plan must be: (1) developed in consultation and cooperation with appropriate federal, state and local agencies responsible for public health and safety; and (2) designed to provide early warning to upstream and downstream inhabitants, property owners, operators of water-related facilities, recreational users, and other persons in the vicinity who might be affected by a project emergency. Annual dam safety inspections conducted by Commission dam engineers and independent consultant inspections every 5 years ensure the dam and all monitoring equipment is functioning. As such, Commission regulations already address Missouri DNR recommendations.

Flow Releases for Recreation

As described in its proposed Water Management Plan (see discussion in section 3.3.2, *Aquatic Resources*), Ameren Missouri proposes operating procedures that would result in outflows from the lower reservoir dam that approximate inflow into the project. Flows are passed through the lower reservoir dam using the two gates, with a combined discharge capacity of approximately 2,525 cfs. River flows exceeding the gate capacity are passed over the lower reservoir spillway. In addition, as part of the proposed Water Management Plan, Ameren Missouri proposes to monitor and publish water level, volume, and outflow information on the internet and maintain the information for documenting project operation.

Our Analysis

Daily flow information indicates that the East Fork Black River is “flashy,” meaning that high flow events triggered by rainstorms appear in the river quickly, peak, and then return to base flows on the order of hours to a few days. This pattern is more pronounced during dry years and drawn out during wet years. The “flashy” nature of the river can make it difficult for recreational users to determine the adequacy of the river for safe recreational use.

There are 14 canoe outfitters identified by the Black River Chamber of Commerce who rent canoes and rafts and provide camping on the Black River. Providing access to the flow, water level, and volume information through a single source (i.e., a web page) as proposed by Ameren Missouri in its Water Management Plan, would enable outfitters and members of the public to better determine when high-flow events are underway and if opportunities are available on the East Fork Black River for boating, swimming, fishing, or other water-based recreational activities.

Changes to the Project Boundary

Ameren Missouri proposes to remove 497.3 acres of land from the project boundary (see figure 3). Ameren Missouri states that the lands are not necessary for operation and maintenance of the project.

Our Analysis

The lands proposed for removal from the project boundary are undeveloped and forested. Commission regulations require that all lands necessary for the operation and maintenance of the project be included in the project boundary.³⁹ The lands being

³⁹ See 18 C.F.R. § 4.41(h)(2) (2012).

proposed for removal from the project boundary would not be used for project operation, and would not be needed for other project purposes such as recreation, protection of cultural resources, or protection of other environmental resources. As such, these lands should not be included in any proposed project boundary. This issue could be resolved through a license condition requiring Ameren Missouri to modify the exhibit G drawings by removing the lands from the project boundary.

3.3.6 Cultural Resources

3.3.6.1 Affected Environment

Under section 106 of the NHPA of 1966, as amended, the Commission must take into account whether any historic property within the project's APE could be affected by the project. The Advisory Council on Historic Preservation defines an APE as the geographic area or areas in which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE for the project includes: (1) lands enclosed by the project boundary; and (2) any areas outside of the project boundary where project operation is found to potentially be affecting historic properties, including portions of the predicted emergency overflow release structure pathway.

Regional History

The earliest archaeological record indicates that Native Americans were present in Missouri during the Paleo-Indian period (12,000 to 10,000 Before Present [B.P.]). Primarily the Paleo-Indian people were small groups of highly mobile hunters and foragers who specialized in stalking the megafauna of the Late Wisconsinan glacial age. The Ozark Mountains, including Reynolds County, were well inhabited during the Archaic periods. The Early Archaic Period (10,000 to 8,000 B.P.) is characterized by a shift to a more sedentary settlement pattern with an increased reliance on wild plant foods, small game, and fish. A warming climate and an increase in population occurred during the Middle Archaic period (8,000-5,000 B.P.) period, with an increase in the use of aquatic resources, a trend that continued into the Late Archaic (5,000-3,000 B.P.). Early Woodland (1,000 B.P. to A.D. 100) sites are rare in Missouri. During the Middle Woodland period (A.D. 100-600), village sites were present in southern Missouri marked by intensive horticulture.

The first recorded European contact with Native Americans occurred in 1673 when the French discovered the mouth of the Missouri River. The French subsequently explored the majority of the river by 1717. Although Spain controlled southeast Missouri until the early 19th century, the area retained a French character that was later supplemented by English and German immigrants. The Ozark Plateau was one of the last regions settled by Euro-Americans in the eastern United States. Into the 20th century, the area in the vicinity of the Taum Sauk Project remained remote and sparsely settled.

The Taum Sauk Project is in the traditional territory of the Osage people. They inhabited villages on the Osage and Missouri rivers during the winter and made frequent hunting trips into the Ozark Mountains during the summer. Lands were taken from the Osage people beginning in 1808.

Archaeological Resources

No archeological sites had been recorded in the project APE prior to 2005. About 90 acres of land was surveyed prior to land disturbances associated with the rebuilding of the upper reservoir, including candidate silt disposal sites and laydown areas. These surveys did not identify any new eligible properties that would be affected by the proposed project rebuild. The Missouri SHPO concurred with these findings. In the fall of 2007, a combined Phase I and Phase II survey was conducted on 475 acres within the APE. Consistent with the study plan, the survey excluded areas that had been previously surveyed, areas that had been previously disturbed, areas with low probabilities for sites, and locations remote from areas where project operation and maintenance would occur. This approach, developed in consultation with the Missouri SHPO, recognized that the project boundary includes large blocks of land remote from the project reservoirs where proposed project operation and maintenance activities would be unlikely to occur. A total of 565 acres were surveyed by Ameren Missouri.

A total of eight archaeological sites were identified during the 2007 survey. Of these eight sites, two were multi-component sites (23RE1170 and 23RE1171) that were found to contain intact Archaic period components. These two sites were recommended as eligible for inclusion in the National Register. The other six sites were either historic/modern sites or ephemeral litchi reduction sites located on ridges; these six sites were considered not eligible for inclusion in the National Register. The Missouri SHPO concurred with the determinations for eligibility, and concurred with the finding that project would not adversely affect the two eligible archaeological sites under normal proposed operation and maintenance.

Historic Properties

There are no known historic period properties that would be affected by the Taum Sauk Project. Construction of the Taum Sauk Project facilities began in 1960, and the project commenced operation in 1963 as the largest pure pumped storage project in North America. The Institute of Electric and Electronic Engineers' Global History Network identified the Taum Sauk Project in September 2005 for its technological innovations that include both the high capacity turbine generators and the ability to be operated remotely from a control room 90 miles away (<http://www.ieeeahn.org/wiki/index.php/Milestones>).

3.3.6.2 Environmental Effects

Ameren Missouri proposes to enter into a PA prior to issuance of a new license. The PA would require Ameren Missouri to initiate consultation, pursuant to section 106 of the NHPA, on a case-by-case basis in the event that the project is determined to be affecting the identified historic properties during the term of any new license. Also, as a stipulation to the PA, Ameren Missouri proposes to prepare an HPMP in consultation with the Missouri SHPO and Indian tribes in the event that additional historic properties are discovered during the term of any new license and would be affected by the project.

The Missouri SHPO in its letter filed on April 7, 2009, concurred that the project would have no adverse effects on the two identified historic properties under normal operation. The Missouri SHPO also recommended that Ameren Missouri develop an HPMP in case of emergencies, and monitor and mitigate for the two eligible historic properties within the project's APE.

In an email with comments on the draft historic properties survey plan filed on June 2, 2008, the Osage Nation requested to be consulted if human remains were discovered, citing concern for the proper treatment and care of their ancestors' remains.

Our Analysis

Hydroelectric projects can affect archaeological sites through shoreline erosion, land disturbance, recreational use, and routine maintenance activities. The two eligible historic properties are located at an elevation above the operational levels of the project reservoirs and outside of the areas proposed for recreation or maintenance activities. In addition, the sites appear to be stable, and no land disturbance or project-related activities now occur or are planned at either location. However, over the term of the license, it is possible that these locations could be subject to land disturbance, or new sites or human burials could be identified at other locations subject to land disturbance.

A PA that would require Ameren Missouri to consult with the Missouri SHPO and the Osage Nation in the event that the project is determined to adversely affect the two eligible sites, or if other historic properties may be discovered, would ensure the proper treatment of historic properties. Including consultation with the Osage Nation if human remains are found as a result of project-related activities would address the tribe's concern about the proper care and treatment of ancestral remains. The Missouri SHPO would prefer that the PA require the development of an HPMP for the project. Given that the location of these sites would be away from any land disturbance, we find Ameren Missouri's proposal to be reasonable and sufficient to protect historic properties from any adverse effects resulting from project-related activities.

Although the upper reservoir has recently been rebuilt, the lower reservoir has not been substantially altered. The project is 50 years old in 2013, and adding a stipulation to

the PA requiring Ameren Missouri to evaluate the project's significance under the National Register criteria, in consultation with the Missouri SHPO, after 50 years of operation would ensure that any historical engineering significance is formally considered. If the project is considered eligible for the National Register, development and implementation of an HPMP containing principles and procedures to avoid, minimize, or mitigate any adverse effects would ensure that continued operation would not adversely affect the engineering and operations characteristics that qualify the property for listing in the National Register.

3.3.7 Aesthetic Resources

3.3.7.1 Affected Environment

The project region is characterized by scattered conical knobs and high peaks that rise from basins and shut-in streams. Vegetation cover types include mixed pine-oak and deciduous forests, glades, and agriculture (primarily cattle pasture). Forest fragmentation is minimal, and large areas of the region are covered by extensive oak-hickory and oak-pine forests. Glades are scattered on exposed slopes where bedrock is close to the surface. The short leaf pine is not readily visible in the summer, but in the winter they provide a bright green accent scattered across the grey hillsides of "leaf-off" hardwoods. Rather broad, smooth valleys and well-degraded hills with rounded summits and generally smooth contours and skylines, characterize this area. From most view points, the general impression is a rolling landscape covered with native forest and very little human development.

The project is surrounded by three state parks providing forested landscape scenery: (1) Johnson's Shut-Ins; (2) Elephant Rocks; and (3) Taum Sauk Mountain. The Taum Sauk section of the Ozark Trail passes within about 0.5 mile of the upper reservoir along Proffit Mountain. The upper reservoir is visible from the peak of Taum Sauk Mountain, which is about 6 miles away from the project and is the highest point in Missouri. The project is also visible from other significant natural areas in Missouri, including the East Fork Wild Area, Goggins Mountain Wild Area, St. Francois Mountains Natural Area, Johnson's Shut-ins Natural Area, and Johnson's Shut-ins Fen Natural Area.

