ENVIRONMENTAL ASSESSMENT
FOR
HYDROPOWER LICENSE

Gonzales Project
FERC Project No. 2960-006
Texas

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

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ACRONYMS AND ABBREVIATIONS

Advisory Council	Advisory Council on Historic Preservation
APE	area of potential effects
BMPs	best management practices
BP	before present
certification	water quality certification
CFR	Code of Federal Regulations
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
DO	dissolved oxygen
EA	environmental assessment
ESA	Endangered Species Act
ºF	degrees Fahrenheit
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
fps	feet per second
FWS	U.S. Fish and Wildlife Service
GBRA	Guadalupe-Blanco River Authority
HPMP	historic properties management plan
ILP	Integrated Licensing Process
Interior	U.S. Department of the Interior
IPaC	Information for Planning and Conservation system
kW	kilowatt
MADF	mean annual daily flow
mg/L	milligrams per liter
msl	mean sea level
MW	megawatt
MWh	megawatt-hour
National Register	National Register of Historic Places
NERC	North American Electric Reliability Corporation
NHPA	National Historic Preservation Act
PA	Programmatic Agreement
PAD	Pre-application Document
REA	Ready for Environmental Analysis
RM	River Mile
SD	Scoping Document
Texas CEQ	Texas Commission on Environmental Quality
Texas PWD	Texas Parks and Wildlife Department
Texas SHPO	Texas State Historic Preservation Officer

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1.0 INTRODUCTION

1.1 APPLICATION

On July 27, 2018, the City of Gonzales, Texas (City) filed an application for a subsequent license with the Federal Energy Regulatory Commission (Commission or FERC) to continue operating the 900-kilowatt (kW) Gonzales Project No. 2960 (Gonzales Project or project). The project is located on the Guadalupe River, in the City of Gonzales in Gonzales County, Texas. The Gonzales Project generates an estimated 4,500 megawatt-hours (MWh) of energy annually.[1] The project does not occupy federal land.

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the Gonzales Project is to provide a source of hydroelectric power. Therefore, under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue a new license for the 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

[1] The project is currently licensed at a capacity of 1.1 megawatts (MW). In August 2019, the City rehabilitated the powerhouse to remedy structural concerns and the generating units were rebuilt to the 900 kW capacity. The annual generation is an estimate based on the August 2019 rehabilitation.

enhancement of fish and wildlife resources; (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

This environmental assessment (EA) has been prepared in compliance with the National Environmental Policy Act of 1969 to assess the environmental and economic effects associated with operation of the project, alternatives to the project, and makes recommendations to the Commission on whether to issue a new license, and if so, recommends terms and conditions to become a part of any license issued for the project.

In this EA, we assess the environmental and economic effects of: (1) continued project operation as proposed in the application (proposed action) and (2) the proposed action with additional or modified measures (staff alternative). We also consider the effects of the no-action alternative. The primary issue associated with relicensing the project are the effects of continuing operation on aquatic species and their habitat.

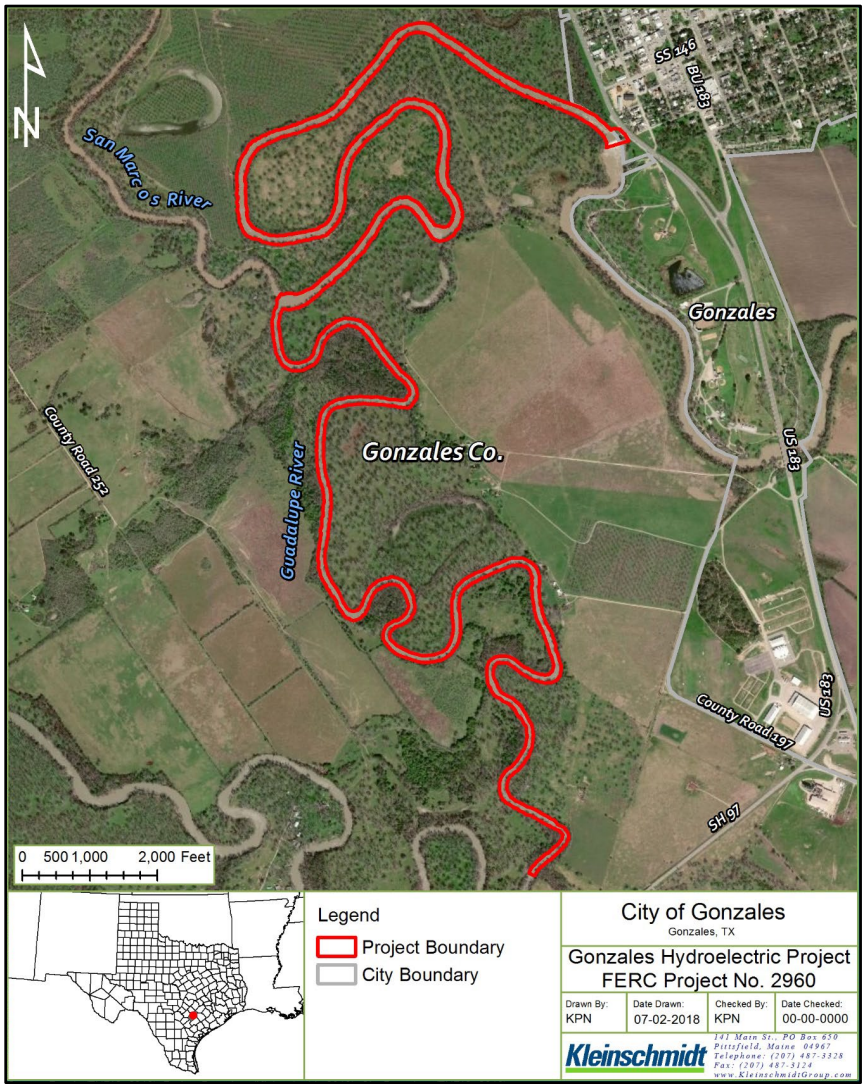

Figure 1-1. Gonzales Project location (Source: license application).

1.2.2 Need for Power

The existing Gonzales Project provides hydroelectric generation to meet part of Texas' power requirements, resource diversity, and capacity needs. The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The Gonzales Project is located in the Electric Reliability Council of Texas (ERCOT) region of NERC. According to NERC's 2018 forecast, net internal demand is expected to increase from 72,030 MW to 84,667 MW over 2018 to 2028 (NERC, 2018). During the same period, annual peak demand in the region is expected to grow at an annual rate of 1.8 percent.

Power generated at the Gonzales Project would help meet a need for power in the ERCOT region in the short- and long-term. The project provides power that displaces generation from non-renewable resources and contributes to a diversified generation mix. Displacing the operation of non-renewable facilities may avoid some power plant emissions, thus creating an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

Any license for the Gonzales Project is subject to numerous requirements under the FPA and other applicable statutes. The major regulatory and statutory requirements are described in the following sections.

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 construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretary of the U.S. Department of Commerce or the Secretary of the U.S. Department of the Interior (Interior). No section 18 fishway prescriptions were filed.

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 were filed.

1.3.2 Clean Water Act

Under section 401(a)(1) of the Clean Water Act, a license applicant must obtain either a water quality certification (certification) from the appropriate state pollution control agency verifying that any discharge from a project would comply with applicable provisions of the Clean Water Act, or a waiver of certification by the appropriate state agency. The failure to act on a request for certification within a reasonable period of time, not to exceed one year, after receipt of such request constitutes a waiver.

On March 7, 2019, the City applied to the Texas Commission on Environmental Quality (Texas CEQ) for a section 401 certification for the Gonzales Project. Texas CEQ acknowledged receipt of the application on March 28, 2019. Texas CEQ has not yet acted on the certification request. The certification is due by March 28, 2020.

1.3.3 Endangered Species Act

Section 7 of the Endangered Species Act (ESA) 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. On February 21, 2019, Commission staff requested an official species list for the project through the U.S. Fish and Wildlife Service's (FWS) Information for Planning and Conservation (IPaC) system, which indicates that the endangered least tern and whooping crane and the threatened piping plover and red knot, may occur within the project boundary. Additionally, one candidate species, the Texas pimpleback, may occur within the project boundary or be affected by the project.[2]

Our analysis of project effects on threatened and endangered species is presented in section 3.3.4, *Threatened and Endangered Species*, and our recommendations are included in section 5.1, *Comprehensive Development and Recommended Alternative*. Based on the available information, we conclude that relicensing the Gonzales Project, with implementation of the proposed measures, is not likely to adversely affect the species noted above.

1.3.4 Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 United States Code (U.S.C.) § 1456(3)(A), the Commission cannot issue a license for

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[2] See memorandum from Kristine Sillett (Wildlife Biologist, Office of Energy Projects) to Public Files for the Gonzales Project (Updated List of Threatened, Endangered Candidate, and Proposed Species, filed September 11, 2019).

a project within or affecting a state's coastal zone unless the state CZMA agency concurs with the applicant's certification of consistency with the state's CZMA program, or the agency's concurrence is conclusively presumed by its failure to act within 6 months of its receipt of the applicant's certification.

In an email dated June 7, 2018, and filed with the City's license application, the Texas General Land Office indicates that the Gonzales Project is not located within Texas's Coastal Management Plan zone and would not affect any coastal natural resource areas. Therefore, no consistency certification is needed for the action.

1.3.5 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA) requires that the Commission take into account the effects of its actions on historic properties and afford the Advisory Council on Historic Preservation (Advisory Council) a reasonable opportunity to comment on the undertaking.[3] Historic properties are those that are listed or eligible for listing in the National Register of Historic Places (National Register). The regulations implementing section 106 of the NHPA also require that the Commission seek concurrence with the state historic preservation office on any finding involving effects or no effects on historic properties, and consult with interested Indian tribes or Native Hawaiian organizations that attach religious or cultural significance to historic properties that may be affected by an undertaking. In this document, we also use the term "cultural resources" for properties that have not been determined eligible for listing in the National Register. Cultural resources represent things, structures, places, or archaeological sites that can be either prehistoric or historic in origin. In most cases, cultural resources less than 50 years old are not considered historic.

Pursuant to section 106, the City consulted with the Texas Historical Commission[4] and affected Indian tribes to locate, determine National Register eligibility, and assess potential adverse effects to historic properties associated with the project. By letter dated August 21, 2015, filed October 13, 2015, the Texas SHPO concluded that no historic properties would be affected by the proposed action.

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[3] An undertaking means "a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license, or approval." 36 C.F.R. § 800.16(y). Here, the undertaking is the potential issuance of a subsequent license for the Gonzales Project.

[4] We will refer to the Texas Historical Commission as the Texas State Historic Preservation Officer or SHPO.

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 Code of Federal Regulations [CFR], section 4.38) require that applicants to 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 complete and documented according to the Commission's regulations.

Relicensing of the project was formally initiated on July 24, 2015, when the City filed with the Commission a Pre-Application Document (PAD) and Notice of Intent to license the project using the Integrated Licensing Process (ILP). The Commission issued a Notice of Commencement of Proceeding on September 18, 2015.

1.4.1 Scoping

Before preparing this EA, we conducted scoping to determine what issues and alternatives should be addressed. During the pre-filing consultation process, scoping meetings were held to determine what issues and alternatives should be addressed in the EA. We issued an initial scoping document (SD1) on September 18, 2015. On October 22, 2015, Commission staff conducted daytime and evening scoping meetings in Gonzales, Texas to receive comments on the project. A court reporter transcribed both meetings, and the transcripts are part of the Commission's public record for the project. An environmental site review was also held on October 22, 2015.

In addition to comments provided at the scoping meetings, the following entities provided written comments:

Commenting Entity	Date Filed
Ysleta del Sur Pueblo	October 6, 2015
Alabama-Coushatta Tribe of Texas	October 13, 2015
Bureau of Land Management	October 13, 2015
Federal Emergency Management Agency	October 13, 2015
Texas Department of State Health Services	October 13, 2015
Texas Historical Commission	October 13, 2015
Texas Parks and Wildlife Department (Texas PWD)	November 23, 2015
FWS	November 23, 2015

A revised scoping document was issued on December 23, 2015.

1.4.2 Interventions

On January 10, 2019, the Commission issued a notice accepting the City's application for a subsequent minor license for the Gonzales Project. The notice set

March 11, 2019, as the deadline for filing motions to intervene and protests and requests for cooperating agency status.[5] No entities filed motions to intervene.

1.4.3 Comments on the License Application

On January 10, 2019, the Commission issued a Ready for Environmental Analysis (REA) notice requesting comments, recommendations, terms and conditions, and prescriptions. Texas PWD filed comments on August 8, 2018 and March 15, 2019.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 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. We use this alternative to establish baseline environmental conditions for comparison with other alternatives.

2.1.1 Existing Project Facilities and Project Boundary

The Gonzales Project is located on the Guadalupe River in the City of Gonzales, Texas, and includes project facilities as shown in figure 2-1.

The Gonzales Project existing facilities consist of: (1) a 16-foot-high, 258-foot-long concrete Ambursen dam with a 178-foot-long ogee-type spillway; (2) an impoundment with a surface area of 300 acres and a storage capacity of 1,400 acre-feet; (3) an intake structure, on the left side of the dam, consisting of 48-foot-long, 13-foot-high trashracks, a 2,500-square-foot headrace pond and six wooden water control gates at the powerhouse; (4) an 78-foot-long, 22-foot-wide brick powerhouse containing three generating units with a total capacity of 900 kW; (5) one step-up transformer adjacent to the powerhouse; (6) a 57-foot-long transmission line connecting to the distribution power pole.

As currently licensed, the Gonzales Project boundary consists of a dam, intake structure, powerhouse, and transmission facilities.

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[5] Due to the funding lapse at certain federal agencies between December 22, 2018 and January 25, 2019, by notice issued February 19, 2019, the Commission extended the deadline for filing motions to intervene and protests and requests for cooperating agency status to March 26, 2019.

Figure 2-1. Gonzales Project facilities (Source: License application and Google Maps; as modified by staff).

2.1.2 Project Safety

The Gonzales Project has been operating for more than 39 years under the existing license and 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. As part of the relicensing process, Commission staff would evaluate the continued adequacy of the proposed project facilities under a subsequent license. Special articles would be included in any license issued, as appropriate. Commission staff would continue to inspect the project during the new license term to assure continued adherence to Commission-approved plans and specifications, special license articles relating to construction (if any), operation and maintenance, and accepted engineering practices and procedures.

2.1.3 Existing Project Operation

One or more hydroelectric projects located upstream of the Gonzales Project operate in a daily peaking mode year-round with the result that inflow to the Gonzales Project is variable throughout the day and reflects the upstream peaking operations. The City currently operates the Gonzales Project to pass the inflow downstream without modification in an operating mode the City terms "run-of-river with no impoundment fluctuation."[6] While operating run-of-river, the City holds the impoundment elevation at or near the top of the dam (i.e., 260 feet above mean sea level [msl]) with the result that outflow from the project approximates inflow at all times.[7]

The City maintains run-of-river operation using automated plant controls and monitoring equipment. The monitoring equipment enables the City to measure and record headwater and tailwater elevations. When inflow to the impoundment is less than 831 cubic feet per second (cfs), which is equivalent to the maximum hydraulic capacity of the powerhouse, the automated plant controls must make continuous adjustments to the flow rate through the powerhouse throughout the day in order to maintain a stable impoundment elevation at the dam crest. Frequent adjustments are required because of the variable inflow caused by upstream hydroelectric peaking operations.

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[6] See revised Exhibit A at 2 (filed on May 23, 2019).

[7] See Exhibit E at 4-9.

2.2 APPLICANT'S PROPOSAL

2.2.1 Proposed Project Facilities

The City does not propose to construct any new facilities or modify any existing project facilities. Remediation of the project facilities, authorized by the Commission on September 5, 2018, was completed in August 2019.

As licensed, the project boundary does not enclose the project's impoundment or existing recreation facilities. For the purposes of relicensing, the City has proposed a project boundary that encloses all project works, the 300-acre impoundment, and two recreation sites: a tailrace fishing area and a kayak dock.