3.3.7.2 Environmental Effects

Project Facilities

The upper reservoir is situated on top of Proffit Mountain, and it has an irregular kidney bean shape. The reservoir walls are about 100 feet high, stepped, constructed of roller-compacted concrete, and have a perimeter length of about 1.3 miles. The dam forming the upper reservoir was recently reconstructed in essentially the same location

and configuration as the original dam, except that the original dam was constructed of rhyolite rock material that, compared to the concrete, was much darker.

Ameren Missouri conducted an aesthetics study to determine the degree of visibility and visual contrast of project facilities and operation in the context of the project-area aesthetic resources. The study used visual contrast methodology, which is part of the Bureau of Land Management's visual assessment protocol, as well as visual assessment concepts developed by the Forest Service.

The results of the study determined that there is a strong visual contrast between the dam forming the upper reservoir and the surrounding natural landscape from key observation points in the middle-ground and background. The strong visual contrast occurs in both summer season (leaf-on) and winter season (leaf-off), but in several situations, the visual contrast is less in the winter because the dam forming the reservoir blends with the overall gray (or white when snow-covered) appearance of the landscape. The actual visibility of the facility does not change from summer to winter. Time of day and weather conditions, such as cloudiness, rain, and snow, can reduce the visual contrast significantly. In general, the intensity of the visual effect correlates with the visual contrast. The aesthetics study concluded that the facility introduced a large, geometric, light-colored shape in a natural-forested landscape.

The 395-acre lower reservoir is on the East Fork Black River in a remote, heavily forested area, and its rocky shoreline is undeveloped. The lower reservoir dam is situated in a narrow, steep-sided gorge immediately downstream of the confluence of the East Fork Black River and Taum Sauk Creek. The boat ramp parking area and campground were expanded, and traffic barriers were installed for visitor safety during the rebuild of the upper reservoir to accommodate work crews and equipment.

Ameren Missouri does not propose specific measures related to aesthetic resources; however, Ameren Missouri is implementing the Upper Reservoir Rebuild Reforestation Plan, developed as part of the rebuild of the upper reservoir.

Our Analysis

Effects of the project on aesthetic resources are generally associated with the rebuild of the upper reservoir. Specifically, areas of concern for aesthetic resources include the white, concrete exterior of the upper reservoir dam; the lighting; and the use and expansion of the areas near the lower reservoir campground and boat ramp as staging areas for construction equipment, personnel, and materials. Visual effects of these elements extend beyond the project boundary to observers on neighboring private land, public roads, state park lands, and National Forest System lands.

The upper reservoir dam is on the top of Proffit Mountain. This elevated position inherently draws a viewer's attention and likely received similar visual attention prior to

the breach in 2005; however, its presence is more acute than in the past. The contrast is exacerbated by the lighter colored concrete of the dam, and the clearing of vegetation around the base of the dam that occurred during upper reservoir rebuild. Ameren Missouri's aesthetic study confirms the strong visual contrast and notes that the dam is visible from a number of areas surrounding the project, including Taum Sauk Mountain State Park Lookout Tower, points along the trail to Mina Sauk Falls, a private residence near Taum Sauk Creek, Bell Mountain Wilderness, and Goggins Mountain campground, as well as from the roads in the area. The structure presents a strong contrast to the surrounding dark green continuous forest cover due to the size of the dam, the light tan almost white color, smooth texture, and geometric shape, and the horizontal top.

Measures to recolor or paint the exterior surface of the upper dam could lessen some of the visual contrast; however, we would expect the color to darken over time. In addition, the trees planted as part of the proposed reforestation plan would take decades to reach maturity; however, once full grown they should be 50 to more than 70 feet tall and provide a vegetative buffer along the toe of the northwestern side of the dam. The trees would create a buffer contrast for viewers in the north and west including those at Goggins Mountain Campground and trails, along roads in the area (e.g., State Highway MM), Ozark Trail, and Bell Mountain Wilderness.

Outdoor Lighting

The project area in southwestern Missouri is surrounded by state parks, national forests, and wilderness areas. The majority of private property in the area is residential or agricultural based, with very limited commercial or industrial development. The reconstruction of the upper reservoir on top of Proffit Mountain also included additional security lighting along the access road to the upper reservoir, the road that ascends the upper reservoir dam, as well as on the top of the upper reservoir dam surrounding the new gage house and emergency overflow spillway. Ameren Missouri cites safety as the primary need for the lighting, which provides illumination for visual inspection through video cameras of the monitoring equipment at the gage house and emergency overflow release structure, as well as along the road to the upper reservoir. Ameren Missouri reported that, prior to the breach, a single 500-watt light was mounted on the rail along the platform at the gage house and there were no lights on project roads in the vicinity of the upper reservoir. Ameren Missouri notes the new lighting includes directional hoods to deflect the lighting downward to where it is needed.

The Missouri Parks Association and East Ozarks Audubon Society comment that the new upper reservoir is much more intrusive than the original structure by day and the lights make it more obvious at night. They request that alternatives to the existing lighting be considered. Missouri DNR and East Ozarks Audubon Society suggest the use of innovative alternative lighting technologies such as infrared surveillance technology that would eliminate the need for light in an otherwise dark landscape. The International

Dark-Sky Association questions the implementation of “best practices” used in selecting and installing the lighting and requests that Ameren Missouri disclose the lighting analysis used, including disclosure of any Illuminating Engineering Society lighting standards that may have been used.

Our Analysis

In 2008, the Missouri Night Sky Protection Act was introduced to reduce the amount of light emitted into the night sky to near natural levels for specified Missouri protected places, including certain parks and historic sites that allow camping, wilderness areas, and riverways. In 2011, the Missouri Senate passed a resolution that urges the Missouri DNR to provide public education on light pollution and develop guidelines to address light pollution in new and existing state facilities. Areas near the project that would be protected under the Missouri Night Sky Protection Act include Taum Sauk Mountain State Park, Bell Mountain Wilderness Area, and Rock Pile Mountain Wilderness Area. The Istituto di Scienza e Tecnologia dell'Inquinamento Luminoso (Light Pollution Science and Technology Institute) of Thiene, Italy, has mapped artificial night sky brightness around the world (LPSTI, 2012). These maps show the levels of light pollution in the atmosphere rather than the stellar visibility. The maps indicate the project (including both reservoirs, nearby Johnson’s Shut-Ins State Park, and the wilderness areas) are all located within an area where artificial sky brightness is 10 percent higher than the natural brightness (which by the authors’ definition is light polluted sky). Areas of Reynolds County west of County Road 807 are considered free of light pollution. A 1997 study of Missouri State Parks and Class 1 Areas⁴⁰ Light Pollution Impact Study (Wagner, 1997) classified Taum Sauk State Park as receiving a moderate light pollution effect while Johnson’s Shut-Ins State Park was classified as slight. For context, the study concluded that more than 75 percent of Missouri State Parks and Class 1 areas analyzed have severe light pollution problems and have lost opportunities for viewing half of the visible stars.

The security lighting installed with the rebuild of the upper reservoir adds additional light sources at the top of the reservoir (where before there was a single light bulb), and new light sources along the access road. These additional lights exist in an area of the mountain that was previously relatively dark at night. Ameren Missouri’s aesthetics report (2011e) stated that nighttime lighting is visible from key observation points established on roads, a private residence, and from several sites in Loop 1 of Goggins Mountain campground. Ameren Missouri characterizes the lighting at the base of the upper reservoir as visible with moderate intensity small points of light surrounded

⁴⁰ Per 40 C.F.R. Part 81, the U.S. Environmental Protection Agency designated areas for air quality purposes for visibility. The two areas in Missouri are the Hercules-Glades Wilderness Area and the Mingo Wilderness Area.

by a halo of suffuse light. Ameren Missouri concludes that downward directional lighting would be effective in directing the light downward and not up into the night sky; however, the assessment fell short of identifying how visitors to the area perceived the lighting on the mountain, a comparison of the new lighting designs with the previous, single-light arrangement, or an evaluation of motion activated lights or other technologies.

Unlike during daylight hours where topography and vegetation can block direct views of the upper reservoir dam, lighting has the potential to extend beyond these barriers, diluting the surrounding darkness. Because the upper reservoir and all security lighting is on the top of Proffit Mountain, and all observation points and recreation users are below the lights, directional lighting may protect counter diffusion of light skyward but does not eliminate the lighting from visitors' views due to the elevated position on Proffit Mountain. Lights at the project would be more visible from some locations than others, and there are many areas where they are not visible at all (e.g., areas within Johnson's Shut-Ins State Park) or for a very short duration (e.g., drivers on area roads). The largest number of recreation users potentially affected by the lights would be campers at Goggins Mountain campground; however, only campsites in loop 1 of the campground have a direct view of the dam. Lighting from campers and facilities within the campground would likely dominate the near-ground visual character diminishing the views toward the dam.

The greatest contrast the lights would provide to recreation users would be for individuals out on night hikes or star gazing who are visiting the area in search of dark skies, or residents who have enjoyed decades of darker views. The estimated number of this user group is not reported. This population is likely much smaller than the day users and overnight campers; however, a number of entities commented that the area surrounding the project was a destination known for its dark night-time skies.

Ameren Missouri states the lights are required for safety and they provide illumination of the gages for the video cameras, so remote project operators have an alternative (redundant) means of monitoring the water elevation in the upper reservoir. The staff gage is lit 24-hours a day for review via the video camera, and there is a separate light cast in the direction of the emergency overflow spillway. There may be opportunity to redirect or even reduce lighting on the top of the dam; however, this ultimately must be balanced with project safety. Lighting directed at the staff gage for visual confirmation of the upper reservoir elevation for the video would be necessary; however, continuous lighting on the spillway might be able to be reduced given that the elevation of the spillway is relative to the staff gage. Conversion of the lights to infrared technology (or other similar lower light sources) would allow the continued use of the video system while reducing or eliminating lights from this elevated position.

The lights along the roads at the upper reservoir provide a new visual element to recreation users in the surrounding areas. Ameren Missouri reports the lights are visible from the majority of key observation points (Ameren Missouri, 2011e). Use of infrared technologies as recommended by East Ozarks Audubon Society would reduce the amount of visible light emitted along the road and at the top of the dam. Alternative technologies such as motion-activated lights could also be used to reduce the amount of light in the area while balancing potential lighting needs. For example, vehicular access to the upper reservoir is restricted by a security gate which is staffed by security personnel. The use of motion-activated lights along roads where they would only be needed intermittently would maintain safety lighting for night patrols while preserving the dark sky for extended periods of time (e.g., between patrols).

Because the region receives such low levels of artificial light pollution, the contribution of the additional lights at the project could have a noticeable effect for visitors. As such, conversion of the lighting of the gages at the top of the upper reservoir to infrared (or other lower light source technology) and motion activated lights along the access road would minimize new light sources conserving the dark night sky qualities of the area while maintaining sufficient lighting for security needs.

Upper Reservoir Rebuild

As part of the upper reservoir rebuild, Ameren Missouri cleared an almost 63-acre site for use as a construction staging and laydown area. Ameren Missouri implemented the Upper Reservoir Rebuild Reforestation Plan for this area to restore this area with native trees and plants. Ameren Missouri also used the area near the lower reservoir boat ramp and campground during the rebuild for personnel, materials, and equipment.

Missouri DNR recommends Ameren Missouri continue to maintain the trees that were planted as part of the Upper Reservoir Rebuild Reforestation Plan, and address the need for additional tree plantings or appropriate native plants where land is disturbed. Missouri DNR also recommends increasing recreation opportunities (e.g., additional trail development) on Ameren Missouri-owned property near Church Mountain as mitigation for the effects of the project on aesthetic resources. Missouri Parks Association, Great Rivers, and East Ozarks Audubon Society recommend Ameren Missouri transfer the title of their Church Mountain and Taum Sauk Creek valley properties to the State of Missouri to compensate for lost aesthetic and recreation values. The L-A-D Foundation also recommends that Ameren Missouri transfer the title of their Church Mountain properties to the State of Missouri.

Our Analysis

Reforestation Plan

The breach event of the upper reservoir and the resulting rebuild required the excavation and clearing of the entire old dam and a complete rebuild. Such a large construction project required the clearing of nearby areas to stage the various steps in constructing the new facilities. The resulting activities in areas at the lower reservoir campground and boat ramp parking area brought additional fencing, road barriers, excess materials, and related damages to the ground surfaces, altering the visual appearance of these areas. In general, the shift was one from primitive, low-use recreation areas to heavily developed, industrial type uses during the construction period and later, post-construction, these areas continue to show signs of the rebuild effort.

The Upper Reservoir Rebuild Reforestation Plan to restore the construction laydown area (62.9 acres) near the toe of the upper reservoir was required as part of the upper reservoir rebuild. The plan required the installation and monitoring of trees and vegetation native to the area for a minimum of 5 years. Over time, these trees would mature to about 50 to 75 feet tall and provide a visual buffer against the lower portions of the upper reservoir dam. Currently the new concrete exterior of the dam is very light in color and contrasts with the surrounding visual landscape. The Upper Reservoir Rebuild Reforestation Plan calls for the use of seed native to the area thereby promoting a future landscape similar to the surrounding conditions. We discuss effects of the plan on terrestrial resources in section 3.3.3.2, *Terrestrial Resources*.

Ameren Missouri has not filed a similar plan for restoration of other areas affected by construction activities. Revegetating the lower reservoir campground and boat launch area is supported by the results from the recreation study. The report concluded that, due to the area's remote and scenic location, it is an attractive destination for nature-based experiences. The removal of the concrete traffic barriers or the replacement with more aesthetically appropriate materials at the boat launch parking area, as part of the reforestation plan, would improve the visual resources of the area while still meeting the function of managing parking and traffic. Also planting native trees and plants at the lower reservoir boat parking area disturbed by the construction of the upper reservoir, as part of the reforestation plan, would improve the visual resources of these areas.

Church Mountain and Taum Sauk Creek valley properties

Ameren Missouri Church Mountain and Taum Sauk Creek valley properties are not within the project boundary and are not needed for project purposes. Any decisions on transferring title to the land or allowing public uses of its property are outside the purview of this EA.

Previously closed trails, such as the popular Ozark Trail are now open to the public, diminishing the need for development of new trails as recommended by Missouri DNR.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the project would continue to operate as it has in the past. None of Ameren Missouri's proposed measures or resource agencies' recommendations and mandatory conditions would be required.

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4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the Taum Sauk Project's use of the East Fork Black River for hydropower purposes to see what effects various environmental measures would have on the project's costs and power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corp.*,⁴¹ the Commission compares the current project cost to an estimate of the cost of obtaining the same amount of energy and capacity using the likely alternative source of power for the region (cost of alternative power). In keeping with Commission policy as described in *Mead Corp.*, our economic analysis is based on current electric power cost conditions and does not consider future escalation of fuel prices in valuing the hydropower project's power benefits.

For each of the licensing alternatives, our analysis includes an estimate of: (1) the cost of individual measures considered in the draft EA for the protection, mitigation and enhancement of environmental resources affected by the project; (2) the cost of alternative power; (3) the total project cost (i.e., for construction, operation, maintenance, and environmental measures); and (4) the difference between the cost of alternative power and total project cost. If the difference between the cost of alternative power and total project cost is positive, the project produces power for less than the cost of alternative power. If the difference between the cost of alternative power and total project cost is negative, the project produces power for more than the cost of alternative power. This estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

4.1 POWER AND DEVELOPMENTAL BENEFITS OF THE PROJECT

Table 12 summarizes the assumptions and economic information we use in our analysis. This information was provided by Ameren Missouri in its license application. We find that the values provided by Ameren Missouri are reasonable for the purposes of this analysis. Cost items common to all alternatives include: (1) taxes and insurance costs; (2) net investment (the total investment in power plant facilities remaining to be depreciated); (3) estimated future capital investment required to maintain and extend the life of plant equipment and facilities; (4) relicensing costs; (5) normal operation and maintenance cost; and (6) Commission fees. All dollars are in year 2012, unless specified otherwise.

⁴¹ See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (July 13, 1995). In most cases, electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

Table 12. Parameters for the economic analysis of the Taum Sauk Project.

Parameter	Value	Source
Period of analysis (years)	30	staff
Local tax rate including property taxes (%)	3.4	staff
Federal income tax rate (%)	35	staff
Net investment (2012 \$)	\$90,250,00	Ameren Missouri
Operation and maintenance, \$/year	\$5,138,050	Ameren Missouri
Power value including energy, capacity and ancillary services (\$/MWh)	\$163.20	staff
Pumping ratio (MWh pumping/MWh generating)	1.40	Ameren Missouri
Pumping energy cost (2012 \$)	\$19,248,000	Ameren Missouri
Interest rate (%)	8	staff
Discount rate (%)	8	staff

As currently operated, the Taum Sauk Project has an installed capacity of 408 MW and generates an average of 497,241 MWh annually. Table 12 includes our estimate of the power value in dollars per megawatt-hour, which includes energy, capacity, and ancillary services. This value is based on composite energy and ancillary services rates from the MISO 2010 State of the Market Report and a capacity rate of \$159/kilowatt-year based on the amortization and fixed operation and maintenance cost for a simple-cycle combustion turbine. We discuss the effects of proposed operational changes on power benefits in section 4.2.2.

4.2 COMPARISON OF ALTERNATIVES

Table 13 compares the installed capacity, annual generation, cost of alternative power, estimated total project cost, and difference between the cost of alternative power and total project cost for each of the alternatives considered in this EA: (1) no action; (2) Ameren Missouri's proposal; (3) the staff alternative; and (4) staff alternative with mandatory conditions.

Table 13. Summary of the annual cost of alternative power and annual project cost for the alternatives for the Taum Sauk Project (Source: staff).

	No action alternative	Ameren Missouri's Proposal	Staff Alternative	Staff Alternative with Mandatory Conditions
Installed capacity (MW)	408	408	408	408
Annual generation (MWh)	497,241	497,241	497,241	497,241
Dependable capacity (MW)	1,276	1,276	1,276	1,276
Annual cost of alternative power (\$/MWh)	\$80,701,000 162.30	\$80,701,000 162.30	\$80,701,000 162.30	\$80,701,000 162.30
Annual project cost (\$/MWh)	\$108,660,940 218.53	\$109,303,980 219.82	\$109,356,410 219.93	\$109,364,380 219.94
Difference between the cost of alternative power and project cost (\$/MWh)	(\$27,959,940) (56.23)	(\$28,602,980) (57.52)	(\$28,655,410) (57.63)	(\$28,663,380) (57.64)

Note: A number in parenthesis denotes that the difference between the cost of alternative power and project cost is negative, thus the total project cost is greater than the cost of alternative power.

4.2.1 No-action Alternative

Under the no-action alternative, the project would continue to be operated as it does now. The project would have an installed capacity of 408 MW, and generate an average of 497,241 MWh of electricity annually. The average annual cost of alternative power would be \$80,701,000, or about \$162.30/MWh. The average annual project cost would be \$108,660,940, or about \$218.53/MWh. Overall, the project would produce power at a cost that is \$27,959,940, or \$56.23/MWh, more than the cost of alternative power.

4.2.2 Ameren Missouri's Proposal

Ameren Missouri proposes to continue to operate the Taum Sauk Project now that the upper reservoir has been reconstructed and returned to service. Ameren Missouri proposes various environmental measures to protect existing environmental resources in the vicinity of project features.

Under Ameren Missouri's proposed alternative, the project would generate an average of 497,241 MWh annually. The annual cost of alternative power under Ameren Missouri's proposed alternative would be \$80,701,000, or \$162.30/MWh. The average annual project cost would be \$109,303,980, or \$219.82/MWh. Overall, the project would produce power at a cost that is \$28,602,980, or \$57.52/MWh, more than the cost of alternative power.

4.2.3 Staff Alternative

The staff alternative would have the same capacity and energy attributes as Ameren Missouri's proposed project. Table 14 shows the staff-recommended additions, deletions, and modifications to Ameren Missouri's proposed environmental protection and enhancement measures and the estimated cost of each. Under the staff alternative, the average annual cost of alternative power would be \$80,701,000, or \$162.30/MWh. The annual project cost would be \$109,356,410, or \$219.93/MWh. Overall, the project would produce power at a cost that is \$28,655,410, or \$57.63/MWh, more than the cost of alternative power.

4.2.3 Staff Alternative with Mandatory Conditions

The staff alternative with mandatory conditions would have the same capacity and energy attributes as Ameren Missouri's proposed project. Table 14 shows the staff-recommended and mandatory additions, deletions, and modifications to Ameren Missouri's proposed environmental protection and enhancement measures and the estimated cost of each. Under the staff alternative with mandatory conditions, the average annual cost of alternative power would be \$80,701,000, or \$162.30/MWh. The annual project cost would be \$109,364,380, or \$219.94/MWh. Overall, the project would produce power at a cost that is \$28,663,380, or \$57.64/MWh, more than the cost of alternative power.