2.2.2 Proposed Project Operation

The City proposes to continue operating the project in a run-of-river mode but only at inflows between 831 cfs and 3,000 cfs. At inflows above 3,000 cfs, the City would cease project generation due to insufficient head between the tailwater and impoundment surface elevations. At inflows below 831 cfs, the project would cease run-of-river operation in a manner that results in a steady impoundment elevation at the crest of the dam. Instead, the City would operate the powerhouse at a steady flow rate of either 831 cfs, 554 cfs, or 277 cfs (i.e., using 3, 2, or 1 generating unit(s)), depending upon inflow to the impoundment, and allow the impoundment to fluctuate between the dam crest and one foot below the dam crest (see table 2-1). The powerhouse flow rate would remain at the steady rate until the impoundment surface elevation drops to a level of one foot below the dam crest, whereupon the automated system would shut down one or more of the generating units depending upon the inflow to the impoundment, in order to refill the impoundment back to the dam crest. If inflow drops below the minimum powerhouse hydraulic capacity of 200 cfs, the powerhouse would completely shut down and all flows would pass over the dam crest.[8]

[8] If the powerhouse shutdown were to occur when the reservoir elevation would be lower than the dam crest, then the reservoir would need to fill to the dam crest in order for flow to pass downstream over the dam's spillway.

Table 2-1. The number of turbine units operating and outflow released into the tailrace during the City's proposed operations (Source: staff).

Inflow	Number of turbine units operating when reservoir elevation is falling	Powerhouse outflow when reservoir elevation is falling	Number of turbine units operating when reservoir elevation is rising	Powerhouse outflow when reservoir elevation is rising
277 cfs to 200 cfs	1	277 cfs	0	0 cfs
278 to 554 cfs	2	554 cfs	1	277 cfs
555 cfs to 830 cfs	3	831 cfs	2	554 cfs

2.2.3 Proposed Environmental Measures

The City proposes to:

- Continue to operate and maintain the existing tailrace fishing area and kayak dock and to install signage.

2.3 STAFF ALTERNATIVE

Under the staff alternative, the project would include all of the City's proposed measures, with the following modifications and additional measures:

- Operate the project in a run-of-river mode, except at inflows less than 831 cfs and greater than 554 cfs, when the project may be operated with impoundment fluctuations between the crest of the dam and a level 1 foot below the crest of the dam.

- Develop an operation compliance monitoring plan that specifies the methods that will be used to monitor and document project operation and impoundment surface elevations.

- Conduct routine maintenance drawdowns when inflows are between 555 cfs and 830 cfs to protect water quality and aquatic habitat upstream and downstream of the project.

- Develop an aquatic invasive vegetation management plan that includes: (a) best management practices (BMPs) to remove or control alligatorweed and to allow native vegetation to reestablish in the littoral area extending

from the kayak dock to the powerhouse intakes; (b) periodic monitoring for alligatorweed and other invasive plants in the littoral area extending from the kayak dock and powerhouse intakes; (c) criteria that would determine when control measures should be implemented; and (d) a schedule for filing monitoring reports and any recommended control measures with the Commission.

- For each tree trimming or woody vegetation disturbance event that occurs at the project during the migratory bird nesting season of February 1 through September 15: (1) conduct a survey prior to the event in the projected area of the trimming or disturbance to determine the presence of active migratory bird nesting and fledging, and (2) if migratory birds are nesting or fledging at or near the area of the planned trimming or disturbance activity, do not conduct any trimming or disturbance activity, (a) within 25 feet in diameter from any migratory bird nest until all young have fledged and (b) do not conduct any trimming or vegetation disturbance within 300 meters (984 feet) of any heron or egret rookery periphery, and from February 1 through August 31, do not use heavy machinery within 1,000 meters (3281 feet) of any heron or egret rookery periphery.

- Notify and consult with the Texas SHPO and Alabama-Coushatta Tribe of Texas if (a) any unknown archaeological or historic resources are discovered during project operation or other project-related activities or (b) if the City contemplates making changes to authorized project operations or conducting land-clearing, or land-disturbing activities.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

We considered one alternative[9] to the City's proposal (i.e., the no-action alternative), retiring the project, but eliminated it from further analysis because it is not a reasonable alternative in the circumstances of this case.

2.4.1 Project Decommissioning

As the Commission has previously held, decommissioning is not a reasonable alternative to relicensing a project in most cases, when appropriate protection, mitigation,

[9] Because sections 14 and 15 of the Federal Power Act were waived in the original license issued for the project, neither issuing a non-power license nor federal takeover are applicable alternatives.

and enhancement measures are available.[10] The Commission does not speculate about possible decommissioning measures at the time of relicensing, but rather waits until an applicant actually proposes to decommission a project, or there are serious resource concerns that cannot be addressed with appropriate measures, making decommissioning a reasonable alternative.[11] This is consistent with the National Environmental Policy Act and the Commission's obligation under section 10(a) of the FPA to issue licenses that balance developmental and environmental interests.

Project retirement could be accomplished with or without dam removal.[12] Either alternative would involve denial of the relicense application and surrender or termination of the existing license with appropriate conditions. No participant has recommended project retirement, and we have no basis for recommending it.

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, with historic and current conditions described first. The existing condition is the baseline against which the environmental effects of the proposed

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[10] See, e.g., *Eagle Crest Energy Co.*, 153 FERC ¶ 61,058, at P 67 (2015); *Public Utility District No. 1 of Pend Oreille County*, 112 FERC ¶ 61,055, at P 82 (2005); *Midwest Hydro, Inc.*, 111 FERC ¶ 61,327, at PP 35-38 (2005).

[11] *See generally Project Decommissioning at Relicensing; Policy Statement*, FERC Stats. & Regs., Regulations Preambles (1991-1996), ¶ 31,011 (1994); *see also City of Tacoma, Washington*, 110 FERC ¶ 61,140 (2005) (finding that unless and until the Commission has a specific decommissioning proposal, any further environmental analysis of the effects of project decommissioning would be both premature and speculative).

[12] In the event that the Commission denies relicensing, a project or a licensee decides to surrender an existing project, the Commission must approve a surrender "upon such conditions with respect to the disposition of such works as may be determined by the Commission." 18 C.F.R. § 6.2 (2018). This can include simply shutting down the power operations, removing all or parts of the project (including the dam), or restoring the site to its pre-project condition.

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 5.1, *Comprehensive Development and Recommended Alternative*.[13]

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The Gonzales Project dam is located at river mile (RM) 167 on the Guadalupe River in Gonzales, Texas. The Guadalupe River's headwaters begin in Kerr County, Texas at an elevation of 2,000 feet above sea level and the river flows over 400 miles southeast to the San Antonio Bay (Texas WDB, 1973). The basin has a total drainage area of 6,070 square miles, spanning diverse terrain that varies from steep, limestone Hill Country, to the flat rolling terrain of the lower basin. The watershed contains many natural springs from the Edwards Aquifer that contribute to baseflow in the Guadalupe River and its tributaries. The primary tributaries to the Guadalupe River are the North and South Fork, the Comal River, the Blanco River, and the San Marcos River (Texas CEQ, 2012).

The San Marcos River flows 81 miles from its headwaters in the City of San Marcos, Texas to its confluence with the Guadalupe River. This confluence is located just west of the City of Gonzales, within the project boundary. Beginning in the mid-to-late 1800s, a number of low-head dams were built on the San Marcos River to provide for agricultural irrigation, to power and run gristmills, and to provide domestic water supply. Many have been significantly damaged or washed away in flood events (Saunders and Aziz, 2015). The remaining dams, which are primarily used for water supply and recreation, include: Spring Lake Dam, Rio Vista Dam, Thompson's Island Dam, Cummings Dam, Martindale Dam, Staples Dam, and Luling Dam (TWS, 2019). Luling Dam is the last functioning dam on the San Marcos River, and is about 39 river miles upstream from the project's dam.

On the Guadalupe River, there are seven hydropower developments directly upstream of the Gonzales Project in Comal, Guadalupe, and Gonzales Counties. The most upstream, the 6-MW Canyon Dam Project No. 3866, is located at RM 303, and is operated under FERC license by the Guadalupe-Blanco River Authority (GBRA, 2019a).

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[13] Unless noted otherwise, the sources of our information are the pre-application document filed on August 24, 2015; license application filed August 27, 2018; and additional information provided by the City and filed on November 16, 2018, November 19, 2018, May 12, 2019, May 23, 2019, and June 14, 2019.

Downstream from Canyon Lake Dam, GBRA operates six hydropower developments at Lake Dunlap, Lake McQueeney, Lake Placid, Meadow Lake, Lake H-4 (also known as Lake Gonzales, not to be confused with the project's impoundment), and Lake Wood.[14] Located about 11 river miles downstream from Lake Wood Dam, the project's dam at RM 167 is the lowermost impoundment on the Guadalupe River (GBRA, 2019c).

Geologically, the Guadalupe River Basin is divided into two distinct regions: The northern region, which includes the Edwards Plateau with limestone-walled valleys and sloping hills; and the southern region, which is characterized by sloping prairies toward the Gulf Coast. These two physiographical regions span four different ecoregions: the Edwards Plateau, the Texas Blackland Prairie, the East Central Texas Plains, and the Western Gulf Coastal Plains (Texas PWD, 2011). The Edwards Plateau is primarily rangeland. The Texas Blackland Prairie is characterized by streams lined with oak, pecan, elm, and mesquite trees. The East Central Texas Plains contain subtropical dryland vegetation composed of small trees, shrubs, cacti, weeds, and grasses. The Western Gulf Coastal Plain contains marsh and salt grasses at the tidewater and tall grasses farther inland; oaks, elms, and other hardwoods grow alongside abundant, fertile farmland.

Recreation, including swimming, tubing, canoeing, kayaking, and fishing, is an important water use in the upper Guadalupe River Basin. Land use is dominated by farming and ranching, with the areas around the cities of Kerrville, Boerne, New Braunfels, Seguin, San Marcos, Lockhart, Luling, Gonzales, Cuero, Victoria, and Port Lavaca, becoming more urbanized. The largest population growth is occurring along the highways (U.S. 281, I-35, and Rt. 130) that lie in the central Guadalupe River Basin. Most industrial facilities are located in the lower basin, near Victoria Barge Canal and ports along the coast. The economy of the basin relies heavily on agriculture and manufacturing of steel, gravel, plastics, and chemicals. Oil and gas production can be found in all areas of the basin.

The Guadalupe River Basin is located in both the South Central and Upper Coast climatic regions of Texas. The climate can generally be described as subtropical, with

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[14] The six hydropower developments are not under the Commission's jurisdiction. Two of these developments, at Lake Dunlap and Lake Wood, have failed spillway gates and are not operational. In August 2019, GBRA approved dewatering of all six reservoirs to ensure public safety and prevent similar spillway gate failures at the remaining four developments; however a settlement reached in a temporary injunction will prevent dewatering of the dams for 12 months (until about September 2020). GBRA is currently involved in ongoing negotiation with stakeholders about the continued use of all six dams. Options range from dewatering the six reservoirs to dam repair or replacement (www.gvlakes.com).

hot and dry summers and mild winters, with the climate becoming more temperate and humid closer to the coast. The annual average temperature is just below 80 degrees Fahrenheit (°F). The region is prone to drought, with major rainfall events clustered in the spring and fall. Annual rainfall averages from 31 inches in the upper basin to 44 inches in the lower basin (GRBA and Texas CEQ, 2018).

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (40 CFR § 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 other actions. Cumulative effects can result from individually minor, but collectively significant actions occurring over time, including hydropower and other land and water development activities.

Based on our review of the license application and agency and public comments, we have identified water quality and fishery resources as being cumulatively affected by the proposed operation and maintenance of the Gonzales Project.

3.2.1 Geographic Scope

The geographic scope of the cumulative analysis defines the physical limits or boundaries of the proposed action's effects on the resource, and contributing effects from other hydropower and non-hydropower activities within the Guadalupe River Basin.

We have identified the Guadalupe River Basin upstream of the project as the geographic scope of analysis for aquatic resources. We chose this geographic scope because operation and maintenance of the Gonzales Project, in combination with other upstream uses of the river basin, including hydroelectric generation, water withdrawals, land development, agriculture, and industrial use may contribute to cumulative effects on the resource. The Gonzales Project is the downstream-most of eight hydroelectric dams on the mainstem the Guadalupe River. In addition, there are several low-head dams located on the San Marcos River, which has its confluence with the Guadalupe River within the project boundary. Operation of these dams cumulatively affect aquatic resources through turbine mortality and by impeding the passage of American eel and river shrimp to spawning and rearing habitat. Contributors to cumulative effects on water quality in the basin include urban development, agriculture, and wastewater discharges.

3.2.2 Temporal Scope

The temporal scope of our cumulative effects analysis in the EA includes a discussion of past, present, and reasonably foreseeable future actions and their effects on

water quality, turbine mortality, and American eel and river shrimp passage. Based on the potential term of any license issued, the temporal scope will look 30 to 50 years into the future, concentrating on the effects on the resources from reasonably foreseeable future actions. The historical discussion will, by necessity, be limited to the amount of available information for each resource. The quality and quantity of information, however, diminishes as we analyze resources further away in time from the present. We identified the present resource conditions based on the license application, agency comments, comprehensive plans, and publically available information as cited herein.

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. Finally, we present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

Only the resources that have the potential to be affected are addressed in this EA. Based on this, we have determined that geology and soils, aquatic resources, terrestrial resources, recreation, and cultural resources may be affected by the proposed action and action alternatives. We have not identified substantive issues relating to aesthetics or socioeconomics; therefore, these resources are not discussed in the EA.

3.3.1 Geology and Soils

3.3.1.1 Affected Environment

Much of the City is located in the geologic unit known as the Cook Mountain Formation, which is characterized by clay and sandstone with a depth of 200 to 350 feet. However, the project itself lies within an alluvium[15] formation composed of floodplain deposits and low terraces of between 3 to 8 feet above the floodplain. These features are characterized by fine silt and clay and larger particles of sand and gravel (USGS, 2019). The Eagle Ford Shale formation, which is an important source for oil and gas, underlays the project area (Texas RRC, 2019).

Dominant soils with the project area include Meguin silty clay loam and Luckenbach sandy clay loam . Meguin silty sandy loam is a well-drained, calcareous

[15] Alluvium is any deposit of clay, silt, sand, and gravel left by flowing streams in a river valley or delta.

loamy alluvium with a depth of more than 80 inches. Luckenbach sandy clay loam is a well-drained, clayey alluvium with a depth of more than 80 inches (NRCS, 2019).

The shoreline surrounding the project consists of clayey sand, lean clay, and fat clay.[16] These soils are classified as dense to very dense and very stiff or hard in consistency/strength. Much of the shoreline along the project impoundment is densely vegetated, with interspersed areas of grassland. Within the proposed project boundary, the City owns land on the west bank of the river, which is inaccessible and largely unmaintained. There, vegetation is dense and well established. On the east bank of the river, the City maintains the area around the powerhouse and kayak dock as mowed lawn. Within the maintained lawn, there are some areas of localized erosion, which the City monitors and reports to be generally stable and not worsening. Downstream from the project, the shoreline has been used extensively hardened with riprap to reduce erosion and control the effects of flooding on infrastructure, including around the tailrace fishing pier.

3.3.1.2 Environmental Effects

Effects of Project Operation and Maintenance on Shoreline Erosion

As discussed in section 2.2.2, *Proposed Project Operation,* the City proposes to continue operating the project in a run-of-river mode at inflows between 831 cfs and 3,000 cfs. At inflows above 3,000 cfs, the City would cease project generation due to insufficient head between the tailwater and impoundment surface elevations. Unlike under existing conditions, at inflows below 831 cfs, the project would cease run-of-river and operate the powerhouse at a steady flow rate using 3, 2, or 1 generating units, depending upon inflow to the impoundment. The impoundment would fluctuate between the dam crest and one foot below the dam crest (see table 2-1). When inflow falls below 200 cfs, the project would cease generation. Maintenance drawdowns up to 1 foot below the crest of the dam could occur whenever the trash racks or dam require debris removal.