4.3 COST OF ENVIRONMENTAL MEASURES

Table 14 gives the cost of each of the environmental enhancement measures considered in staff's analysis. We convert all costs to equal annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

Table 14. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of the continued operation of the Taum Sauk Project (Source: staff).

Enhancement/Measure	Entity	Capital Cost (2012\$)	Annual Cost (2012\$) ^a	Levelized Annual Cost (2012\$) ^b
Geologic and Soils Resources				
1. Finalize and implement the Gravel and Sedimentation Control Plan.	Ameren Missouri, staff	\$5,000	\$2,670	\$3,400 ^c
2. Modify the draft Gravel and Sedimentation Control Plan to include a cleanup and recovery plan to be implemented in case the overflow release structure is overtopped.	Missouri Parks Association, Great Rivers, Missouri DNR, staff	\$5,000	\$0	\$730 ^c
3. Modify the draft Gravel and Sedimentation Control Plan to include a provision to truck coarse-grained sediment from upstream of the bin wall to a location(s) downstream from the lower reservoir dam for enhancement of downstream aquatic habitat.	Missouri DOC, staff	\$12,000	\$0	\$1,760 ^c
4. Upon request of the Missouri DNR, design and implement erosion control measures as necessary to address erosion resulting from use of project lands that causes turbidity or otherwise compromises water quality. Any erosion	Missouri DNR	\$0	\$0	\$0 ^c

Enhancement/Measure	Entity	Capital Cost (2012\$)	Annual Cost (2012\$)^a	Levelized Annual Cost (2012\$)^b
control work that exceeds minor maintenance would be subject to prior approval by Missouri DNR.				
Water Resources				
1. Install upgraded flow release systems at the lower reservoir including an upgraded slide gate.	Ameren Missouri, staff	\$2,453,330	\$131,870	\$492,100 ^f
2. Implement the Water Management Plan for operation of the upper and lower reservoirs, that would: (1) match the outflow downstream of the lower reservoir dam to inflow into the lower reservoir under normal conditions to the extent possible; (2) maintain USGS gaging station nos. 07061270 and 07061290; (3) provide a minimum discharge of 1.7 cfs from the lower reservoir dam; (4) implement ramping rates for the return from off-normal operation and maintenance activities; (5) include an assessment period between August 15, 2011 and January 14, 2013; and (6) monitor and publish water level, volume, and outflow information on the internet and maintain the information for	Ameren Missouri, Missouri DNR, Missouri DOC, staff	\$20,440	\$104,270	\$107,270 ^e

Enhancement/Measure	Entity	Capital Cost (2012\$)	Annual Cost (2012\$)^a	Levelized Annual Cost (2012\$)^b
documenting the operation of the project.				
3. Implement passage of moderate flood events (channel maintenance flows) to maintain the stream channel downstream of the lower reservoir.	Missouri DOC	\$0	\$0	\$0 ^d
4. Develop and implement a water quality monitoring plan for temperature, DO, conductivity, pH, and turbidity and monitor for the term of the license.	Missouri DOC, Missouri DNR,	\$10,000	\$5,000	\$6,470 ^c
5. Maintain healthy riparian corridors in the project area for the protection of water quality.	Missouri DNR	\$0	\$0	\$0 ^c
6. Ensure continued protection of project lands within the watershed to minimize public lands and to maintain water quality of state waters.	Missouri DNR	\$0	\$0	\$0 ^c
7. Clean up and report any petroleum spills to Missouri DNR in a timely manner.	Missouri DNR, staff	\$0	\$0	\$0 ^c

Enhancement/Measure	Entity	Capital Cost (2012\$)	Annual Cost (2012\$)^a	Levelized Annual Cost (2012\$)^b
Fisheries Resources				
1. Maintain a “put-and-take” fishery in the lower reservoir for the term of the license with a detailed annual stocking plan developed in consultation with the Missouri DOC.	Ameren Missouri, Missouri DOC, staff	\$0	\$20,440	\$20,440 ^e
2. Relocate fish from the upper reservoir to the lower reservoir whenever the upper reservoir is dewatered for maintenance.	Ameren Missouri, staff	\$0	\$2,560	\$2,560 ^e
3. Develop and implement a habitat enhancement plan for fisheries in the lower reservoir.	Missouri DNR, Missouri DOC, staff	\$17,500	\$2,000	\$4,570 ^c
Terrestrial Resources				
1. Work with resource agencies to find ways to manage feral hog and contribute to feral hog population control efforts. Continue to provide support to the Feral Hog Task Force’s efforts to control and eradicate feral hogs in the area.	Missouri DNR, Missouri DOC	\$10,220	\$0	\$1,500 ^e

Enhancement/Measure	Entity	Capital Cost (2012\$)	Annual Cost (2012\$)^a	Levelized Annual Cost (2012\$)^b
2. Allow access to the project lands for agencies to trap and/or kill feral hogs.	Missouri DNR, staff	\$0	\$0	\$0 ^c
3. Support efforts of Missouri DNR and Missouri DOC to control non-native invasive species.	Missouri DNR, staff	\$0	\$0	\$0 ^c
Threatened and Endangered Species				
1. Finalize, after consultation with FWS and Missouri DOC, and implement the Indiana and Gray Bat Management Plan after consultation with FWS and Missouri DOC.	Ameren Missouri, Missouri DNR, Missouri DOC, staff	\$25,560	\$5,110	\$8,860 ^e
2. Develop a protection plan for threatened and endangered plant and animal species including Mead's milkweed, Hine's emerald dragonfly, and Ozark hellbender.	Missouri DNR, Missouri DOC	\$10,220	\$0	\$1,500 ^c
3. Continue to support protection of threatened and endangered plant and animal species on Ameren Missouri lands, in consultation with FWS and Missouri DOC.	Missouri DNR, staff	\$0	\$0	\$0 ^c

Enhancement/Measure	Entity	Capital Cost (2012\$)	Annual Cost (2012\$)^a	Levelized Annual Cost (2012\$)^b
Recreation Resources				
1. Continue to provide for public access to the lower reservoir.	Ameren Missouri, staff	\$0	\$0	\$0 ^g
2. Develop a recreation management plan in consultation with Missouri DNR and Missouri DOC to address all recreational issues including, but not limited to: (1) the preservation of Church Mountain; (2) development of a new trail network connecting public use areas; and (3) offsetting the loss of free access to the museum and overlook through development of additional public recreation opportunities.	Missouri DNR, Missouri DOC	\$80,000	\$0	\$11,750 ^c
3. Continue to prohibit public ATV use on Ameren Missouri-owned lands and maintain signs and gates to prohibit ATV use.	Ameren Missouri	\$22,490	\$5,110	\$8,410 ^e

Enhancement/Measure	Entity	Capital Cost (2012\$)	Annual Cost (2012\$)^a	Levelized Annual Cost (2012\$)^b
4. Accommodate scheduled, supervised educational tours of the upper reservoir and powerhouse/tailrace channel area while prohibiting general public access to the upper reservoir, powerhouse, museum, and picnic pavilion in the interest of project safety and security.	Ameren Missouri, staff	\$0	\$0	\$0 ⁱ
5. Address the need to control unauthorized and harmful ATV/ORV use in nearby conservation lands, wilderness, and natural areas.	Missouri DNR	\$0	\$0	\$0 ^j
6. Develop, after consultation with Missouri DNR and Missouri DOC, and implement a recreation management plan to address all recreational issues including, but not limited to: (1) provisions to provide for public access to the lower reservoir, which includes a boat ramp, parking area, campgrounds, and an informal overlook at the lower reservoir dam; (2) provisions to operate and maintain recreation facilities; and (3) accommodate scheduled, supervised educational tours of the upper reservoir.	staff	\$77,000	\$0	\$11,310 ^c

Enhancement/Measure	Entity	Capital Cost (2012\$)	Annual Cost (2012\$)^a	Levelized Annual Cost (2012\$)^b
Land Use				
1. Transfer the title to Church Mountain properties to the State of Missouri to compensate for lost aesthetic and recreational value.	Missouri Parks Association and Great Rivers, L-A-D Foundation, East Ozarks Audubon Society	\$0	\$0	\$0 ^j
2. Transfer the title to Taum Sauk Creek Valley properties to the State of Missouri to compensate for lost aesthetic and recreation value.	Missouri Parks Association and Great Rivers, East Ozarks Audubon Society	\$0	\$0	\$0 ^j
Aesthetic Resources				
1. Develop, after consultation with Missouri DNR, Missouri DOC, Missouri Parks Association, East Ozark Audubon Society, Missouri Coalition for the Environment, and International Dark Sky, and implement an outdoor lightning plan, to evaluate the specification of the existing lighting and evaluate alternative configurations and technologies.	Missouri Parks Association and Great Rivers, Missouri DNR, East Ozarks Audubon Society	\$80,000	\$0	\$11,750 ^c

Enhancement/Measure	Entity	Capital Cost (2012\$)	Annual Cost (2012\$)^a	Levelized Annual Cost (2012\$)^b
2. Convert the lighting at the top of the upper reservoir to infrared (or other lower light emitting technology) and convert the lights along the access road to motion-activated lights to maintain dark skies to the extent possible.	staff	\$5,000	\$0	\$730 ^c
3. Develop, after consultation with Missouri DNR, and implement a reforestation plan for the upper reservoir and extend revegetation efforts to the lower reservoir recreation areas, to install, maintain, and monitor trees planted following the rebuild of the upper reservoir and to reclaim and restore construction laydown areas at the lower reservoir boat launch parking area and campground.	Missouri DNR, staff	\$135,000	\$20,000	\$39,820 ^c
4. Mitigate for aesthetic effects by increasing recreational opportunities through further trail development on Ameren Missouri-owned property, such as the existing trail easements between Ameren Missouri and Missouri Division of State Parks and other recreational opportunities on Church Mountain.	Missouri DNR	\$0	\$0	\$0 ^j

Enhancement/Measure	Entity	Capital Cost (2012\$)	Annual Cost (2012\$) ^a	Levelized Annual Cost (2012\$) ^b
Cultural Resources				
1. Execute and implement a PA that requires Ameren Missouri to initiate consultation under section 106 of the NHPA with the Missouri SHPO and the Osage Nation, and prepare an HPMP on a case-by-case basis in the event that the project is determined to affect either identified historic properties or as-yet unidentified historic properties during the term of any new license, if issued.	Ameren Missouri, staff	\$0	\$0	\$0 ⁱ
2. Modify the PA to include a provision that requires Ameren Missouri to evaluate, after consultation with the Missouri SHPO, the Taum Sauk Project's eligibility for the National Register when the project is 50 years old, and develop an HPMP if the project is determined to be eligible for the National Register.	staff	\$10,000	\$0	\$1,470 ^c

^a Annual costs typically include operation and maintenance costs and any other costs which occur on a yearly basis.