The City proposes to continue operating and maintaining the two existing recreation facilities at the project, including mowing and trimming the lawn around the kayak dock. The City proposes no measures related to erosion control, but does state that if localized areas of erosion expand or become severe to the extent that they would negatively affect project facilities or access to the impoundment, the City would address them on a case-by-case basis.

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[16] Lean clay is a clay of low to medium plasticity owing to a relatively high content of silt or sand. Fat clay is highly plastic.

Texas PWD recommends that, during construction activities, the City avoid stabilization materials that could entangle snakes and other wildlife and use no-till drilling, hydromulching, and/or hydroseeding as alternatives to plastic mesh netting.

Our Analysis

During the course of normal operations, fluctuations in impoundment levels and instream flows downstream from hydropower projects have the potential to contribute to shoreline erosion. The geology of the region tends to include erodible soils on stream and river banks, and flooding of the Guadalupe River routinely redeposits eroded sediment in the floodplain. The extent of such effects can be influenced by the timing, magnitude, and frequency of impoundment or instream flow fluctuations. Continuing to operate the project in a run-of-river mode at flows between 831 cfs and 3,000 cfs would limit impoundment fluctuations except during extreme flow events. During low flow events, fluctuation would be limited to 1 foot. Because the impoundment has no storage capacity under normal operation, the project would have little ability to influence erosion during high-flow (flood) events.

Vegetation maintenance practices have the potential to influence shoreline erosion. For much of the project's shoreline, the upland areas along the Guadalupe River are in private ownership, and vegetation management practices fall to individual landowners. The shoreline is largely vegetated, but agricultural use contributes to streambank erosion in some areas. Within the project boundary, the City maintains the upland area around the project's powerhouse and kayak dock as mowed lawn. The City-owned land on the west bank of the river across from the powerhouse is undeveloped and inaccessible, and the vegetation there is dense and unmaintained. Where lawn dominates, erosion is more likely to occur. Vegetation maintenance is discussed further in section 3.3.3, *Terrestrial Resources*.

The City proposes no construction or significant ground disturbance at the project. In the future, should the City propose to make significant modifications to the project, the City would be required to seek approval from the Commission in the form of an application to amend the license. At that time, the need for protective measures during construction, as requested by Texas PWD, would be evaluated.

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

Water Quantity

The Gonzales Project receives water from the Guadalupe River and the San Marcos River, which enters the Guadalupe River 3.2 river miles upstream of the project dam. The Guadalupe River flow is regulated for flood control, water supply, and

hydropower generation by operations at the Canyon Dam Project,[17] which is located 128 river miles upstream of the Gonzales Project dam. The flow coming from the San Marcos River is unregulated, but does pass several low-head dams, none of which have hydroelectric development.

Table 3-1 shows the monthly flow data for the Guadalupe River at the Gonzales Project.[18] The mean annual flow is approximately 1,699 cfs, with monthly flows generally highest during early summer (June and July) and fall (October and November) and lowest during late summer (August and September) and winter (January and February). The project is able to operate when flows are equal to or greater than the minimum hydraulic capacity of the project (200 cfs) and less than flows that cause the rising tailwater to reduce project head below 9 feet (about 3,000 cfs or greater), which is the minimum head required for efficient turbine operation. Flows are within the operational range (200 cfs to 3,000 cfs) about 86 percent of the time.[19] Flows exceed the maximum hydraulic capacity of the project (831 cfs) and the project spills water over the dam crest while operating about 53 percent of the time. Because of one or more hydroelectric projects upstream of the Gonzales Project that operate in a daily peaking mode year-round, inflow to, and outflow from the Gonzales Project is variable throughout the day. Flows at the project have been observed fluctuating by as much as 400 cfs in less than 24 hours (figure 3-1).

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[17] FERC Project No. 3865, which is licensed to the Guadalupe-Blanco River Authority.

[18] Flow data are from United States Geological Survey (USGS) gauge 08173900, which is located about 1 mile downstream from the dam.

[19] Flows exceed 200 cfs about 98 percent of the time and exceed 3,000 cfs about 12 percent of the time.

Table 3-1. Monthly flow data (cfs) from 1997-2018 at USGS gauge number 08173900 Guadalupe River near Gonzales, Texas (Source: staff).

Month	Minimum Flow (cfs)	90 percent exceedance	Mean Flow (cfs)	10 percent exceedance	Maximum Flow (cfs)
January	217	446	1,305	2,440	18,700
February	324	504	1,402	2,580	21,200
March	260	496	1,660	3,580	28,400
April	186	420	1,511	3,110	11,400
May	173	418	1,592	2,560	35,700
June	205	340	2,015	6,370	40,600
July	132	249	2,086	5,850	50,200
August	108	191	1,383	3,470	41,000
September	101	210	1,275	2,610	11,000
October	122	309	2,088	2,620	188,000
November	154	382	2,376	5,560	80,800
December	309	425	1,673	4,620	8,850

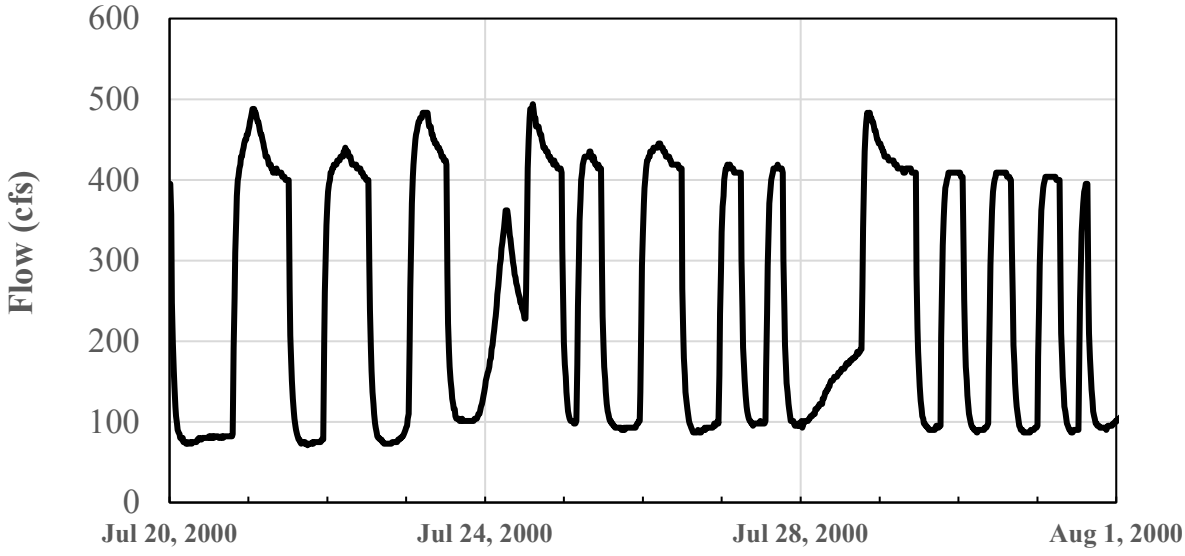

Figure 3-1. Representative flow data collected at 15-minute intervals at USGS gauge number 08173900 located about 1 mile downstream from the Gonzales Project (Source: staff).

Water Quality

Water Quality Standards

To manage the water quality in the state, Texas CEQ has divided all major rivers, lakes, and estuaries into "classified segments," each identified by a tracking number. The Gonzales Project impoundment occurs in two classified segments (hereafter, referred to as "river segments") with slightly different water quality standards. Waters within the project boundary that occur in the Guadalupe River upstream of the confluence with the San Marcos River are in river segment 1804 (figure 1-1). Waters within the project boundary that occur in the Guadalupe River downstream of the confluence with the San Marcos River are in river segment 1803. River segments 1803 and 1804 have identical designated uses (i.e., high aquatic life use,[20] primary contact recreation,[21] and public water supply[22]) and numeric water quality criteria (table 3-2), with the exceptions being that waters in river segment 1804 have an aquifer protection[23] designated use and a maximum water temperature of 90°F, which is 3°F less than river segment 1803 (Texas CEQ, 2014a).

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[20] High aquatic life use waters have highly diverse habitat characteristics, sensitive species present, high species diversity, high species richness, and a balanced to slightly imbalanced trophic structure.

[21] Primary contact recreation include activities that are presumed to involve a significant risk of ingestion of water.

[22] Public water supply refers to waters known to be used or exhibit characteristics that would allow them to be used as the supply source for public water systems.

[23] Segments designated for aquifer protection are capable of recharging the Edwards Aquifer. The Edwards Aquifer is a unique groundwater system underlying about 3,600 square miles of land in Texas and serves as a water supply for drinking and agriculture. The principal purpose of aquifer protection designation is to protect the quality of water infiltrating into and recharging the aquifer.

Table 3-2. Summary of water quality criteria applicable to the Gonzales Project.

Numeric Criteria	Guadalupe River upstream of the confluence with the San Marcos River (river segment 1804)	Guadalupe River downstream of the confluence with the San Marcos River (river segment 1803)
Average dissolved oxygen (DO)	Must be greater than or equal to 5.0 milligrams per liter (mg/L) during a 24-hour period, but during the spring spawning period (i.e., first half of the year when water temperature is between 63°F and 73°F), average DO must be greater than or equal to 5.5 mg/L during a 24-hour period	
Minimum DO	Cannot be less than or equal to 3.0 mg/L for more than 8 hours per 24-hour day, but during the spring spawning period (see above), minimum DO cannot be less than or equal to 4.5 mg/L for more than 8 hours per 24-hour day.	
Water temperature	Not to exceed 90°F	Not to exceed 93°F
pH	6.5-9.0	

Water Quality Monitoring

The City monitored dissolved oxygen (DO), water temperature, and pH hourly at three locations (i.e., impoundment [site 1], tailrace [site 2], and 1.2 miles downstream of the dam [site 3]; see figure 3-2) in river segment 1803 from October 21, 2016 to October 31, 2017 using multiprobe sondes (The City, 2018).[24] During water quality monitoring, flows at USGS gauge number 08173900, located about 1 mile downstream from the project, ranged from 484 cfs to 41,000 cfs. The City did not monitor water quality in river segment 1804. However, the Guadalupe-Blanco River Authority (GBRA) does monitor water quality within five separate reaches of river segment 1804, and one of

[24] Occasionally, during high flows, the sonde housing became clogged with excess sediment and debris and/or the sondes malfunctioned, resulting in inaccurate data collection on those days. Days with inaccurate data were removed from the data set (The City, 2018).

those reaches, identified as assessment unit 1804_01, includes the portion of the project impoundment located upstream of the confluence of the Guadalupe River and San Marcos River (GBRA, 2018). Assessment unit 1804_01 has been monitored for DO, water temperature, pH, and other variables since 1996.[25]

Figure 3-2. Water quality monitoring sites (Source: Google Earth, 2014; as modified by staff).

[25] Water quality monitoring in assessment unit 1804_01 is conducted at station 15110, which is located about 3.8 river miles upstream from the upstream boundary of the Gonzales Project impoundment. Monitoring occurred monthly from 1996 to September 2015, and quarterly subsequent to September 2015 (GBRA, 2019b).

Dissolved Oxygen

The DO concentration varied seasonally at all three sites monitored by the City in river segment 1803, and was lowest during the summer (June through September) (figure 3-3). The average daily DO concentration was at least 5.0 mg/L at all three sites during the monitoring period, except on August 7, 2017 and September 26, 2017, when the average DO concentrations were 4.94 mg/L and 4.86 mg/L, respectively in the tailrace. The lowest observed DO concentration of 4.05 mg/L occurred in the tailrace (site 2) on August 7, 2017. The DO concentration never dropped to the state standard minimum concentration of 3.0 mg/L at any site during the monitoring period. Further, when water temperature was between 63°F and 73°F, during the first half of the year (i.e., spring spawning period [see table 3-2]), the average daily DO concentration was never less than 5.5 mg/L at any site, and the hourly DO concentration was never less than or equal to 4.5 mg/L for more than 8 hours at any site. Thus, DO was at a level consistent with the state's standards at each site during the spring spawning period. In addition, the most recent EPA approved 303(d) list does not identify any water quality impairments for DO or any other water quality variable in river segment 1803 (Texas CEQ, 2014b).

In river segment 1804, GBRA's water quality monitoring indicates that the DO concentration never dropped below 5.2 mg/L within assessment unit 1804_01 during the most recent 10 years (2009-2018) (GBRA, 2018). Also, the most recent EPA approved 303(d) list does not identify any water quality impairments for DO or any other water quality variable in river segment 1804 (Texas CEQ, 2014b).

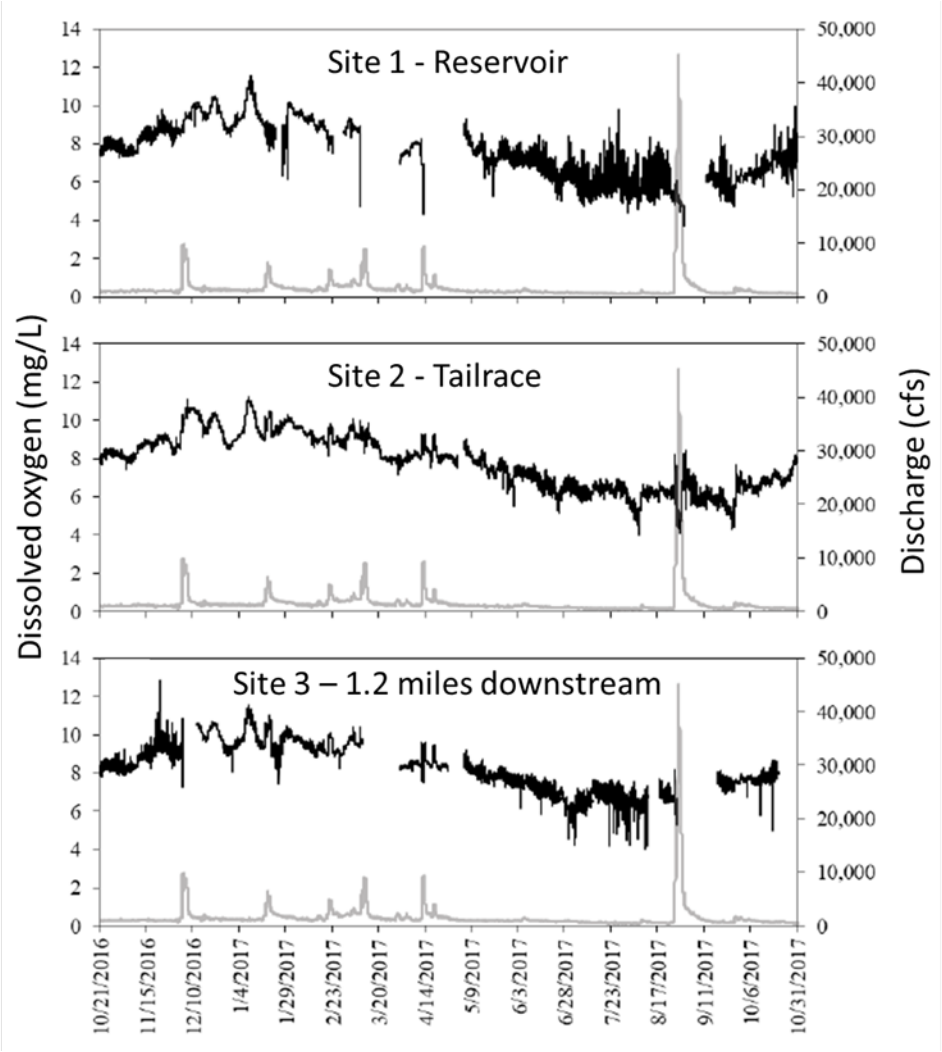

Figure 3-3. Dissolved oxygen concentrations in the Gonzales Project impoundment and downstream (Source: the City, 2018; as modified by staff).

Water temperature

Water temperature also varied seasonally at all three sites monitored by the City in river segment 1803, and was highest during the summer (figure 3-4). The maximum water temperature of 33.43°C (92.2°F) occurred on July 30, 2017 in the impoundment, but was within the state standard maximum temperature of 33.89°C (93°F) for river segment 1803.