^b All capital and annual costs are converted to equal annual costs over a 30-year period to give a uniform basis for comparing costs.

^c Cost estimated by staff.

^d No cost was assigned for this measure; our analysis determined that no substantive benefit would result from implementation.

^e Cost provided by Ameren Missouri.

- f Cost for the replacement of the slide gate in 2011 and again in 2030 was provided by Ameren Missouri; we used half of the current cost of replacement of the gate in 2030 to reflect the fact that it would occur well into the new license term.
- g Although Ameren Missouri provided a cost for this measure (\$52,000/year), this is measure is for continuation of existing operation and maintenance costs which are included in the base costs of the no action, proposed and staff alternatives so we did not add this cost as a proposed new cost.
- h Ameren Missouri did not assign a cost for this measure.
- i There would be no additional cost for implementation of this measure.
- j No cost was assigned for this measure as the lands are located outside of the project boundary and the Commission would have no authority to impose this requirement on Ameren Missouri.
- k This measure is addressed in the staff-recommended recreation management plan and the staff-recommended landscaping plan and the cost is included under those plans.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPARISON OF ALTERNATIVES

In this section we compare the developmental and non-developmental effects of Ameren Missouri's proposal, the staff alternative, the staff alternative with mandatory conditions, and the no-action alternative.

We estimate the annual generation of the project under the proposal and two alternatives identified. Our analysis shows that the annual generation would be 497,241 MWh for the proposed action; the staff alternative; and for the no-action alternative. We summarize the environmental effects of the different alternatives in table 15.

Table 15. Comparison of alternatives (Source: staff).

Resource	No-Action Alternative	Proposed Action	Staff Recommended Alternative	Staff Recommended Alternative with Mandatory Conditions
Geologic and Soils Resources	Operation of the project would continue to trap sediment behind the bin wall.	Sediment would continue to be trapped behind the bin wall. Ameren Missouri proposes to finalize the Gravel and Sedimentation Control Plan for removal and disposal of sediments.	Same as under the proposed action except that Ameren Missouri would include a cleanup and recovery plan to mitigate for potential effects if the emergency overflow release structure were to overtop. Ameren Missouri would also be required, as a provision of the Gravel and Sedimentation Control Plan, to transport bedload material from upstream of the bin wall to the East Fork Black River downstream from the lower reservoir dam to enhance aquatic habitat.	Same as Staff Recommended Alternative, except erosion control measures would be implemented to address erosion in the lower reservoir.
Water Quality	DO and turbidity would periodically be inconsistent with state water quality standards, but these inconsistencies would not be	Same as the no-action alternative.	Same as under the no-action alternative.	Same as Staff Recommended Alternative, except Ameren Missouri would develop and implement a temperature, DO, conductivity, pH, and

Resource	No-Action Alternative	Proposed Action	Staff Recommended Alternative	Staff Recommended Alternative with Mandatory Conditions
	caused by project operations.			turbidity monitoring plan to determine if there are any inconsistencies with water quality standards, and would include provisions to address any issues detected during monitoring.
Fisheries	Operation of the project would cause habitat limitations in lower reservoir because of reservoir fluctuation, continued fish entrainment mortality, and fluctuations of aquatic habitat in the East Fork Black River downstream from the lower reservoir dam.	Similar to no action, but Ameren Missouri would implement its proposed Water Management Plan that would match outflow downstream from the lower reservoir dam to inflow upstream of the project under normal conditions and release a minimum flow of 1.7 cfs downstream from the lower reservoir dam to limit the effect of discharges from the	Same as under the proposed action, except that Ameren Missouri would develop and implement a habitat enhancement plan to improve habitat for sportfish in the lower reservoir, and would prepare a fish stocking plan in consultation with Missouri DOC.	Same as Staff Recommended Alternative.

Resource	No-Action Alternative	Proposed Action	Staff Recommended Alternative	Staff Recommended Alternative with Mandatory Conditions
Terrestrial	The habitat restored at the upper reservoir after the rebuild of the upper reservoir would not be maintained and monitored.	<p>lower reservoir and to protect downstream aquatic habitat. Ameren Missouri would also implement a fish stocking program in the lower reservoir to enhance fisheries.</p> <p>Same as no-action alternative.</p>	Same as under the proposed action, except that Ameren Missouri would develop and implement a reforestation plan to maintain and monitor native vegetation planted following the rebuild of the upper reservoir to improve terrestrial habitat.	Same as Staff Recommended Alternative, except Ameren Missouri would ensure the maintenance of healthy riparian corridors along the lower reservoir shoreline, minimize any effects on project lands that may result from project activities, and provide support to control and eradicate feral hogs in the area.

Resource	No-Action Alternative	Proposed Action	Staff Recommended Alternative	Staff Recommended Alternative with Mandatory Conditions
Threatened and Endangered Species	Project operation would continue to affect Indiana bats and gray bats.	Ameren Missouri would finalize the Indiana and Gray Bat Management Plan, which contains measures to protect these species during proposed project operation.	Same as under the proposed action.	Same as under the proposed action.
Recreation and Land Use	Access and use of the reach downstream from the lower reservoir dam would continue.	Access to the lower reservoir would continue and access to the upper reservoir would be by appointment only.	Same as under the proposed action except that Ameren Missouri would develop and implement a recreation management plan that would include Ameren Missouri measures and would ensure that the existing facilities would be operated and maintained to enhance recreationists' experiences.	Same as Staff Recommended Alternative.
Aesthetics	Trees planted after the rebuild of the upper reservoir would not be maintained and	Same as the no-action alternative.	Same as under the proposed action, except that Ameren Missouri would develop and implement a reforestation plan to maintain trees at the	Same as Staff Recommended Alternative.

Resource	No-Action Alternative	Proposed Action	Staff Recommended Alternative	Staff Recommended Alternative with Mandatory Conditions
	<p>construction laydown areas near the lower reservoir boat ramp parking area would not be improved. Also the amount of security lighting would remain unchanged, affecting recreation experiences at night.</p>		<p>upper reservoir and revegetate laydown areas at the lower reservoir boat ramp parking area to improve project aesthetics. Also Ameren Missouri would convert the security lighting at the top of the reservoir and along the access road to infrared and motion-activated lighting, respectively, to reduce the effects of nighttime lighting.</p>	
Cultural	<p>Potential for existing or newly discovered cultural resources at the project to be affected during the term of any license, if issued for the project.</p>	<p>Ameren Missouri would comply with a PA and initiate consultation with the Missouri SHPO and the Osage Nation for any potential effects on known historic properties or unknown properties discovered during the term of any new license, and prepare an HPMP on an</p>	<p>Same as under the proposed action except that Ameren Missouri would also evaluate the historical significance of the project, after consultation with the Missouri SHPO, after 50 years of operation, and develop an HPMP if the project is deemed eligible for listing in the National Register to ensure that</p>	<p>Same as Staff Recommended Alternative.</p>

Resource	No-Action Alternative	Proposed Action	Staff Recommended Alternative	Staff Recommended Alternative with Mandatory Conditions
		as-needed basis after consultation with the Missouri SHPO and the Osage Nation.	project operation would not diminish its eligibility.	

5.2 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife; the protection of recreational opportunities; and the preservation of other aspects of environmental quality. Any license issued shall be such as in the Commission's judgment would be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. This section contains the basis for, and a summary of, our recommendations for relicensing the Taum Sauk Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on this project and our review of the environmental and economic effects of the proposed project and its alternatives, we select the staff alternative as the preferred option. We recommend this alternative because: (1) issuance of a new hydropower license by the Commission would allow Ameren Missouri to operate the project as a dependable source of electrical energy for its customers; (2) the public benefits of this alternative would exceed those of the no-action alternative; and (3) the recommended measures would protect and enhance fish and wildlife resources, and would provide improved recreation opportunities at the project.

In the following section, we make recommendations as to which environmental measures proposed by Ameren Missouri or recommended by agencies and other entities should be included in any license issued for the project. In addition to Ameren Missouri's proposed environmental measures, we recommend several additional staff-recommended measures that would modify Ameren Missouri's proposed environmental measures. We also discuss which measures proposed by Ameren Missouri or recommended by others that we do not recommend including in a license.

Measures Proposed by Ameren Missouri and Recommended by Staff

Based on our environmental analysis of Ameren Missouri's proposal discussed in section 3, *Environmental Analysis*, and the costs discussed in section 4, *Developmental Analysis*, we conclude that the following environmental measures proposed by Ameren Missouri would protect and enhance environmental resources and would be worth the cost. We recommend including these measures in any license issued for the project:

- finalize, after consultation with Missouri DNR, and implement its proposed Gravel and Sedimentation Control Plan which contains procedures and timeframes for cleaning out and disposing of the gravel and sediment behind the bin wall under both normal and emergency conditions;

- finalize and implement its proposed Water Management Plan for operation of the upper and lower reservoirs, with provisions to: (1) approximately match outflow downstream of the lower reservoir dam to inflow to the lower reservoir under normal conditions to the extent possible; (2) maintain U.S. Geological Survey (USGS) gaging stations upstream (USGS no. 07061270) and downstream (USGS no. 07061290) of the project; (3) provide a minimum discharge of 1.7 cubic feet per second from the lower reservoir to the East Fork Black River; (4) implement ramping rates in the East Fork Black River immediately downstream from the lower reservoir when powerhouse operations or maintenance activities require changes to the withdrawal from or release of flow to the East Fork Black River; (5) evaluate the effectiveness of the ramping rates; and (6) monitor and maintain water level, volume, and outflow information to document project operation, and publish such information on the internet for use by the agencies and recreating public;
- install upgraded flow release systems at the lower reservoir, including an upgraded slide gate, to implement the provisions of the proposed Water Management Plan, including providing the proposed minimum flow;
- maintain a "put-and-take" fishery in the lower reservoir for the term of any license issued, with annual stockings based on a detailed stocking plan developed after consultation with Missouri DOC;
- relocate fish from the upper reservoir to the lower reservoir whenever the upper reservoir is dewatered for maintenance;
- finalize, after consultation with FWS and Missouri DOC, and implement an Indiana and Gray Bat Management Plan;
- continue to provide public access to the lower reservoir;
- accommodate scheduled, supervised educational tours of the upper reservoir and powerhouse/tailrace channel area, while prohibiting general public access to the upper reservoir, powerhouse, museum, and picnic pavilion in the interest of project safety and security;
- remove 497.3 acres of land from the existing project boundary that are not necessary for operation and maintenance of the project or for other project purposes, such as recreation or protection of environmental resources; and
- execute and implement a PA that requires Ameren Missouri to initiate consultation under section 106 of the NHPA with the Missouri SHPO and the Osage Nation, and prepare an HPMP on a case-by-case basis in the event that

the project is determined to affect either identified historic properties or as yet unidentified historic properties during the term of any new license.