Water quality monitoring conducted by GBRA (2018) between 2009 and 2018 in assessment unit 1804_01 indicated that water temperature never exceeded 31.5°C (or 88.7°F), which was below the state standard maximum temperature of 32.22°C (or 90°F) for river segment 1804.

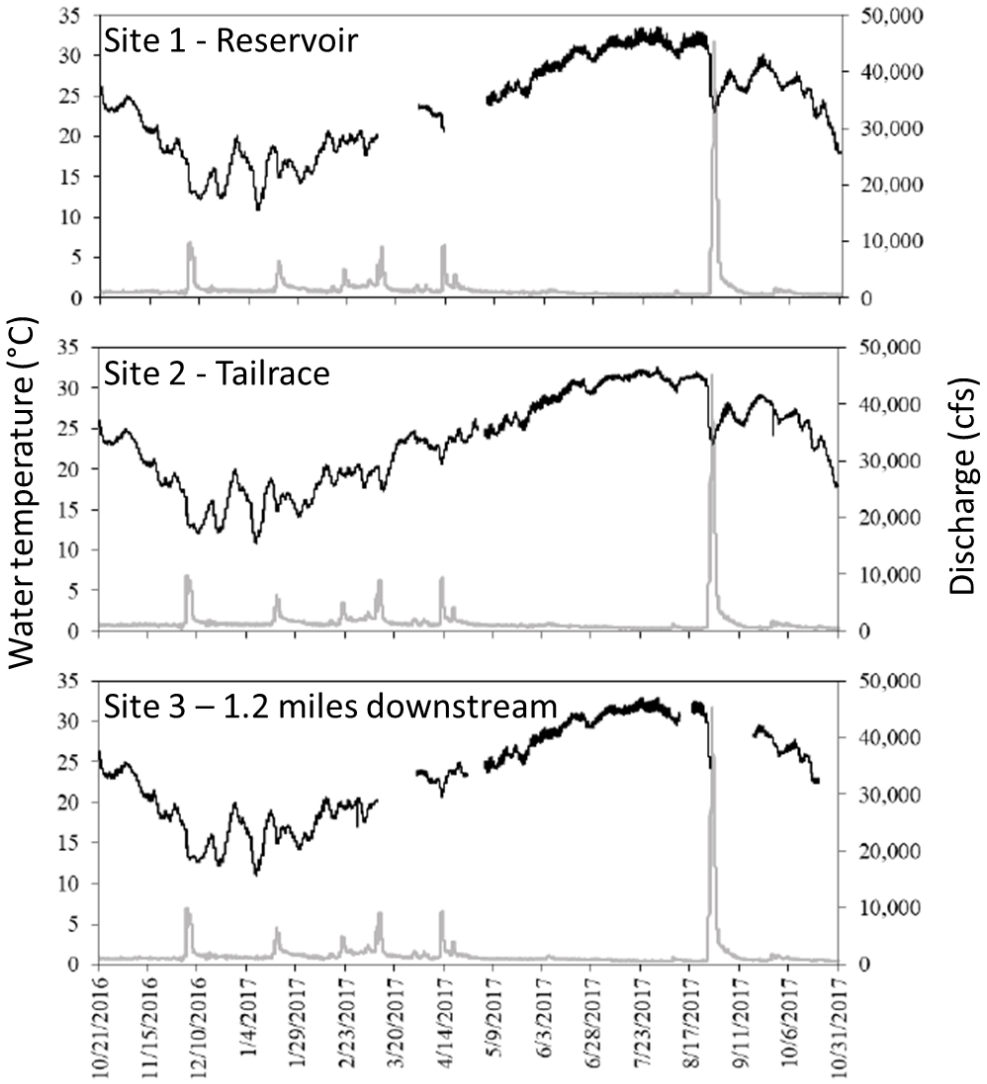

Figure 3-4. Water temperature in the Gonzales Project reservoir and downstream (Source: the City, 2018; as modified by staff)

Water pH

Hourly pH values ranged between 7.20 and 8.43 at all sites monitored by the City in river segment 1803, and were within the state standard range of 6.5 to 9.0. Monitoring conducted by GBRA (2018) between 2009 and 2018 in assessment unit 1804_01 indicated that pH was always between 7.2 and 8.2, and was within the state standard range for river segment 1804.

Aquatic Habitat

The Gonzales Project impoundment is a 7.2-mile-long, 300-acre riverine body of water with 14.4 miles of shoreline and an average depth of about 8 feet. On July 17, 2017, Texas PWD conducted a survey in the project impoundment from the dam to the confluence with the San Marcos River to characterize the impoundment bathymetry and substrate composition using side-scan sonar and random substrate samples.[26] The survey results indicated that the center of the channel is about 20 to 23 feet deep, and is deepest (33 feet) at the confluence with the San Marcos River. The survey results also demonstrated that the impoundment bottom substrates are primarily silt within the main channel, with clay and clay/silt closer to the shoreline. Patches of gravel and sand, cobble, and large woody debris (near the dam) are also present in the impoundment, but are not common.

[26] Substrate samples were collected using a substrate scoop (a cup-like sampler), as well as a mini-Ponar dredge sampler (or "grab" sampler) for deeper locations.

Fishery Resources

Reservoir Fish Community

To characterize the fish community within the project impoundment, the City conducted fish surveys using boat electrofishing (day and night), gill nets, and baited eel pots during the spring (April 6-7, 2017), summer (September 6-7, 2016), fall (November 9-10, 2016), and winter (January 11-12, 2017) (BIO-WEST, 2017a). The specific purpose of the nighttime electrofishing and baited eel pots was to identify whether American eels were present within the project impoundment.

The impoundment fish community was represented by 30 species in 11 families and included fish species common to small riverine impoundments in south Texas (tables 3-3 and 3-4). The dominant fish species in the impoundment were gizzard shad, Cyprinids (minnows), Centrarchids (sunfish), and smallmouth buffalo. No state or federally listed species were observed in the impoundment. However, one Guadalupe bass,[27] a Texas Species of Greatest Conservation Need,[28] was observed in the impoundment during the summer 2016 sampling. No American eels were observed in the impoundment using any of the sampling methods.

[27] Guadalupe bass is a popular sportfish found exclusively in flowing waters of Texas (Texas PWD, 2018a).

[28] Species of Greatest Conservation Need are native animals or plants that are declining or rare and in need of attention to recover or to prevent the need to list under state or federal regulation. See: https://tpwd.texas.gov/huntwild/wild/wildlife_diversity/nongame/tcap/sgcn.phtml (last visited Sept. 6, 2019).

Table 3-3. Relative abundance of fish in the project impoundment based on daytime and nighttime boat electrofishing (Source: BIO-WEST, 2017a; as modified by staff).

Family	Common name	Summer Relative abundance[a]	Fall Relative abundance	Winter Relative abundance	Spring Relative abundance	All Seasons Combined Relative abundance	All Seasons Combined Percent of Relative abundance
Lepisosteidae	Spotted gar	3.8	5.6	5.4	2.9	4.4	1.52
	Longnose gar	0.8	1.6	0	0	0.6	0.21
Clupeidae	Gizzard shad	28.4	9.6	5.4	4.3	11.8	4.08
Cyprinidae	Red shiner	112.7	375.3	169	119.5	191	66.09
	Blacktail shiner	1.5	3.2	2.3	1.4	2.1	0.73
	Common carp	3.1	1.6	1.6	0.7	1.7	0.59
	Ghost shiner	0	0	0.8	0	0.2	0.07
	Mimic shiner	0.8	0	0	0	0.2	0.07
	Bullhead minnow	13	15.1	31.8	35.1	24	8.30
Catostomidae	Smallmouth buffalo	0.8	7.2	10.1	2.1	5	1.73
	Gray redhorse	0	1.6	0	0.7	0.6	0.21
Characidae	Mexican tetra	0	0	0	0.7	0.2	0.07
Ictaluridae	Yellow bullhead	0	0	0	0.7	0.2	0.07
	Blue catfish	0	0.8	0	0	0.2	0.07
	Channel catfish	1.5	4	4.7	5	3.8	1.31
	Flathead catfish	3.1	0	0	1.4	1.1	0.38
Fundulidae	Blackstripe topminnow	0.8	0	0	0	0.2	0.07
Poeciliidae	Western mosquitofish	19.2	0.8	0	2.9	5.7	1.97
	Sailfin molly	0	0	0	1.4	0.4	0.14
Centrarchidae	Green sunfish	0	0	2.3	0.7	0.8	0.28
	Warmouth	0	0.8	3.1	0	1	0.35

Family	Common name	Summer Relative abundance[a]	Fall Relative abundance	Winter Relative abundance	Spring Relative abundance	All Seasons Combined Relative abundance	All Seasons Combined Percent of Relative abundance
	Bluegill	15.3	14.3	7	17.9	13.7	4.74
	Longear sunfish	3.1	15.1	15.5	22.9	14.3	4.95
	Redear sunfish	0	0	0.8	0	0.2	0.07
	Spotted bass	2.3	1.6	0.8	3.6	2.1	0.73
	Guadalupe bass	0.8	0	0	0	0.2	0.07
	Largemouth bass	2.3	0	0.8	0.7	1	0.35
	White crappie	2.3	0.8	2.3	0.7	1.5	0.52
Sciaenidae	Freshwater drum	0	0	0.8	0	0.2	0.07
Cichlidae	Rio Grande cichlid	0.8	0.8	0	0.7	0.6	0.21

[a] Relative abundance refers to the number of fish caught per hour of electrofishing effort.

Table 3-4. Relative abundance of fish in the project impoundment based on gill net sampling (Source: BIO-WEST, 2017; as modified by staff).

Family	Common name	**Summer 2016** Relative abundance[a]	**Fall 2016** Relative abundance	**Winter 2017** Relative abundance	**Spring 2017** Relative abundance	**All seasons combined** Relative abundance
Lepisosteidae	Spotted gar	0.4	0.2	0	0.2	0.8
	Longnose gar	1.2	0.6	0	0.2	2
Cyprinidae	Common carp	0.4	0.6	0	0	1
Catostomidae	Smallmouth buffalo	2	2.6	3.2	1.8	9.6
Ictaluridae	Blue catfish	0.2	0.4	0.4	0	1
	Channel catfish	0.2	0.2	0.6	0	1
	Flathead catfish	0	0.2	0	0	0.2
Sciaenidae	Freshwater drum	0.2	0.4	0.6	0	1.2

[a] Relative abundance is the number of fish caught per night of sampling.

Table 3-5. Relative abundance of fish in the project tailrace based on daytime boat electrofishing (Source: BIO-WEST, 2018; as modified by staff).

Family	Common name	**Fall 2016** Relative abundance[a]	**Spring 2017** Relative abundance	**Fall & Spring Combined** Relative abundance
Anguillidae	American eel	4	8	6
Lepisosteidae	Spotted gar	4	0	2
	Longnose gar	12	0	6
Clupeidae	Gizzard shad	44	60	52
Cyprinidae	Red shiner	20	100	60
	Common carp	4	16	10
	Bullhead minnow	0	4	2
Catostomidae	Smallmouth buffalo	12	20	16
Ictaluridae	Blue catfish	0	4	2
	Channel catfish	4	8	6
	Flathead catfish	8	0	4
Mugulidae	Striped mullet	0	4	2
Moronidae	White bass	0	4	2
Centrarchidae	Green sunfish	0	8	4
	Warmouth	4	0	2
	Bluegill	4	16	10
	Longear sunfish	40	28	34
	Spotted bass	8	16	12

[a] Relative abundance is the number of fish caught per night of sampling.

American eel

The American eel is a catadromous[29] species that spends most of its life in fresh or brackish water to feed and grow, before migrating to the Sargasso Sea to spawn. The

[29] The term "catadromous" is used to describe a life history strategy where fish reproduce and spend early life stages in the ocean, move into freshwater to rear as sub-adults, then move back to the ocean to spawn as adults.

American eel also occurs throughout warm and cold waters of the Atlantic Ocean and Atlantic coastal drainages in North America, but are relatively rare in Gulf coastal drainages, particularly in Texas (Boschung and Mayden, 2004; Shepard, 2015). In Texas, the American eel is listed as a Species of Greatest Conservation Need, but is currently considered secure. Observations of American eel in the Guadalupe River Basin are limited, but historical and recent surveys have documented the species presence both upstream and downstream of the project (GBRA and Texas PWD, 2014; Hendrickson *et al*., 2015), and as recently as 2017 in the San Marcos River (Adam Cohen, Ichthyology Collection Manager, Texas Natural History Collections, University of Texas, unpublished data).[30]

Spawning occurs in the Atlantic Ocean (specifically the Sargasso Sea), and eggs and larvae drift with the Gulf Stream currents along the east coast of the U.S. (Jenkins and Burkhead, 1993). Juvenile "glass" eels migrate into estuaries and tidal rivers in late winter/early spring, develop pigments as elvers (young yellow eels), and eventually reach the primary growth phase (yellow eels) at about 4 inches in length. Yellow eel movements are typically to upstream habitats, and most yellow eels that migrate upstream tend to be females (Shepard, 2015). The yellow eel phase can last from 5 to 40 years before they mature into silver eels and out-migrate to spawning grounds (*i.e.*, Sargasso Sea) in the fall and winter months (Boschung and Mayden, 2004).[31]

During the 2016 and 2017 fish surveys, eels were collected in low abundance in the tailrace, but no eels were observed in the impoundment. Daytime electrofishing conducted in the tailrace by the City indicated that the American eel relative abundance was 4 eels per hour of electrofishing during the fall of 2016 and 8 eels per hour of electrofishing during the spring of 2017, or an average of 6 eels per hour of electrofishing

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[30] See BIO-WEST, 2018.

[31] Juvenile eels that reside in estuaries reach maturity and migrate earlier than juveniles found in freshwaters, and that these eels can reach full maturation while never migrating to freshwater (FWS, 2007).

for both seasons combined (table 3-5).[32] Nighttime electrofishing conducted in the tailrace by Texas PWD indicated that American eel relative abundance was 5.5 eels per hour of electrofishing.[33] No eels were collected using ramp traps, minnow traps, or trotlines.

Figure 3-5. Photo of ramp traps used in the tailrace to target American eels (Source: the City, 2017)

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[32] The City did not successfully net any American eels during the 2016 and 2017 electrofishing surveys, but one eel was observed during 2016 survey and two eels were observed during 2017 survey. When we estimated American eel relative abundance, we included eels that were not netted. However, because the eels that were observed and not netted may have been counted more than once, we recognize that these relative abundance estimates may reflect a population size that is higher than the one that actually exists in the river.

[33] During Texas PWD's survey, two American eels were successfully netted and two eels were observed. As with the City's data, observed American eels were included in our estimate of relative abundance.

Mussels

Freshwater mussels are filter feeding bivalves that occur in a variety of freshwater environments, but are most abundant in well-oxygenated, shallow waters of medium to large rivers (Dillon, 2000; Smith, 2001). Mussels generally persist in areas where flows are high enough to minimize high water temperature and low DO events, and low enough to prevent scouring and displacement of mussels from substrates (Strayer, 1999; Hardison and Layzer, 2001; Golladay et al., 2004; Haag and Warren, 2008). Mussels also typically occupy stable substrates including different combinations of silt, sand, gravel, cobble, and boulder (Smith, 2001).

In 2013, GBRA and Texas PWD (2014) conducted mussel surveys[34] and benthic macroinvertebrate surveys[35] in the Guadalupe River at locations upstream and downstream of the Gonzales Project. The mussel surveys indicated that 10 freshwater mussel species were observed during the study, but the abundance and specific locations in the Guadalupe River were not identified. Those mussels species included threeridge (*Amblema plicata*), Tampico pearlymussel (*Cyrtonaias tampicoensis*), Louisiana fatmucket (*Lampsilis hydiana*), yellow sandshell (*Lampsilis teres*), washboard (*Megalonaias nervosa*), golden orb (*Quadrula aurea*), false spike (*Quadrula mitchelli*), Texas pimpleback (*Quadrula petrina*), lilliput (*Toxolasma parvus*), and pistolgrip (*Tritogonia verrucosa*). Texas pimpleback is listed as state threatened and is candidate species for listing as federally threatened or endangered, and golden orb and false spike are state threatened species. GBRA and Texas PWD (2014) included the locations of mussels collected during the benthic macroinvertebrate survey, and indicated that golden orb and Texas pimpleback were the only mussels observed at a site downstream of Highway 183, which is the site closest to the project (table 3-6).[36]

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[34] The mussel surveys involved timed searches along the shoreline and within the river channel.

[35] The benthic macroinvertebrate surveys involved kicknet sampling in riffles and/or collecting invertebrates from woody debris, rocks, or other structures.

[36] Highway 183 is about 1.3 river miles downstream of the Gonzales Project dam and golden orb and Texas pimpleback were collected at a site located about 1.4 river miles downstream. All other sites surveyed were located at least 15 river miles downstream of the project dam, or over 73 river miles upstream of the project dam.

Between 2014 and 2016, Tsakiris and Randklev (2016) conducted a mussel survey involving qualitative[37] and quantitative[38] sampling in five study reaches that were all located downstream of Highway 183. The reach identified as study reach I was closest to the project and began just downstream of Highway 183 and extended downstream for about 6.2 river miles. All other study reaches were located greater than 7 miles downstream of the project dam, and thus study reach I is likely most representative of the project area. At study reach I, eight mussel species were collected, and threeridge and golden orb were the most abundant (table 3-6).

Randklev et al. (2012) also conducted a survey in the Guadalupe River in 2011 and indicated that threeridge, Tampico pearlymussel, Louisiana fatmucket, yellow sandshell, washboard, giant floater (*Pyganodon grandis*), golden orb, false spike, Texas pimpleback, and lilliput, were collected near Gonzales, Texas, but the specific locations were not identified.

The surveys discussed above indicate that freshwater mussels are present in the vicinity of the project, including state threatened and federal candidate species (see additional discussion below), but there is no evidence that freshwater mussels are present within the project boundary.

[37] Qualitative sampling involved timed searches using visual and tactile techniques.

[38] Quantitative sampling involved excavating sediment in 2.7 square feet quadrats to a depth of 7.9 inches using modified Surber samplers, and passing sediment through a sieve to separate out mussels.

Table 3-6. Percent abundance of freshwater mussels collected by Tsakiris and Randklev (2016) at study reach I (Source: Tsakiris and Randklev, 2016; as modified by staff).

Common name	Scientific name	Federal or State Status	Percent abundance
Threeridge	*Amblema plicata*	none	61
Rock pocketbook	*Arcidens confragosa*	none	0
Tampico pearlymussel	*Cyrtonaias tampicoensis*	none	1
Louisiana fatmucket	*Lampsilis hydiana*	none	1
Yellow sandshell	*Lampsilis teres*	none	3
Washboard	*Megalonaias nervosa*	none	8
Giant floater	*Pyganodon grandis*	none	0
Golded orb	*Quadrula aurea*	State threatened	19
False spike	*Fusconaia mitchelli*	State threatened	2
Texas pimpleback	*Quadrula petrina*	Federal candidate/State threatened	6
Pistolgrip	*Quadrula verrucosa*	None	0
Lilliput	*Taxolasma parva*	None	0
Texas Lilliput	*Taxolasma texasense*	None	0

Special Status Mussel Species

As indicated above, three special status mussel species were collected downstream of the Gonzales Project and include the Texas pimpleback (state threatened/federal candidate), golden orb (state threatened), and false spike (state threatened). Texas fatmucket (*Lampsilis bracteata*) is another federal candidate mussel species that was not observed in the studies discussed above, but historically occurred in the Guadalupe River, and during scoping was included as a resource to be included in this environmental assessment.[39] These four mussel species are discussed in more detail below.

Texas Pimpleback[40]

Texas pimpleback is a state threatened species (Texas PWD, 2019a), and was added to the FWS's candidate species list on October 6, 2011.[41] Like the golden orb, the life history of Texas pimpleback is not well understood. Gravid females have been found from June through August, suggesting that reproduction occurs during the summer. Although no host fish have been confirmed, Texas pimpleback glochidia (i.e., parasitic mussel larvae) have been observed attached to flathead catfish, yellow bullhead, and bluegill in the laboratory. Texas pimpleback is known to inhabit mud, sand, gravel, and cobble in moderately sized rivers. This species also tolerates faster moving water than most mussel species. It has not been found in deep, low velocity waters created by impoundments.

The Texas pimpleback historically occurred throughout most of the Colorado and Guadalupe-San Antonio River Basins of central Texas, where it is endemic. The species has declined rangewide and is now only known to occur in the San Saba and Concho Rivers of the Colorado River Basin, and in the Guadalupe and San Marcos Rivers of the Guadalupe River Basin. In the Guadalupe River Basin, the Texas pimpleback has been extirpated from the majority of mainstem habitat in the Guadalupe, San Antonio, and Blanco Rivers, but small populations exist in the lower Guadalupe and San Marcos Rivers.

As discussed above, recent surveys indicate that Texas pimpleback is present downstream (GBRA and Texas PWD, 2014; Tsakaris and Randklev, 2016) of the

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[39] See Scoping Document 2 issued on December 23, 2015.

[40] All information about the Texas pimpleback in this section is from 76 Fed. Reg 62,170-62,171 unless otherwise noted.

[41] 76 Fed. Reg. 62,166-62,212 (October 6, 2011).

Gonzales Project, but there is no indication it occurs within the project boundary. The Texas pimpleback observations located closest to the project were those found by GBRA and Texas PWD (2014) in 2013 and occurred about 1.4 river miles downstream of the project dam. Tsakaris and Randklev (2016) also collected Texas pimpleback between 2014 and 2016 in study reach I (see discussion above).

Golden Orb[42]

Golden orb is a state threatened species (Texas PWD, 2019a). Golden orb life history is not well understood, but based on other species in the same genus (i.e., *Quadrula* spp.), golden orb is likely a short-term brooder that holds fertilized eggs and glochidia for 3 to 6 weeks before releasing glochidia that parasitize and develop successfully on catfish.[43] Gravid females have been found from May through August, suggesting that reproduction occurs primarily during the summer months (Hammontree et al., 2012). Golden orb is typically found in flowing waters of moderately sized rivers. Golden orb prefer firm substrates, whether mud, sand, or gravel, and does not tolerate loose sand or silt.

The golden orb was historically distributed throughout the Nueces-Frio and Guadalupe-San Antonio River basins in central Texas, where it is endemic. Based on historical and current data, the golden orb has declined significantly range-wide and is now known only from nine locations in four rivers (i.e., Guadalupe, San Marcos, San Antonio, and Nueces).[44] In the Guadalupe River Basin, the golden orb historically occurred throughout the Guadalupe, San Antonio, and San Marcos Rivers. Currently in this basin, the species only persists in the upper and lower Guadalupe River and the lower San Marcos and San Antonio Rivers.

As discussed above, recent surveys indicate that golden orb is present both upstream[45] and downstream (GBRA and Texas PWD, 2014; Tsakaris and Randklev,

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[42] All information about the golden orb in this section is cited from 76 Fed. Reg 62,170-62,171 unless otherwise noted.

[43] Freshwater mussels begin life as glochidia, which are expelled by reproductive females and must attach themselves to a host fish's gills to develop.

[44] 81 Fed. Reg. 87,259 (December 2, 2016).

[45] As recently as 2008, live golden orb were found downstream of Lake Wood, which is about 11 river miles upstream from the Gonzales Project dam (76 Fed. Reg 62,171 [October 6, 2011]). The specific distance downstream of Lake Wood was not specified.

2016) of the Gonzales Project, but there is no indication it occurs within the project boundary. The golden orb observations located closest to the project were those found by GBRA and Texas PWD (2014) in 2013 and occurred about 1.4 river miles downstream of the project dam. Tsakaris and Randklev (2016) also collected golden orb between 2014 and 2016 in a river reach (study reach I) that began 1.4 miles downstream of the project dam and extended about 6.2 miles downstream.

False spike

False spike is a state threatened species (Texas PWD, 2019a) that is under review for protection under the ESA. Until 2011, false spike was thought to be extinct (Randklev et al., 2012). Because accounts of false spike are limited, information on its life history is unavailable. Nevertheless, recent collections of false spike in the Guadalupe River and San Sabo River indicate that the species inhabits relatively shallow water (less than 2 feet) with gravel and cobble substrates (Randklev et al., 2012; Sowards et al., 2013). Gravid females have been collected from mid-March to late April, suggesting that reproduction occurs during the spring, at minimum (Dudding et al., 2019).

Historically, the geographic range of false spike included the Rio Grande, San Antonio, Guadalupe, Colorado, and Brazos River basins (Randklev et al., 2012). As indicated above, the species range has contracted, but false spike have recently been collected in the Brazos, Colorado, and Guadalupe River basins (Randklev et al., 2013). No living populations of false spike are known in the Rio Grande River Basin (Randklev et al., 2013). In the Guadalupe River, false spike have recently been collected at unspecified locations near Gonzales (Randklev et al. 2012, Randklev et al., 2013), and at locations downstream of Highway 183 (GBRA and Texas PWD, 2014; Tsakiris and Randklev, 2016).

Texas fatmucket[46]

Texas fatmucket is a state threatened species (Texas PWD, 2019a), and was added to the FWS's candidate species list on October 6, 2011.[47] Like the golden orb and Texas pimpleback discussed above, the life history of the Texas fatmucket is not well understood. Texas fatmucket females have been found gravid from July through

[46] All information about the Texas fatmucket in this section is from 76 Fed. Reg 62,170-62,171 unless otherwise noted.

[47] 76 Fed. Reg. 62,166-62,212 (October 6, 2011).

October, suggesting that reproduction primarily occurs during the summer and fall. Female Texas fatmucket mussels are known to display a mantle lure[48] that attracts host fish and releases glochidia when bitten or struck by a fish. In the laboratory, bluegill and green sunfish have been successful hosts to Texas fatmucket glochidia. Typically, Texas fatmucket occur in moderately sized rivers in mud, sand, or gravel and sometimes in crevices between bedrock slabs. The species does not occur in ponds, lakes, or impoundments.

The Texas fatmucket was historically distributed in at least 18 rivers in the upper Colorado, Guadalupe, and San Antonio River systems. The species was never widely distributed in the Guadalupe River Basin, but is known to have historically occurred in Kerr County, Texas.

In 2005, live and recently dead Texas fatmucket mussels were observed in the Guadalupe River near Louise Hayes Park (about 100 miles northwest of the Gonzales Project), but in 2007 and 2008, no live or dead Texas fatmucket were observed at the same location. There is no other recent evidence of Texas fatmucket in the mainstem of the Guadalupe River. Recent surveys conducted by GBRA and Texas PWD (2014) and Tsakaris and Randklev (2016) found no evidence of Texas fatmucket near the project, either upstream or downstream.

River Shrimp

River shrimp are primarily tropical crustaceans that occur in rivers and estuaries along the Gulf of Mexico and the southern Atlantic Coast of the U.S. (Hedgpeth, 1949). Four species of river shrimp (i.e., *Macrobrachium acanthurus*, *M. ohione*, *M. olfersii*, and *M. carcinus*) have historically occurred in the Guadalupe River Basin (Horne and Beisser, 1977), but their current presence and distribution in the basin is unknown. River shrimp are amphidromous[49] and spend the majority of their life in freshwater and a brief period of their juvenile life in estuaries (Bowles *et al.*, 2000; Bauer, 2011). The river shrimp life cycle begins in freshwater with embryos developing into larvae on the pleon

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[48] A mantle lure is a modified mantle (soft tissue that lines the inside of the shell) that resembles prey (e.g., fish, benthic invertebrates) and is used to lure fish to the mussel.

[49] Amphidromy refers to non-breeding animal migrations from freshwater to brackish/sea water or from brackish/sea water to freshwater.

(abdomen) of the female shrimp (Bauer, 2011).[50] After larvae hatch,[51] they drift downstream to estuarine or marine habitats to molt into feeding stage larvae (Bauer, 2011). When larval development is complete, juveniles migrate back upstream to freshwater habitat, where they complete their life-cycle (Bauer, 2011).[52] Juveniles migrate upstream by swimming, walking, and crawling along the bottom, and have been observed crawling up vertical, or near-vertical natural barriers like waterfalls and brush piles and artificial barriers, such as low weirs and dams (Benstead et al., 1999; Bauer, 2011).

3.3.2.2 Environmental Effects

Project Operation

Some hydropower facilities that operate under variable impoundment surface elevations have the potential to reduce retention times[53] and water levels in the impoundment, causing littoral (near-shore) habitat to dewater. Upon refill, these hydropower facilities can increase retention times in the impoundment, and cause water temperature to increase and DO to decrease. Some hydropower operations can also cause unnatural flow fluctuations downstream of the dam, leading to dewatering when operations reduce flows downstream and scouring when operations increase flows downstream. These changes in water quality and habitat, in turn can create poor conditions for reproduction and survival of fish and freshwater mussels.

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[50] Studies on the timing of embryonic development are limited, but based on M. ohione that occupy Galveston Bay, Texas, most females incubate embryos in April and May (Reimer et al., 1974, as cited by Bauer and Delahoussaye, 2008).

[51] Studies on the timing of hatching are limited, but based on *M. ohione* in the Atchafalaya River, Louisiana, hatching and subsequent drifting occurs from April through June (Bauer and Delahoussaye, 2008, Rome et al., 2009).

[52] Juveniles appear to migrate upstream when water velocities are slower (Bauer, 2011). For *M. ohione* in the Atchafalaya River, Louisiana, the upstream juvenile migration occurs during the summer (approximately July through August) (Bauer and Delahoussaye, 2008).

[53] Retention time is a measure of the average amount of time that water is stored in an impoundment.

As discussed in section 2.3.3, *Proposed Project Operation*, the City proposes to continue operating the project in a run-of-river mode at inflows between 831 cfs and 3,000 cfs, but would operate with impoundment level fluctuations between the dam crest and a level 1 foot below the crest of the dam when flows are greater than or equal to 200 cfs and less than or equal to 830 cfs.

Our Analysis

Impoundment Water Quality

As discussed above in section 3.3.1.1, *Affected Environment*, *Water Quality*, during run of river operation at flows between 484 cfs and 41,000 cfs, DO concentrations were always greater than 5.0 mg/L in the impoundment (downstream of the confluence with the San Marcos River) and remained at levels consistent with the state standard DO concentrations for river segment 1803.[54] (see table 3-2) during an entire year when inflows ranged from 484 cfs to 41,000 cfs. Although no DO monitoring was conducted in the portion of the impoundment located upstream of the confluence with the San Marcos River (i.e., river segment 1804), GBRA does have a monitoring site upstream of the impoundment that represents river segment 1804. Data from this site indicates that DO never dropped below 5.2 mg/L from 2009 to 2018. Further, Texas CEQ has not identified any water quality impairments, including DO, in either river segment 1803 or 1804 (Texas CEQ, 2014b). DO concentrations of 5.0 mg/L or greater are generally optimal for freshwater fishes and mussels to survive, grow, and reproduce (EPRI, 1990; Gagnon et al., 2004). Thus, during existing run-of-river operation, at flows between 484 cfs and 41,000 cfs, the DO concentrations are suitable for the survival, growth, and reproduction of any fish and mussels present in the project impoundment. DO concentrations were not observed at flows less than 484 cfs, but could fall below 5.0 mg/L.