Additional Measures and Modifications Recommended by Staff

In addition to Ameren Missouri's proposed measures listed above, we recommend the following modifications to Ameren Missouri's proposed measures and additional staff-recommended measures in any license issued for the Taum Sauk Project:

- include the following additional provisions in the proposed Gravel and Sedimentation Control Plan: (1) a cleanup and recovery plan to be implemented in the unlikely event that the emergency overflow release structure is overtopped, and (2) transporting the removed gravel and sediment to a disposal site in the East Fork Black River downstream from the lower reservoir dam to enhance aquatic habitat
- develop, after consultation with Missouri DOC and Missouri DNR, and implement a habitat enhancement plan, to include provisions for installing artificial structures, for the fisheries in the lower reservoir;
- develop, after consultation with Missouri DOC and Missouri DNR, and implement a recreation management plan that includes provisions to maintain the recreation facilities at the lower reservoir and provide for supervised tours of the upper reservoir;
- develop, after consultation with Missouri DNR, and implement a reforestation plan that includes provisions to: (1) extend the existing Upper Reservoir Rebuild Reforestation Plan for a minimum of 5 years, (2) revegetate the former construction laydown areas at the lower reservoir boat launch parking area and campground, and (3) maintain and monitor the vegetation for a minimum of 5 years and until the seedlings reach a survival rate of 70 percent and are well established at the project;
- convert existing lighting at the top of upper reservoir and along the upper reservoir access road to infrared and motion-activated lights, respectively, to provide surface night-lighting along roads and at the top of the upper reservoir dam that maintains project safety, while minimizing unnecessary lighting that could adversely effect aesthetic resources important to local residents and recreationists; and
- modify the PA to include a provision that Ameren Missouri evaluate, after consultation with the Missouri SHPO, the Taum Sauk Project's eligibility for the National Register when the project is 50 years old, and develop an HPMP if the project is determined to be eligible for the National Register.

Below, we discuss our rationale for modifying Ameren Missouri's proposal and the basis for our staff-recommended measures.

Geology and Soils

Ameren Missouri proposes to implement a Gravel and Sedimentation Control Plan to assess sedimentation transport during project operation. As discussed in section 3.3.1, *Geologic and Soils Resources*, the proposed Gravel and Sedimentation Control Plan would include procedures for cleaning out the sediment behind the bin wall and disposal of that excavated sediment under both normal and emergency conditions. However, Ameren Missouri's proposed Gravel and Sedimentation Control Plan does not address any measures that would be implemented in the unlikely event that the emergency overflow release structure would be overtopped, which would result in erosion of the pathway that the flows would take. A plan for the cleanup and recovery to be implemented in case the emergency overflow release structure is used would help ensure environmental effects would be minimized and that protocols would be in place in an unlikely event of dam failure.

The presence of the bin wall and the lower reservoir dam has limited bedload movement and gravel recruitment into the East Fork Black River immediately downstream from the lower reservoir dam. Ameren Missouri proposes periodic cleanout and trucking of bedload material from upstream of the bin wall, and this material would be a good source of gravel for placement immediately downstream of the lower reservoir dam, to enhance existing conditions in the East Fork Black River where gravel recruitment has been interrupted by the presence of the dam.

Material trucked from above the bin wall would require disposal, and adding coarse-grained sediment in the river downstream from the lower reservoir dam via trucking could have a short-term benefit to aquatic habitat downstream from the dam. Therefore, modifying Ameren Missouri's proposed Gravel and Sediment Control Plan to include a provision for trucking coarse-grained sediment from upstream of the bin wall to a location(s) downstream from the lower reservoir dam would be a reasonable approach to addressing the issue of bedload movement within the East Fork Black River.

In section 4, *Developmental Analysis*, we determined that the total annualized cost of a final Gravel and Sedimentation Control Plan with our recommended additional measures would be about \$5,900. Our recommended measures would ensure that provisions and protocols are in place to minimize any adverse effects that might result from use of the overflow release structure, and would provide the opportunity to enhance aquatic habitat in the East Fork Black River downstream of the lower reservoir dam. Therefore, we conclude that the development and implementation of the Gravel and Sedimentation Control Plan with our recommended measures would be worth the cost.

Therefore, we recommend that Ameren Missouri, after consultation with the Missouri DNR and Missouri DOC, modify its proposed Gravel and Sedimentation Control Plan to include additional provisions for: (1) a cleanup and recovery plan to be implemented in the unlikely event that the emergency overflow release structure overtopped; and (2) transporting bedload material removed from upstream of the bin wall to downstream from the lower reservoir dam to enhance aquatic habitat.

Aquatic Resources

Fish Habitat Enhancement Plan

As discussed in section 3.3.2, *Aquatic Resources*, Missouri DOC commented that almost all significant habitat features were removed from the lower reservoir after the 2005 breach event, that daily water level fluctuations associated with project operation affect habitat availability for reservoir fish species, and that these effects should be considered. Missouri DOC also commented that fisheries management in the reservoir depends on natural recruitment of largemouth bass and bluegill. To achieve its management goals for the lower reservoir, Missouri DOC recommends that habitat enhancement be considered.

In section 3.3.2, *Aquatic Resources*, we concluded that, while maintaining a constant reservoir level would enable some species to successfully spawn, such a measure would not allow the pumped storage project to operate as designed. While the combination of a reservoir level fluctuation and existing poor habitat may limit natural fish production in the reservoir, we determined that improving habitat via artificial structures placed within the lower reservoir could improve fish production.

We recommend that Ameren Missouri develop and implement a habitat enhancement plan for the lower reservoir. Because Missouri DOC did not provide specific recommendations for habitat enhancement, any enhancements installed in the reservoir would need to be preceded by preparation of a habitat enhancement plan. The plan should be prepared after consultation with Missouri DOC and Missouri DNR, and, at a minimum, include: (1) the specific objectives of the habitat enhancement program for largemouth bass, bluegill, and any other identified target species; (2) the proposed location(s) for the habitat enhancement structures placed in the Taum Sauk Creek and East Fork Black River arms of the lower reservoir, including identifying the elevations of the proposed structure(s) within the reservoir; (3) the conceptual design of any habitat enhancement structure(s) chosen (e.g., log cribs, tire reefs, anchored woody debris, rock piles, anchored used Christmas trees, or any other alternative designs that may be identified during consultation with the agencies); (4) a schedule for the placement of the structure(s); and (5) a 5-year monitoring program to assess fish usage of the structures, and any effects the structures have on fish production in the reservoir. This plan would

be consistent with condition 3.g of the WQC, which requires Ameren Missouri to support efforts to improve aquatic habitat in the lower reservoir.

In section 4, *Developmental Analysis*, we determined that the annualized cost for the preparation of a habitat enhancement plan and initial implementation would cost about \$4,570. We expect that the structures would be placed in the reservoir during the first few years of the license, which would constitute the greatest cost of the program. Once the structures are in place, we determined that ongoing maintenance of the structures would cost about \$2,000 per year. We find that the benefits of the habitat enhancement would be worth this cost.

Reforestation Plan

As discussed in section 3.3.3, *Terrestrial Resources*, we determined that management of the trees would restore native wildlife habitat lost during the breach event. Also as discussed in section 3.3.7, *Aesthetic Resources*, once the trees planted as part of the existing Upper Reservoir Rebuild Reforestation Plan mature, they would screen the view of the upper reservoir from several vantage points. In section 3.3.3, we conclude that the development and implementation of a reforestation plan that is based on the existing Upper Reservoir Rebuild Reforestation Plan would ensure that the trees planted at the upper reservoir would be maintained over the term of any new license. We also conclude in section 3.3.7 that restoring the landscape at the former construction laydown areas near the lower reservoir boat ramp parking area and campground would enhance the visual qualities of the project facilities. Further, to minimize the risk of introducing non-native invasive species during the revegetation of the laydown areas near the lower reservoir boat ramp parking area and campground, we recommend using native plant species and certified weed-free straw.

In section 4, *Developmental Analysis*, we determined that the development and implementation of a reforestation plan would have an annualized cost of \$39,820. Continued restoration and revegetation of the upper reservoir area, as well as the restoration of the former laydown areas at the lower reservoir, would enhance the aesthetic resources at the project and would also have a beneficial effect on terrestrial resources. Therefore, we find that the benefit of the reforestation plan would be worth the cost.

We recommend that Ameren Missouri develop, after consultation with Missouri DNR, and implement a reforestation plan that includes, at a minimum, the following measures: We recommend that Ameren Missouri develop, after consultation with Missouri DNR, and implement a reforestation plan that includes, at a minimum, the following measures: (1) maintain the trees planted at the construction laydown and staging areas near the toe of the upper reservoir for a minimum of 5 years or until the vegetation reaches a survival rate of 70 percent; (2) plant vegetation at the construction

laydown areas at the lower reservoir boat ramp parking area and campground for a minimum of 5 years after the initial planting or until the vegetation reaches a survival rate of 70 percent; (3) remove the concrete traffic barriers and replace them with aesthetically appropriate materials at the boat launch parking area; (4) use native vegetation management planting methods (e.g., use of certified weed-free straw and native plant species) to revegetate the laydown areas; (5) a monitoring plan and schedule; and (6) an annual report for at least the first 5 years to be filed before the end of the calendar year to ensure requests for modifications can be accommodated before the subsequent growing season.

Recreation Resources

As discussed in section 3.3.5, *Recreation and Land Use*, Ameren Missouri would continue to provide public access to the lower reservoir. Although unsupervised access to the upper reservoir would be restricted, the proposed arranged tours of the upper reservoir would continue to provide access to the project lands and views of the surrounding landscape. Johnson's Shut-Ins State Park would provide similar opportunities to that which were previously available at the upper reservoir museum. We determined that these measures, along with additional measures to operate and maintain the existing recreation facilities, would enhance recreational opportunities at the project.