Monitoring conducted by the City also indicated that water temperature in the impoundment (downstream of the confluence with the San Marcos River in river segment 1803) was maintained below the 93°F state standard for river segment 1803 during existing run-of-river operation. Although no water temperature monitoring was conducted in the portion of the impoundment, located upstream of the confluence with the San Marcos River (i.e., river segment 1804), GBRA's monitoring, at the site upstream of river segment 1804, indicates that water temperature did not exceed the 90°F standard from 2009 to 2018 (GBRA, 2018). Further, the water temperatures observed in the

[54] Texas CEQ assigns tracking numbers to river segments for the purpose of managing water quality. Tracking numbers 1803 and 1804 are assigned to river segments that occur within the Gonzales Project boundary. See section 3.3.1.1, *Affected Environment, Water Quality*.

impoundment during run-of-river operation were within the range suitable for the warmwater fish species present (Beitinger et al., 2000). Although information is limited on the thermal limits of freshwater mussels, the water temperatures observed during run-of-river operation also appear to be within the thermal limits for mussels acclimated to warm water conditions (e.g., Martin, 2016), like those that occur in the Guadalupe River.

The City's proposal to operate the project with impoundment level fluctuations of up to 1 foot below the crest of the dam when flows are between 200 cfs and 830 cfs has the potential to alter water quality compared to run-of-river operation. However, there is no information on the effects of these operational fluctuations on water quality at the Gonzales Project because the City did not operate with impoundment level fluctuations during the water quality study. There also is no reason to believe that DO would decrease or water temperature would increase when the City is lowering the impoundment surface elevation below the crest of the dam, because water would continue to enter and leave the impoundment without an increase in retention time. In contrast, after the impoundment surface elevation reaches 1 foot below the crest of the dam, one or more turbines would shut down to allow the impoundment to refill to the crest of the dam, reducing outflows relative to inflows (table 2-1), causing increased retention times. Increased retention times could, in turn, cause water temperatures to increase and DO to decrease.

The City's proposal to operate in a run-of-river mode at inflows between 831 cfs and 3,000 cfs would maintain the current good DO and water temperature conditions in the project impoundment, and support any fish and mussels that are present. However, operating with impoundment fluctuations could cause water quality to degrade during refilling relative to current conditions.

Impoundment Aquatic Biota and Habitat

The City's proposal to continue operating the project in a run-of-river mode with no impoundment level fluctuation at inflows between 831 cfs and 3,000 cfs would maintain relatively stable water levels in the impoundment, and continue to limit the potential for fish and macroinvertebrate stranding that otherwise could occur during unnatural water level fluctuations. Run-of-river operation would also continue to minimize water level disruption to any spawning and rearing habitat that exists in the littoral zone of the impoundment. Continuing to maintain relatively stable water levels in the impoundment would benefit fish and other aquatic organisms that rely on near-shore habitat for feeding and cover. Thus, operating the project in a run-of-river mode at inflows between 831 cfs and 3,000 cfs would continue to provide suitable habitat conditions in the project's impoundment and support the fish and mussels that are present.

Unlike run-of-river operation, the City's proposal to operate with impoundment level fluctuations of up to 1 foot below the crest of the dam when flows are between 200

cfs and 830 cfs, could result in impoundment fluctuations that potentially disrupt the spawning of some fish species (e.g., sunfish and bass) that use littoral zone habitat to construct nests used for egg and larval development. Based on the flow record near the project,[55] the City under its proposal, could operate with fluctuations about 45 percent of the time annually, or about 164 days per year (figure 3-6). Lowering the impoundment water level to 1 foot below the crest of the dam would always take at least 13 hours.[56] Similarly, refilling the impoundment would also be gradual and take at least 13 hours to reach the crest of the dam.[57] The gradual increase and decrease of impoundment water levels when the City is operating with impoundment fluctuations would help to prevent streambank erosion and maintain littoral habitat. In addition, gradually decreasing water levels would allow fish present in littoral habitat to swim to areas that would not be exposed when the impoundment water level is lower than the crest of the dam.

As indicated above, some littoral habitat would be exposed during impoundment fluctuations when the City lowers the impoundment water level below the crest of the dam. This exposure has the potential to impact the reproduction of sunfish and bass species that produce spawning nests in littoral habitat. The more common (i.e., bluegill, longear sunfish, and largemouth bass) and at risk (i.e., Guadalupe bass) species all tend to produce spawning nests in water greater than 1 foot deep (Jenkins and Burkhead, 1993; Hendrickson et al., 2015). Thus, the City's proposal to operate with impoundment level fluctuations would have minimal effects on the availability and suitability of fish spawning habitat in the project impoundment.

Fluctuating the impoundment also has the potential to negatively affect freshwater mussels by dewatering shallow-water impoundment habitat and exposing mussels to heat, desiccating conditions, and predators. We are unaware of any mussel surveys conducted in the project impoundment, but based on sediment surveys in the impoundment, substrates are likely unsuitable (i.e., clay and silt) for most mussels to exist in the

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[55] The flow record is based on data collected from 1997 to 2018 at USGS gauge number 08173900, which is located about 1 mile downstream from the project dam.

[56] We estimated the number of days it would take the City to lower the impoundment surface elevation to 1 foot below the crest of the dam when inflows are between 200 cfs (i.e., the lowest observed flow in the flow record between 1997 and 2018) and 830 cfs as follows: [(useable volume)/(outflow during drawdown – inflow during drawdown)]/(60 seconds per minute/60 minutes per hour/24 hours); where useable volume is 13,067,980.5 $feet^3$ (i.e., 300 acre-feet).

[57] Refills would take more than 24 hours when inflow is between 278 cfs and 428 cfs, and 555 cfs and 704 cfs. Based on the flow record from 1997 to 2018 at USGS gauge number 08173900, flows in these ranges occur about 56 percent of the time.

impoundment. The clay and silt sediments, which are prone to movement under high flows, likely lack the sediment stability mussels need to persist in a habitat (Niraula et al., 2017). If mussels are present in the project impoundment, they are likely not common. In addition, only those mussels present in the top 1-foot of water along the shoreline would be affected by impoundment fluctuations. Thus, the small number of mussels that might be negatively affected by small reductions in habitat during impoundment fluctuations would likely have minimal effects on the mussel community in the project vicinity. Our analysis above indicates that impoundment fluctuations would have minimal effect on fish and mussels present in the project impoundment.

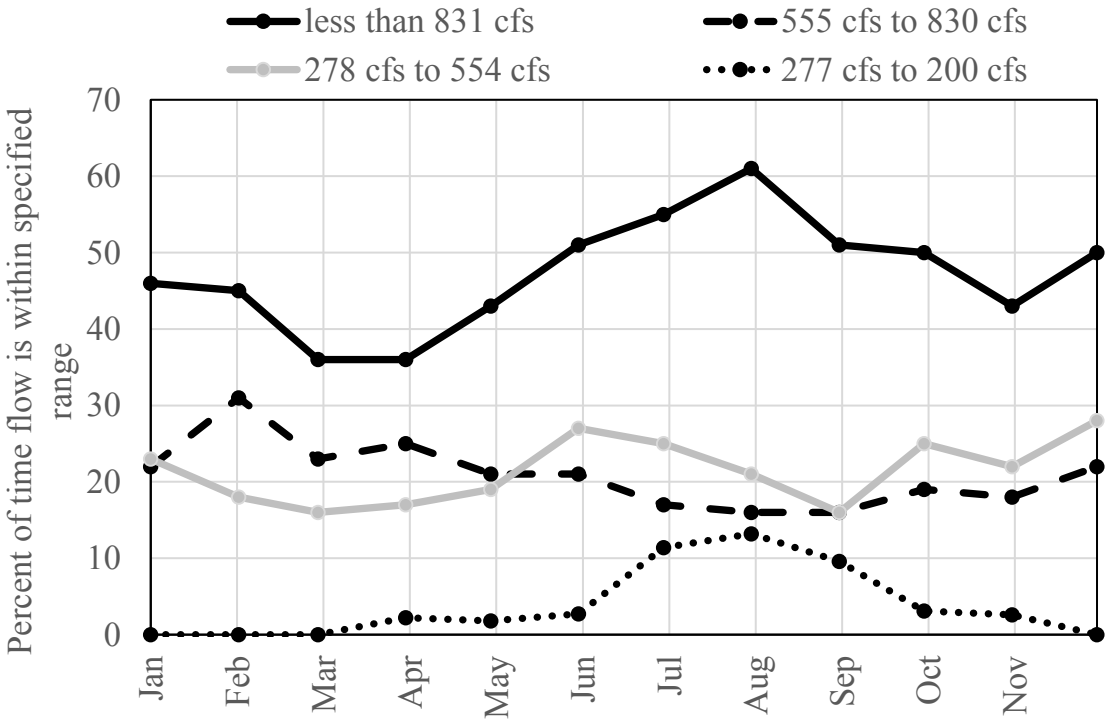

Figure 3-6. The percent of time that flow is in the specified ranges at the project based on data from 1997 to 2018 at USGS gauge 08173900 (Source: staff).

Downstream Water Quality

As discussed above in section 3.3.1.1, *Affected Environment*, *Water Quality*, during existing run-of-river operation, DO in the project tailrace was maintained at a level consistent with the state standard DO concentrations (see table 3-2) during an entire year with the exception of 2 days of minor deviations. The two deviations occurred on August 7, 2017 and September 26, 2017, when the average DO concentration was 0.06 mg/L and 0.14 mg/L, respectively, below the state standard daily average DO concentration of 5.0 mg/L or greater. With the exception of those two minor deviations, monitoring conducted by the City indicated that DO never dropped below the state

standard minimum DO concentration of 3.0 mg/L, or below the state standard DO concentrations for the spawning season (i.e., daily average concentration of 5.5 mg/L and a minimum of 4.5 mg/L, see table 3-2). Similarly, monitoring conducted downstream from the tailrace (1.2 miles downstream of the dam) also indicated that DO was maintained at a level consistent with the state standard during run-of-river operation. Monitoring conducted by the City also indicated that water temperature in and downstream from the tailrace was maintained below the 93°F state standard for river segment 1803 during run-of-river operation. These results indicate that continuing to operate in run-of-river mode at inflows between 830 cfs and 3,000 cfs would maintain DO and water temperature at levels that support the fish and mussels present (see *Impoundment Water Quality* above in this section for suitable water quality conditions for fish and mussels).

As discussed in section 3.3.2.1, *Affected Environment, Water Quantity*, under existing conditions, flows through the project can fluctuate by as much as 400 cfs in less than 24 hours because one or more developments upstream of the Gonzales Project operate in daily peaking mode year-round. Under the City's proposal, downstream flow fluctuations would be mediated by impoundment level fluctuations. Operating with impoundment level fluctuations would cause the downstream flow fluctuations to be more abrupt and increase in magnitude compared to existing conditions at the same inflow (figures 3-7 and 3-8).[58] Flows downstream also would be reduced to lower levels than those that occur under existing operations at the same inflow. The downstream flow reductions would occur when the impoundment surface elevation drops to a level of 1 foot below the dam crest and the automated system shuts down at least one generating unit to allow the impoundment to refill to the dam crest. Simulations of proposed project operation demonstrate that the proposed impoundment level fluctuations could cause flows downstream to be as much as 170 cfs lower than the lowest flows that would occur under existing run-of-river operation during the same time period (figure 3-8).[59] When the City is refilling the impoundment, reduced downstream flows are likely to result in reduced aeration and decreased DO compared to the flows that would occur under existing operation. When reduced flows and a decreased volume of water in the river

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[58] To identify how flows downstream of the dam would change during the City's proposed impoundment fluctuations, we simulated outflow from the project using Excel. Simulated outflow routines were based on proposed operation as described in table 2-1, a useable volume of 300 acre-feet, and inflow. Inflow was approximated using 15-minute interval data collected at USGS gauge number 08173900 (located about 1 mile downstream from the project).

[59] See the red highlighted regions of figure 3-8, which mark the areas of the graph when a generating unit would be shut down to allow the impoundment to increase to the crest of the dam.

channel occurs during the daytime, there would be increased solar heating that would cause water temperatures to increase above those that occurred immediately prior to generation curtailment. Warmer temperatures in turn decrease oxygen solubility in water, further lowering the DO concentration.[60]

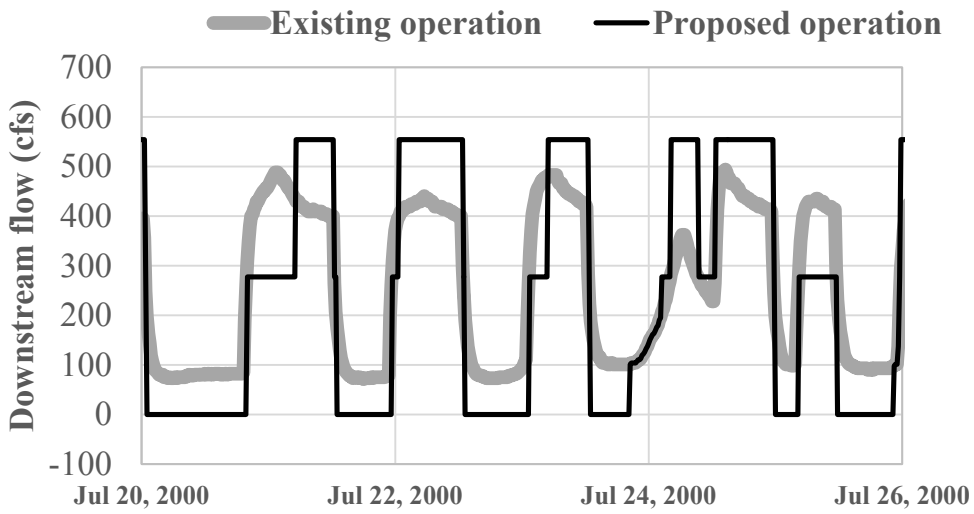

Figure 3-7. Downstream flows at the project under existing operation and simulated proposed operation when inflow is less than 555 cfs (Source: staff).

[60] Microorganisms consume oxygen during decomposition of organic matter. As water temperatures increase, microorganism activity increases resulting in increased decomposition and oxygen consumption.

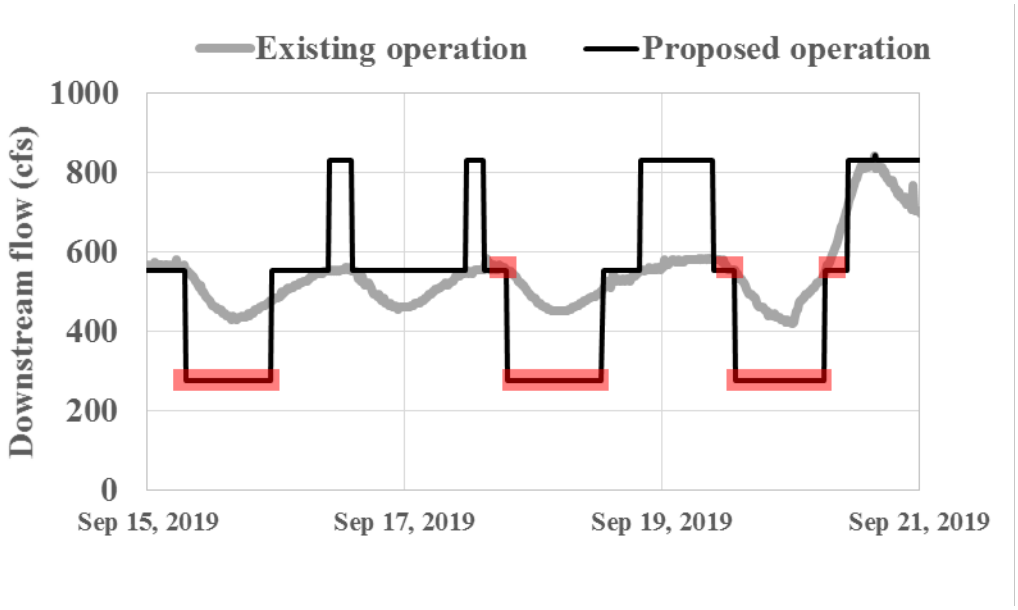

Figure 3-8. Downstream flows at the project under existing operation and simulated proposed impoundment fluctuations when inflow is greater than 277 cfs. Red highlights represent periods during proposed operation when the impoundment surface elevation would be lower than the crest of the dam and rising (Source: staff).

During the proposed operation, when inflows are between 555 cfs and 830 cfs, the City would reduce flows in the tailrace from 831 cfs to 554 cfs to allow the impoundment to refill to the crest of the dam. Under existing run-of-river conditions, flows currently drop to 554 cfs or less about 40 percent of the time annually.[61] Thus, under existing conditions, the biota present downstream of the project have experienced the water quality conditions provided by flows of 554 cfs. Data collected during the City's water quality monitoring indicate that during 11 days when flow was between 484 cfs and 554 cfs, the DO concentration only dropped slightly below 5.0 mg/L in the tailrace on one day (4.94 mg/L at 534 cfs), but never dropped below 5.0 mg/L downstream from the tailrace. Based on available information, reducing flows from 831 cfs to 554 cfs to allow the impoundment to refill would likely maintain the DO concentration near the 5.0 mg/L state standard and DO threshold that would protect fish and mussels (see discussion

[61] This estimate is based on data collected at 15 minute intervals from January 1, 2009 to December 1, 2018 at USGS gauge number 08173900. We also used this same data in our simulations to determine how the frequency of specific flows would change under the City's proposal to operate with impoundment fluctuations.

above in *Impoundment Water Quality* regarding DO and temperature requirements for fish and mussels), even during warm summer months.

When inflows are between 278 cfs and 554 cfs, the City proposes to reduce flows in the tailrace from 554 cfs to 277 cfs to allow the impoundment to refill. Under existing run-of-river operations, flows drop to less than or equal to 277 cfs about 12 percent of the time annually. Although flows did not drop to 277 cfs or less during the City's water quality monitoring, the existing water quality data indicate that DO has the potential to drop below 5.0 mg/L as flows decrease beyond the existing data set (i.e., the lowest flow represented in the data was 484 cfs; figure 3-9). Thus, under both existing run-of-river operation and proposed impoundment level fluctuations, DO may drop below 5.0 mg/L when flows are less than or equal to 277 cfs. However, when we simulate the City's proposed impoundment level fluctuations using the last 10 years of historical flow data,[62] our results indicate that flows less than or equal to 277 cfs would occur about 25 percent of the time, compared to only 12 percent of the time under existing run-of-river operation. Thus, during the City's proposed operations when inflows are between 278 and 554 cfs, DO has the potential to drop below 5.0 mg/L, and, based on our simulations, these low DO events would likely occur more frequently than under existing run-of-river operation.

An evaluation of several studies indicates that exposure to DO less than 5.0 mg/L, but greater than 3.0 mg/L often has non-lethal effects on non-salmonid fish species, such as behavioral avoidance, reduced growth, reduced reproduction, and reduced swimming performance (EPRI, 1990). As DO declines below 3.0 mg/L, the probability of fish mortality increases substantially (EPRI, 1990). Less research has been conducted on the DO requirements for freshwater mussels. It is known, however, that low DO can impair respiration, slow growth, reduce energy stores, and inhibit reproduction in mussels (Fuller, 1974). Further, one study conducted in the Southeastern U.S. (i.e., Flint River, Georgia), indicated that most mussel species had higher mortality when DO was less than 5.0 mg/L (Gagnon et al., 2004). Thus, the available evidence indicates that compared to existing run-of-river conditions, the City's proposal to release 277 cfs when refilling the impoundment could negatively affect the fish and mussels present downstream of the project by increasing the frequency of DO concentrations less than 5.0 mg/L.

The City also proposes to release no flow into the tailrace when inflow is less than 278 cfs and the City is refilling the impoundment during impoundment level fluctuations.

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[62] We simulated outflow from the project during the City's proposed operational fluctuations using Excel. Simulated outflow routines were based on proposed operation as described in table 2-1, a useable volume of 300 acre-feet, and inflow. Inflow was approximated using 15-minute interval data collected at USGS gauge 08173900 (located about 1 mile downstream from the project) from January 1, 2009 to December 31, 2018.

No flow conditions do not occur under existing operations, but based on our simulations, would occur about 4 percent of the time under the City's proposed operation. The absence of flow in and downstream from the tailrace would have an even greater negative impact than the reduced flows discussed above, because the absence of flowing water would lead to stagnation and additional loss of aeration, causing further declines in DO and increases in water temperature. Thus, the City's proposal to release no flow during impoundment refill when inflow is less than 278 cfs would likely cause DO to drop below 5.0 mg/L, especially during extended periods on warm summer days.

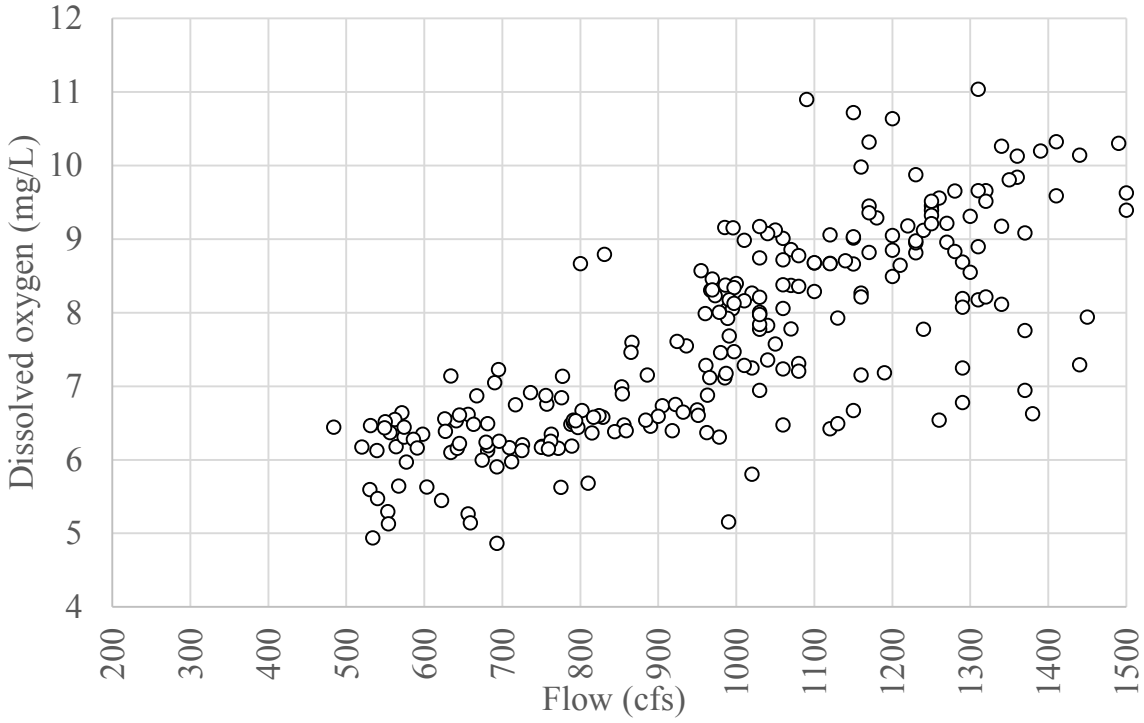

Figure 3-9. The relationship between DO measured by the City (2018) and flow (USGS gauge number 08173900) in the project tailrace from October 21, 2016 to October 21, 2017. DO at flows greater than 1,500 cfs are excluded for improved data display (Source: staff).

Downstream Aquatic Biota and Habitat

As discussed above, under existing run-of-river operation, daily fluctuations occur downstream of the project because of one or more upstream hydroelectric projects that operate in peaking mode year round. Unnaturally high flow fluctuations can result in the dewatering of habitat when water recedes and the scouring of habitat when high flows are released. These conditions can create unsuitable habitat for fish to spawn and mussels to survive (Turner et al., 1980; Watters, 1999). The City's proposal to continue operating the project in a run-of-river mode when inflows are greater than 830 cfs, would not change the existing fluctuations that pass through and occur downstream of the Gonzales

Project. Existing run-of-river operation currently supports the growth, reproduction, and survival of at least 18 species of fish, known to exist in the tailrace (see table 3-5), as well as one federal candidate freshwater mussel species (Texas pimpleback) that is present about 1.4 miles downstream of the project, and an additional 12 mussel species (including the state threatened, golden orb and false spike) that are present in habitats located 1.4 to 6.2 miles downstream of the project dam (see table 3-6). Thus, continuing to operate the project in run-of-river mode when inflows are greater than 830 cfs would continue to support the fish and mussels present downstream of the project.

The City's proposal to operate with impoundment level fluctuations between the dam crest and a level 1 foot below the crest of the dam when flows are between 200 cfs and 830 cfs would also result in fluctuations downstream. However, as discussed above, under proposed operation, there would be changes to the downstream fluctuations, which include an increase in the magnitude of the fluctuations, faster changes in downstream flow rates, and periods when flows downstream would be reduced to lower levels than occur under existing operations at the same inflow (see figures 3-7 and 3-8).

The downstream flow reductions that would occur during refill of the impoundment, in particular, have the potential to negatively affect fish and mussels downstream of the dam by degrading water quality, as discussed above, and reducing available habitat. Reduced flows and dewatering reduces the volume of habitat available, and could lead to increased water temperature and decreased DO. While most adult fish can successfully move to more suitable habitats when flow decreases, many juvenile fish are not as mobile as adults, and mussels are immobile most of the time. Thus, some fish and mussels could become stranded in off-channel habitats that become dewatered. These isolated off-channel habitats often expose fish to greater predation risk, lower DO, and higher water temperature, which can lead to stranding mortality (Nagrodski *et al*., 2012). Dewatered habitat could also expose mussels to heat, desiccating conditions, and predators. Even if aquatic biota do not become stranded, both fish and macroinvertebrates are more likely to be preyed on or stressed by the increased water temperatures and decreased DO levels that could occur during lower flow, especially during the summer.

Maintaining sufficient flow downstream of the project during times when the impoundment is refilling would help protect aquatic biota. The City is proposing to release 554 cfs, 277 cfs, or no flow, to maintain impoundment levels within 1 foot of the dam crest (table 2-1). To evaluate the effects of these proposed flow releases on downstream aquatic resources compared to existing conditions, we selected a subsample of days in the flow record at USGS gauge number 08173900 at inflows that would trigger impoundment level fluctuations under the City's proposal. To identify whether operating with impoundment level fluctuations would affect downstream aquatic resources differently compared to existing run-of-river operation, we used the Tennant Method, which is a desktop approach for evaluating habitat suitability based on flows. The

Tennant Method is based on the assumption that habitat suitability (i.e., suitable depths and water velocities) can be estimated by evaluating flow as a proportion of mean annual daily flow (MADF; see table 3-7) (Tennant, 1976).

Table 3-7. Minimum flows recommended by Tennant (1976).

	Percent of MADF[a]	
Description of flow	Dry season (July to December)	Wet season (January to June)
Outstanding	40	60
Excellent	30	50
Good	20	40
Fair or degrading	10	30
Poor or minimum	10	10
Severe degradation	0-10	0-10

[a] MADF is 1,703 cfs

To evaluate the downstream effects of operating with impoundment level fluctuations when inflows are between 555 cfs and 830 cfs, we selected the flow record from September 3, 2019 to September 6, 2019 (figure 3-10). During this period (under existing run-of-river operation), flows ranged from a low of 575 cfs to a high of 733 cfs. The lowest flow of 575 cfs represents 34 percent of MADF, and based on the Tennant Method would provide fair to good conditions during the wet season and excellent to outstanding conditions during the dry season. Our simulations of proposed operation with impoundment level fluctuations indicate that, during the same time period, flows downstream from the project would range from a low of 554 cfs to a high of 831 cfs (figure 3-10). The lowest flow of 554 cfs represents 33 percent of MADF, and based on the Tennant Method would provide similar conditions to those that occur under existing operations. Thus, the flow reductions caused by operating with impoundment level fluctuations when inflows are between 555 cfs and 830 cfs would provide fair to outstanding conditions, which are similar to those provided under existing run-of-river operation.

To evaluate the downstream effects of operating with impoundment level fluctuations when inflows are between 278 cfs and 554 cfs, we selected the flow record from September 17, 2019 to September 18, 2019 (figure 3-11). During this period, flows ranged from a low of 450 cfs to a high of 585 cfs. The lowest flow of 450 cfs represents 26 percent of MADF, and based on the Tennant Method would provide close to fair conditions during the wet season and close to excellent conditions during the dry season. Our simulations of proposed operation with impoundment level fluctuations indicate that during the same time period flows downstream from the project would range from a low of 277 cfs to a high of 831 cfs (figure 3-11). The lowest flow of 277 cfs represents

16 percent of MADF, and based on the Tennant Method would provide between poor and fair conditions during the wet season and between fair and good conditions during the dry season. These results indicate that when inflows are between 278 cfs and 554 cfs, operating with proposed impoundment fluctuations has the potential to reduce downstream flows to levels that are at least 170 cfs lower than under existing operation, and the reduced flows would provide less suitable conditions for aquatic resources compared to existing run-of-river operation.

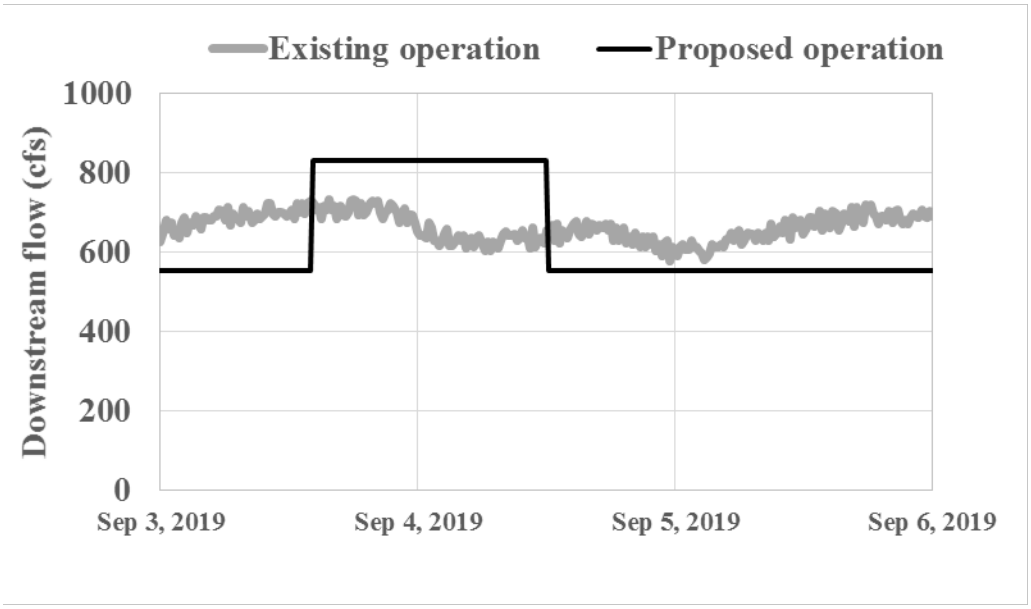

Figure 3-10. Downstream flows at the project under existing operation (i.e., USGS gauge number 08173900) and simulated proposed operation when inflow is in a range between 555 cfs and 830 cfs (Source: staff).

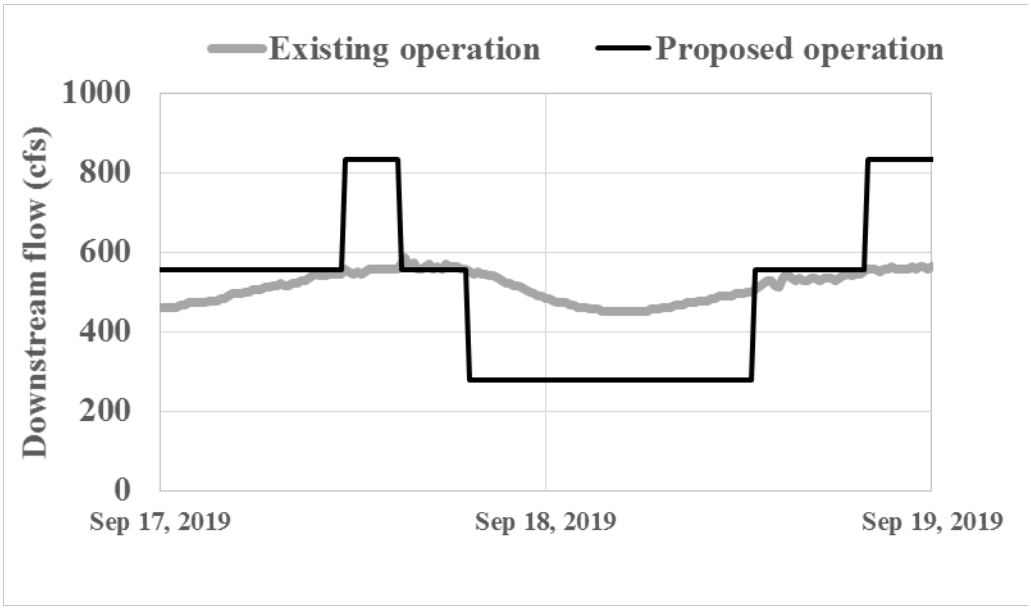

Figure 3-11. Downstream flows at the project under existing operation (i.e., USGS gauge number 08173900) and simulated proposed operation when inflow is in a range between 278 cfs and 554 cfs (Source: staff).