Therefore, we recommend that Ameren Missouri develop, after consultation with Missouri DOC and Missouri DNR, a recreation management plan that includes, at a minimum, the following measures: (1) continued public access of the lower reservoir for recreational use; (2) procedures for educational, supervised tours of the upper reservoir; (3) maintenance of the existing lower reservoir recreation facilities, including the campground and boat ramp; and (4) a discussion of how the needs of the disabled were considered in the planning and design of the supervised tours of the upper reservoir.

In section 4, *Developmental Analysis*, we determined that the annualized cost for developing a recreation management plan would be \$11,310. We conclude that the benefits of the measures that would be implemented through our recommended plan would be worth the cost.

Aesthetic Resources

Outdoor Lighting

Ameren Missouri operates lights stationed near the gage house on the upper reservoir and along the access road to the upper reservoir. As discussed in section 3.3.7, *Aesthetic Resources*, we determined that project lighting increases the lighting in the project area, affecting the nighttime sky of local residents and recreationists. We concluded in section 3.3.7 that viable options that reduce the effects of the existing security lighting exist. Lighting directed at the staff gage for visual confirmation of the

upper reservoir elevation for the video would be necessary; however, conversion of the remaining existing lighting at the top of the dam to infrared (or other lower light) lighting would result in reducing the effects of night security lighting on recreationists and residents. Also, given that the access road is gated and attended by security personnel, the use of motion-activated lights along the project's access road would meet Ameren Missouri's security needs while preserving dark skies when not in use.

In section 4, *Developmental Analysis*, we determined that implementation of lighting changes would have an annualized cost of \$730. We find that the benefit of reducing any unnecessary lighting would be worth the cost. Therefore, we recommend that Ameren Missouri convert the existing lighting at the top of the reservoir, with the exception of the lighting directed at the staff gage, to infrared (or other lower light technology) and convert the security lighting along the project's access road to motion-activated lights. These changes would ensure that surface night-lighting along roads and at the top of the upper reservoir dam would be maintained for safety issues, while minimizing unnecessary lighting.

Cultural Resources

As discussed in section 3.3.6, *Cultural Resources*, no historic properties would be affected by the normal operation and maintenance of the project; however, there is a possibility that the two identified historic properties may be affected by land disturbance that may occur during emergencies (e.g., a dam failure). There is also a possibility that unknown archaeological resources or human remains may be affected during the term of any new license, if issued. To ensure that any adverse effects on historic properties would be avoided, lessened, or mitigated, we recommend executing a PA that would require Ameren Missouri to consult with the Missouri SHPO and Osage Tribe on a case-by-case basis, and prepare an HPMP after consultation with the Missouri SHPO and Osage Tribe, if project operation would affect the identified historic properties. The PA also would require Ameren Missouri to prepare an HPMP, after consultation with the Missouri SHPO and Osage Tribe, in the event that additional historic properties (e.g., unknown archaeological resources) would be discovered that would be affected by the project.

There is also a possibility that the project itself may be eligible for listing in the National Register once it has been in place for over 50 years of age. To ensure that the historical significance of the project is given proper consideration, the PA would require that Ameren Missouri, after consultation with the Missouri SHPO, evaluate the project under the criteria for listing in the National Register. If the project is deemed eligible, then Ameren Missouri would be required to prepare an HPMP to ensure that continued operation would not adversely affect the characteristics of the project that would qualify it for listing.

In section 4, *Developmental Analysis*, we determined that the evaluation of the historical significance of the project after 50 years of operation would have an annualized cost of \$1,470. Evaluation of the historical significance of the project, after consultation with the Missouri SHPO, would ensure that any historical significance is recognized and any adverse effects to the project would be avoided, lessened, or mitigated over the term of any new license. Therefore, we find that the benefit of the evaluation of historical significance and, if considered eligible, development of an HPMP, would be worth the cost.

Measures Not Recommended by Staff

Some of the measures proposed by Ameren Missouri and recommended by other interested parties would not contribute to the best comprehensive use of the East Fork Black River water resources, do not exhibit sufficient nexus to the project environmental effects, or would not result in benefits to non-power resources that would be worth their cost. The following discusses the basis for staff's conclusion not to recommend such measures.

Erosion Control

WQC condition 3.b requires erosion control measures be implemented to mitigate for erosion, which may cause turbidity or otherwise compromise water quality. As discussed in section 3.3.1, *Geologic and Soils Resources*, we determined that the shoreline in the lower reservoir is stable. Also, while boating is allowed in the lower reservoir, they are required to operate without a wake, limiting project-related wave-induced erosion. Therefore, we conclude that shoreline erosion in the lower reservoir would likely be minimal over the term of any new license, and erosion control measures would not be necessary. We recognize however that the implementation of monitoring would be required by WQC condition 3.b; therefore, it would be included in any license issued to Ameren Missouri for the project.

Water Quality Monitoring

WQC condition 4 requires the monitoring of water temperature, DO, turbidity, pH, and conductivity. As discussed in section 3.3.2, *Aquatic Resources*, we determined that water quality data collected since the post-breach recovery of the lower reservoir indicate that overall water quality conditions may now be similar to pre-breach conditions, when water quality was consistent with state standards most of the time. Although post-breach sampling has indicated occasional higher turbidity levels in the lower reservoir (short-term spikes), these events are unlikely the direct result of project operations. Any turbidity that may be generated by wave action on windy days would be considered as part of the baseline conditions within the lower reservoir, which may still contain some sediment deposits as a result of the upper reservoir breach or recent major floods. Based on available data, there is little indication that continued project operation would result in

an increase in the frequency of water quality conditions not consistent with state standards. Therefore, there is no basis for requiring a water quality monitoring program in the lower reservoir and in the East Fork Black River downstream from the lower reservoir dam, as recommended by Missouri DOC and required by the WQC. We recognize however that water quality monitoring would be required by WQC condition 4; therefore, it would be included in any license issued to Ameren Missouri for the project.

Riparian Corridors and Watershed Protection

As discussed in section 3.3.2, *Aquatic Resources*, the WQC includes several conditions that are broadly worded and lack specifics necessary to adequately analyze their effects and benefits. These measures include: (1) WQC condition 3.d, ensuring the maintenance of healthy riparian corridors; and (2) WQC condition 5, ensuring the protection of project lands within the watershed and working to minimize any effects that may result from project activities. Because of the lack of specific details, we do not recommend that Ameren Missouri implement these measures. We recognize however that the implementation of these measures would be required by WQC conditions 3.d and 5; therefore, they would be included in any license issued to Ameren Missouri for the project.

Feral Hog Management

In sections 3.3.3, *Terrestrial Resources*, and 3.3.5, *Recreation and Land Use*, we conclude that feral hogs are present throughout Missouri and other states, and the fertilizer packets, used to promote growth of the trees planted as part of the Upper Reservoir Rebuild Reforestation Plan, have attracted feral hogs to the upper reservoir. Ameren Missouri is cooperating with Missouri DNR and allowing the agency access to the project lands to trap and/or kill feral hogs to ensure revegetation survivability goals. However, the project does not directly contribute to the proliferation of feral hogs in the area. Therefore, we do not recommend that Ameren Missouri be required to contribute to local efforts to control feral hogs in and near the project area, as recommended by Missouri DNR, or provide support to the Feral Hog Task Force in its efforts to control and eradicate feral hogs in the area, as required by WQC condition 3.c. We recognize however that the requirement to support to the Feral Hog Task Force's efforts would be required by WQC condition 3.c; therefore, it would be included in any license issued to Ameren Missouri for the project.

Protection Plan for Threatened and Endangered Species

In section 3.3.3, *Terrestrial Resources*, we conclude that the only rare species known to occur in the project boundary is the collared lizard. Surveys conducted in 2005 did not identify any other rare or state-listed threatened or endangered species. Proposed project operation would not affect the areas where surveyors observed collared lizards, which included slopes near the upper reservoir prior to the breach, as well as downstream

of the lower reservoir on southerly ledge faces. Therefore, because the project would not affect the collared lizard, we have no basis for recommending that Ameren Missouri develop and implement a protection plan, as recommended by Missouri DNR and Missouri DOC.

All-Terrain Vehicle Use

In section 3.3.5, *Recreation and Land Use*, we conclude that ATV use occurs within and outside of the project boundary. Ameren Missouri proposes to install gates, other barriers, or signs to discourage ATV use on project lands, which would help preserve the natural environment enjoyed by recreationists in the area. However, the installation of gates, other barriers, or signs would occur at sites that are outside the proposed project boundary (i.e., lands not needed for project purposes). The project does not directly contribute to unauthorized ATV use on lands outside of the proposed project boundary; therefore, we have no basis for recommending a license condition requiring implementation of measures to minimize ATV use on these lands (e.g., nearby conservation lands or wilderness areas).

Transfer of Titles of Church Mountain and Taum Sauk Creek Valley Properties

Missouri DNR and Missouri DOC recommend the preservation of Church Mountain. Missouri DNR, Missouri Parks Association, Great Rivers, and the East Ozarks Audubon Society recommend that Ameren Missouri transfer the title of its Church Mountain and Taum Sauk Creek valley properties to the state of Missouri to compensate for lost aesthetic and recreation values. The L-A-D Foundation recommends that Ameren Missouri transfer the title of its Church Mountain properties to the state of Missouri.

As discussed in sections 3.3.5, *Recreation and Land Use*, and 3.3.7, *Aesthetic Resources*, the project provides recreation opportunities for boating, picnicking, and camping. In addition, the project is surrounded by state lands, including Johnson's Shut-Ins and Taum Sauk Mountain state parks, which provide additional recreation and aesthetic resources in the area. The project and the surrounding parks provide adequate recreation experiences, and there is no demonstrated need for additional recreation resources.

Ameren Missouri Church Mountain and Taum Sauk Creek valley properties are not within the proposed project boundary, and we find that they are not needed for project purposes. Therefore, we have no basis for recommending a license condition requiring the transfer of these properties.

5.3 UNAVOIDABLE ADVERSE EFFECTS

As discussed in sections 3.3.1, *Geologic and Soils Resources*, and 3.3.2, *Aquatic Resources*, sediments would continue to accumulate behind the project's bin wall. The periodic removal and disposal of sediments from behind the bin wall, as proposed in Ameren Missouri's Gravel and Sedimentation Control Plan, would control the buildup of sediments upstream of the project. Transporting bedload material removed from behind the bin wall to river reaches downstream from the lower reservoir dam could improve sediment transport through the project area and enhanced aquatic habitat in the East Fork Black River downstream from the lower reservoir dam, without affecting the lower reservoir's storage volume.

As discussed in section 3.3.2, *Aquatic Resources*, continued project operation would result in the entrainment of some fish in the powerhouse, causing some fish to be pumped up to the upper reservoir. Surviving fish could be entrained a second time during the generation cycle, and fish surviving the first pump/generating cycle may be susceptible to additional entrainment. However, because the Taum Sauk Project is not located at a mainstem dam on a major river where there is suitable habitat, there is less likelihood that fish would be congregating near the project intake and be susceptible to multiple entrainment cycles. The fish stocking program and measures to rescue fish in the upper reservoir during maintenance drawdowns would reduce any effects of entrainment on the resident fish population.

As discussed in section 3.3.5, *Recreation and Land Use*, access to recreational opportunities at the upper reservoir would be restricted because of security issues and tours would be available only by appointment.

As discussed in section 3.3.7, *Aesthetic Resources*, nighttime security lighting at the rebuilt upper reservoir affects dark sky conditions. Converting the lighting at the upper reservoir to infrared (or other lower light technology) and along the access road to motion activated type lights would reduce the amount of unnecessary lighting; potentially improving dark sky conditions.

5.4 FISH AND WILDLIFE AGENCY RECOMMENDATIONS

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by the federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project.

In response to our ready for environmental analysis notice, no fish and wildlife agency filed section 10(j) recommendations for the project.

5.5 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2)(A) of the FPA, 16 U.S.C. §803(a)(2)(A) (2006), requires the Commission to consider the extent to which a project is consistent with the federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. We reviewed nine comprehensive plans that are applicable to the Taum Sauk Project, located in Missouri.⁴² No inconsistencies were found.

⁴² (1) Missouri Department of Conservation. 2001. East Osage River Basin watershed inventory and assessment. Sedalia, Missouri. November 30, 2001. 187 pp.; (2) Missouri Department of Natural Resources. 1985. Missouri regional watershed assessment: a basin-by-basin compilation of water problems and issues. Rolla, Missouri. 228 pp.; (3) Missouri Department of Natural Resources. 1986. Missouri water atlas. Jefferson City, Missouri. 97 pp.; (4) Missouri Department of Natural Resources. Statewide Comprehensive Outdoor Recreation Plan (SCORP): 2002 - 2007. Jefferson City, Missouri. March 2003; (5) Missouri Department of Natural Resources. Undated. Missouri water quality basin plans. Jefferson City, Missouri. Eight volumes; (6) National Park Service. 1982. The nationwide rivers inventory. Department of the Interior, Washington, DC, January 1982; (7) U.S. Fish and Wildlife Service. 1993. Upper Mississippi River & Great Lakes region joint venture implementation plan: A component of the North American waterfowl management plan. March 1993; (8) U.S. Fish and Wildlife Service. 1983. Higgins Eye (*Lampsilis higginsii*) mussel recovery plan. Prepared by the Higgins Eye Mussel Recovery Team. Twin Cities, Minnesota. July 29, 1983; and (9) U.S. Fish and Wildlife Service. Undated. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, DC.

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6.0 FINDING OF NO SIGNIFICANT IMPACT

If the Taum Sauk Project is licensed with our recommended measures, the project would continue to operate while providing protective measures for fish, wildlife, aesthetics, recreational, and historic resources in the project area. Our recommended measures would ensure compliance with state water quality standards, provide for natural flow patterns, and potentially improve aquatic habitat downstream of the project. Project operation and the associated fish entrained through the project's turbines would result in some minor adverse effects on the resident fish in the lower reservoir; however, formalizing the annual sportfish stocking program, as well as developing a habitat enhancement plan for the lower reservoir, would ensure that recreational fishing would be maintained. Our recommended measures to restore the construction laydown areas at the lower reservoir recreation areas and maintain the trees planted after the reconstruction of the upper reservoir would improve the aesthetics within the project area.

On the basis of our independent analysis, we find that the issuance of a license for the Taum Sauk Project, with our recommended environmental measures, would not constitute a major federal action significantly affecting the quality of the human environment.

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APPENDIX A

Water Quality Certificate

This certification is issued pursuant to Section 401 of the Clean Water Act and consistent with the Water Quality Standards of the state of Missouri set forth in 10 CSR 20-7.031 provided the following conditions are adhered to:

1. **Compliance with Conditions.** The applicant shall operate and maintain the project consistent with the conditions of this certification. The terms and conditions of the Water Quality Certification may be amended and additional terms and conditions added as necessary to ensure compliance with Missouri water quality standards. At the request of the Department, the applicant shall meet with the Department to discuss and resolve issues related to the operation of the project.
2. **Water Management Plan (WMP).** The project shall be operated in accordance with the WMP developed by the applicant, the Department, and the Missouri Department of Conservation. The applicant shall follow the prescribed reporting requirements of the WMP. Water management at the Taum Sauk Pumped-Storage Project (Project) is dynamic and changes to the WMP may be necessary to address unanticipated issues should they arise. The applicant shall inform the Department and members of the resource agencies' Water Management Team (Missouri Department of Natural Resources and Missouri Department of Conservation) of any proposed changes to the WMP and may at any time request consultation among the parties to consider any proposed revisions to the WMP. The applicant shall inform FERC of significant modifications to the WMP.
3. **Compliance with Water Quality Standards.** At no time shall the Taum Sauk Pumped-Storage Project cause water quality standards to be violated. If the Department determines that water quality standards are being violated, additional conditions may be imposed or existing conditions amended by the Department. If the applicant fails to meet a standard, the Department may require the applicant to develop a compliance plan, approved by the Department, and timely implementation of the plan.
 - a. **Overflow Relief Structure.** The applicant has previously committed to developing a cleanup and recovery plan in conjunction with state resource

agencies to address any impacts in the event the overflow relief structure is operated. Given that Taum Sauk Creek, an Outstanding State Resource Water, would be the receiving stream if the structure were to be operated, this plan shall address this contingency.

- b. **Erosion Control.** Upon request by the Department, the applicant shall design and implement erosion control measures as necessary to address erosion resulting from use of the Project lands that causes turbidity or otherwise compromises water quality. Any erosion control work that exceeds minor maintenance shall be subject to prior approval by the Department.
 - c. **Control of Feral Hogs.** Feral hogs cause enhanced erosion and its attendant impacts on water quality through increased sedimentation. The applicant will continue to allow access to the Project area for the agencies to trap and/or kill feral hogs. The applicant will also continue to provide support to the Feral Hog Task Force efforts to control and eradicate feral hogs in the area.
 - d. **Healthy Riparian Corridors.** The applicant shall ensure maintenance of healthy riparian corridors within the project area to ensure protection of water quality.
 - e. **Rare, Threatened, and Endangered (RT&E) Species.** The applicant will continue to support protection of threatened and endangered plant and animal species identified on the applicant's lands in consultation with the U.S. Fish and Wildlife Service, the Missouri Department of Conservation, and the Department.
 - f. **Control of Non-native Species.** The applicant will support efforts of the Department and the Missouri Department of Conservation to control non-native invasive species.
 - g. **Aquatic Habitat in the Lower Reservoir.** The applicant will continue to support efforts to improve aquatic habitat in the lower reservoir.
4. **Water Quality Monitoring Plan (WQMP).** The applicant is currently monitoring critical water quality parameters upstream and downstream of the Project. The applicant will continue monitoring of these critical water quality parameters including, but not limited to dissolved oxygen, turbidity, pH, conductivity, and temperature throughout the license period. The Department or the Missouri Department of Conservation may at any time request consultation with the applicant to consider revisions to the applicant's monitoring efforts. The

applicant shall inform FERC of significant modifications to the applicant's water quality monitoring efforts.

- a. **Water Flow Gages and Continuous Monitoring.** The applicant shall provide for the operation and maintenance of the two existing East Fork of the Black River (EFBR) gaging stations for the life of the project. These gages provide instrumental information necessary in determining compliance with the contents of the certification as well as essential support for water quality decisions regarding the EFBR system.
 - b. **Continuous Monitoring.** Continuously monitoring parameters must, at a minimum, include dissolved oxygen, water temperature, conductivity, pH, turbidity, and discharge.
5. **Watershed Protection.** The project is situated in a watershed that contains areas whose preservation and protection is essential to maintain the wild character of the adjacent public lands and the water quality of the waters of the state, including Taum Sauk Creek, an Outstanding State Resource Water. The applicant shall ensure continued protection of project lands within the watershed and work to minimize any impacts that may result from activities on project lands to public lands that surround the project.
6. **Petroleum Spills.** The applicant shall operate the Project in conjunction with best management practices. Petroleum products spilled into any water or on the banks where the material may enter waters of the state should be immediately cleaned up and disposed of properly. Any such spills of petroleum shall be reported as soon as possible, but no later than 24 hours after discovery to the Department's Environmental Emergency Response number at (573) 634-2436.
7. **Approval of Changes.** The applicant shall operate the Project as described in this Water Quality Certification and the WMP. Should the FERC license require modifications or the applicant request to make modifications, the applicant shall consult with the Department for a determination of whether the certification may need to be amended or a new certification issued. Any amendment of certification or new certification, determined appropriate by the Department, must be issued prior to implementing any changes.

8. **Reopening the License.** The Department may request, at any time, that the FERC reopen the license to consider modifications to the license as necessary to ensure compliance with Missouri water quality standards.
9. **Periodic Review.** The administration of the certification will require periodic review of compliance data, review and approval of management plans and other studies, and other consultation with the applicant and other parties. The applicant shall provide data and other materials upon the Department's request.
10. **Compliance Inspection by Departments.** The applicant shall allow the Department and other state and federal resource agencies to inspect the Project at any time to monitor for compliance with the certifications conditions.
11. **Maintenance and Repair.** At least 90 days prior to implementing any alterations of normal reservoir pool levels or streamflow, or maintenance or repair that requires earth-disturbing activities, including but not limited to dredging or desilting operations, the applicant shall consult with the Department. Except under emergency conditions, the applicant shall obtain approval and any necessary permits from the Department prior to initiating these types of maintenance activities.
12. **Discharge of Dredge and Soil Material.** The Certification does not authorize discharge of dredge or soil material in or into jurisdictional waterways. Emergency and Routine Maintenance shall be permitted under the appropriate U.S. Army Corps of Engineers Permit.
13. **Required Permits.** The applicant is responsible for securing and for compliance with required permits or approvals as may be required by the Department, federal, state, or local governmental agencies for project activities.

Document Content(s)

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