To evaluate the downstream effects of operating with impoundment level fluctuations when inflows are less than 278 cfs, we selected the flow record from September 22, 2000 to September 23, 2000 (figure 3-12). During this period, flows ranged from a low of 73 cfs to a high of 440 cfs. The lowest flow of 73 cfs represents 4 percent of MADF, and based on the Tennant Method would provide severely degraded conditions during the wet and dry season. Our simulations of proposed operation with impoundment fluctuations indicate that during the same time period, flows downstream from the project would range from a low of 0 cfs to a high of 554 cfs (figure 3-12). The lowest flow of 0 cfs represents 0 percent of MADF, and like 73 cfs during run-of-river operation, would provide severely degrading conditions downstream. Thus, based on the Tennant Method, when inflows are less than 278 cfs, the habitat conditions downstream could become severely degraded under existing and proposed operation. However, unlike the City's proposal to operate with impoundment fluctuations, existing run-of-river operation never leads to a complete loss of flow into the tailrace. As discussed above in the *Downstream Water Quality* subsection, the absence of flow downstream of the dam would cause dewatering of habitat, stagnation, and decreases in water quality that could have negative consequences for the fish and mussels present downstream of the project dam. Any fish present downstream of the dam would have the ability to move to areas with more suitable flows, DO, and temperature. However, mussels are less mobile and could experience suboptimal conditions that could lead to increased mortality, or decreased growth and reproduction. Further, reduced flows, such as those that occur during droughts, can prevent glochidia (i.e., the mussel's larval stage) from becoming

suspended in the water column, which could result in reproductive failure for mussels (M. Freeman, University of Georgia, personal communication, as cited in Golladay et al., 2004). Thus, the absence of flow downstream of the project would provide unsuitable habitat for aquatic biota, and poorer conditions than under existing run-of-river operation.

To summarize, based on our analysis above, the City's proposal to operate with impoundment level fluctuations when inflows are between 555 cfs and 830 cfs would provide continued good water quality and habitat both upstream and downstream of the project dam, which would provide conditions that support the fish and mussels present. However, our analysis also indicates that operating with impoundment level fluctuations at inflows between 554 cfs and 200 cfs would likely negatively affect water quality and aquatic habitat downstream compared to existing run-of-river operation at the same inflows. The negative effects of the proposed impoundment fluctuations would primarily be caused by reduced flows downstream compared to existing operations.

When inflows are between 278 cfs and 554 cfs, the City proposes to reduce flows in the tailrace from 554 cfs to 277 cfs to allow the impoundment to refill to the crest of the dam. Our analysis indicates that proposed operation would increase the frequency of flows less than or equal to 277 cfs from 12 percent under existing conditions to 25 percent, which could increase the frequency of low DO events (less than 5.0 mg/L). Based on the Tennant Method, the reduced flows caused by operating with fluctuations at inflows between 278 cfs and 554 cfs would also create less suitable habitat conditions compared to existing operation. When inflows are between 200 cfs and 278 cfs, the City proposes to reduce flows in the tailrace from 277 cfs to 0 cfs, to allow the surface elevation of the impoundment to increase to the crest of the dam. As indicated above, some flow always moves into the tailrace under existing operation, and causing no flow conditions to occur under proposed operation would increase stagnation, decrease DO, and increase the amount of dewatered habitat, which would negatively affect the fish and mussels located downstream from the project.

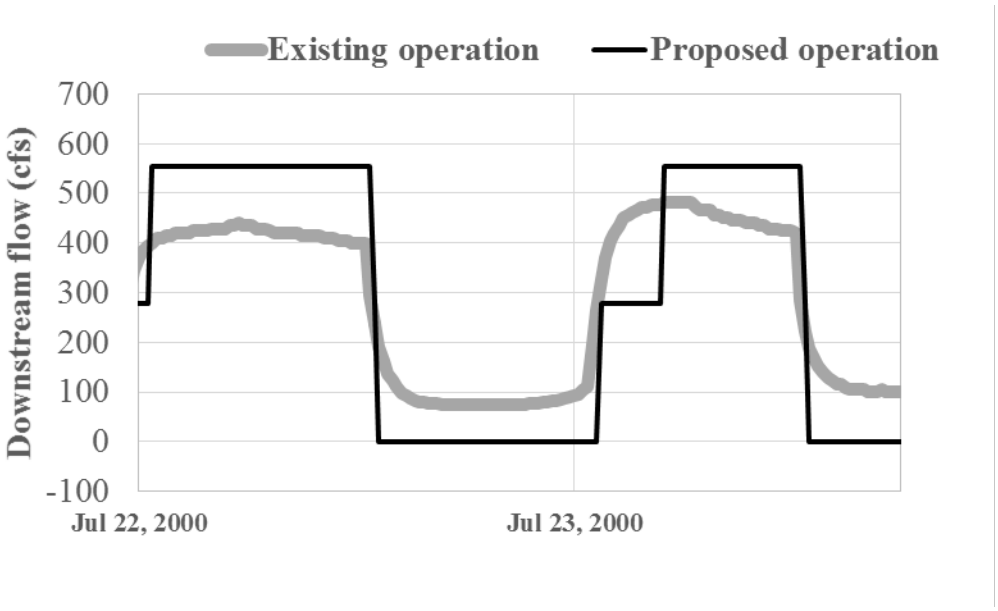

Figure 3-12. Downstream flows at the project under existing operation (i.e., USGS gauge number 08173900) and simulated proposed operation when inflow is less than 278 cfs (Source: staff).

Based on the analysis above, the existing run-of-river operation would be most protective of environmental resources. However, to provide some of the flexibility that the City seeks through its proposed operations, and to allow the City to better react to changing inflow caused by upstream hydropower projects, we have identified an alternative that would provide for the use of a 1 foot impoundment fluctuation for generation at inflows between 555 cfs and 830 cfs with run-of-river operation for remaining inflows. This operating regime would eliminate most of the negative effects of operating with impoundment level fluctuations at inflows less than 555 cfs, especially the effects of no flow downstream that could occur under the City's proposal while the reservoir is refilling and the project generating units are shut down. Under this alternative operating scenario, there could still be times when the project would only be

able to operate with one turbine and release 277 cfs.[63] However, as discussed above, flows less than or equal to 277 cfs already occur about 12 percent of the time annually under existing run-of-river operation. This alternative would cause flows less than or equal to 277 cfs to increase slightly to 18 percent of the time annually.[64] In contrast, under the City's proposed operation, flows less than or equal to 277 cfs would more than double in frequency to 25 percent of the time annually. Thus, this alternative operating regime (i.e., run-of river operation, except at inflows less than 831 cfs and greater than 554 cfs, when the project could be operated with impoundment fluctuations of up to 1 foot below the crest of the dam) represents a compromise that could increase the incidence of low DO events slightly compared to existing operation, but would reduce the incidence of low DO events compared to the City's proposed operation.

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[63] Operating under the alternative impoundment level fluctuations could still cause the project to operate with one turbine and release 277 cfs. This situation would occur if inflows are initially between 555 cfs and 830 cfs, and the impoundment surface elevation is below the crest of the dam. If inflows drop below 555 cfs while the surface elevation is still below the crest of the dam, the City would need to shut down one or two turbines and release 277 cfs to allow the impoundment to refill to the crest of the dam so that the project can spill and begin operating in run-of-river mode (See table 3-8). In theory, inflows could also drop below 278 cfs while the surface elevation is still below the crest of the dam. In this situation, the City would need to shut down all three turbines and release 0 cfs to allow the impoundment to refill to the crest of the dam so that the project can spill and begin operating in run-of-river mode. However, when we simulated project outflow under the alternative operation using data collected at USGS gauge 08173900 from January 1, 2009 to December 31, 2018, there was never a situation that caused the project to shut down all three turbines. Thus, if this type of event ever occurs, it would be extremely rare.

[64] Our estimates of the frequency occurrence of flows less than or equal to 277 cfs are based on simulated outflow during alternative operation. We simulated outflow from the project during the alternative operation using Excel. Simulated outflow routines were based on alternative operation as described in table 3-8, a useable volume of 300 acre-feet, and inflow. Inflow was approximated using 15-minute interval data collected at USGS gauge 08173900 (located about 1 mile downstream from the project) from January 1, 2009 to December 31, 2018.

Table 3-8. The number of turbine units operating and outflow released into the tailrace if the City were to operate under an alternative to their proposed mode at inflows between 200 cfs and 554 cfs (Source: staff).

Inflow	Project operation	Number of turbine units operating when impoundment elevation is falling	Powerhouse outflow released when impoundment elevation is falling	Number of turbine units operating when impoundment elevation is rising	Powerhouse outflow released when impoundment elevation is rising
less than 278 cfs	run-of-river	NA[a]	NA	NA	NA
278 to 554 cfs	run-of-river	NA	NA	1[b]	277 cfs
555 cfs to 830 cfs	impoundment fluctuation	3	831 cfs	2	554 cfs
greater than 830 cfs	run-of-river	NA	NA	NA	NA

[a] Not applicable

[b] When flows are between 555 cfs and 830 cfs, the impoundment can be less than full because of fluctuating operations. However, if the impoundment is less than full because of fluctuating operations and inflows drop below 555 cfs, then the impoundment would need to refill by releasing 277 cfs so that the project could spill and begin to operate in run-of-river mode.

Maintenance Drawdowns

The City proposes to implement maintenance-related drawdowns by lowering the impoundment up to 1 foot below the crest of the dam when needed for such maintenance activities as cleaning the trash racks or removing debris stuck behind the dam.

Our Analysis

The Gonzales Project impoundment may need to be drawn down periodically for scheduled or unscheduled maintenance. A 1 foot drawdown would allow removal of debris from the dam and trash racks more safely than when impoundment water levels are at or above the crest of the dam. Unlike the City's proposal for normal project operation, the City does not propose any inflow conditions or turbine operations under which the maintenance drawdowns would occur. However, given the maximum hydraulic capacity of the project, the number of turbines, and the individual turbine capacity, we assume that maintenance drawdowns would occur under the same inflow and turbine operation schedule as proposed for during operational impoundment level fluctuations (table 2-1).[65]

As discussed in detail in the *Project Operation* section above, the City's proposal to operate with impoundment level fluctuations has the potential to negatively affect water quality (in the impoundment and downstream) and aquatic habitat (downstream) when inflows are less than 555 cfs. Maintenance drawdowns could have similar effects. Conducting scheduled maintenance drawdowns when inflows are between 555 cfs and 830 cfs would provide water quality and habitat conditions in the impoundment and downstream of the dam that would support the fish and mussels present and minimize any negative effects to aquatic resources.

Operation Compliance Monitoring

Compliance measures help to minimize project effects on environmental resources by allowing the Commission to ensure that a licensee complies with the environmental requirements of a license. Operational compliance monitoring and reporting are typical requirements included in Commission-issued licenses to ensure the protection of resources during operation. The City proposes to continue monitoring compliance with project operation using an automated computer system that: (1) continuously monitors and records the water levels in the impoundment and tailwater using laser sensors; and

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[65] Given the maximum hydraulic capacity of 831 cfs and the absence of any other gates for releasing flows, drawdowns could only occur when flows at the project are less than 831 cfs, and would require the City to operate between one and three turbines to release flows. For refills to occur when inflow is less than 831 cfs, the City would have to shut down one or three turbines.

(2) shuts down generators and closes wicket gates when impoundment water levels approach 1 foot below the crest of the dam.

Our Analysis

The City proposes to continue operating the project in run-of-river mode at inflows between 831 cfs and 3,000 cfs, but would operate with impoundment fluctuations between the dam crest and a level 1 foot below the crest of the dam when flows are between 200 cfs and 830 cfs. However, the Gonzales Project has the capacity to store and release water more regularly, which could increase the frequency of water level fluctuations and habitat dewatering both upstream and downstream of the project, with negative effects to aquatic resources compared to a run-of-river operation. To maintain and document compliance with proposed operations, the City proposes to continue using an automated computer system capable of continuously monitoring and recording water levels in the impoundment and tailwater, and automatically shutting off the turbines if deviations occur. The automated turbine shut-off system would allow the City to ensure that the impoundment surface elevation is maintained at a level no less than 1 foot below the crest of the dam when operating the project with impoundment level fluctuations and during maintenance drawdowns. In addition, the continuous monitoring and recording of water levels upstream and downstream of the dam would verify that run-of-river operation is maintained throughout the term of the license, except when operating the project with impoundment level fluctuations and during maintenance drawdowns,.

Under the existing license, the City is not required to follow an operation compliance monitoring plan that formalizes the procedures used to verify run-of-river operation or impoundment level fluctuation limits. Formalizing the City's existing monitoring protocol in an operation compliance monitoring plan would help the City document compliance with the operational provisions of any new license issued. Proper documentation of compliance with project operation would include the collection of water level data as proposed and calibration of the monitoring system to ensure accurate data collection. Proper documentation of compliance would also include the reporting of any water level data, generation data, and deviations from run-of-river operation. Developing an operation compliance monitoring plan that includes the City's proposed monitoring protocol, as well as provisions for documenting and reporting data and deviations, would help facilitate administration of the license, and ensure the protection of resources in the impoundment and downstream.

Impingement, Entrainment, and Turbine Mortality

Water intake structures at hydropower projects can injure or kill fish that come into contact with intake screens/trash racks or turbines. Fish that have body widths greater than the clear spacing between the trash rack bars, and/or have burst swim

speeds[66] lower than approach velocities[67] or through-screen velocities[68] can become trapped against intake screens or bars of a trash rack. This process is known as impingement and can cause physical stress, suffocation, and death of some organisms (EPRI, 2003).

Entrainment into the intake structure occurs if fish are small enough to pass between trash rack bars, and they are unable to overcome the approach velocity, or if they choose to pass downstream through the trash rack. Even if fish are small enough to fit through trash rack bars, they are likely to behaviorally avoid entrainment if their burst swim speeds exceed the approach velocity in front of the trash racks (Knapp *et al.*, 1982). If entrainment occurs, fish injury or mortality can result from collisions with turbine blades, exposure to pressure changes, shear forces in turbulent flows,[69] or water velocity accelerations created by turbines (Rochester *et al*., 1984). The number of fish entrained and at risk of turbine mortality is dependent upon site-specific factors, including physical characteristics of the project (*e.g.*, head, approach velocity, turbine type, turbine speed, number of runner blades), as well as the size, age, and seasonal movement patterns of fish present within the impoundment (EPRI, 2003). Fish that are entrained and killed are removed from the river population and no longer available for recruitment to the fishery.

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[66] Burst swimming speed is the maximum swimming speed that can only be sustained for a few seconds. It is usually used to avoid predators, capture prey, or negotiate high flow (Beamish, 1978).

[67] Approach velocity is the calculated water flow velocity component perpendicular to the trash rack face and is the velocity experienced by a fish as it swims freely near the front of the trash rack (EPRI, 2000).

[68] Through-screen velocity represents the velocity of the water as it passes between the bars of a trash rack (EPRI, 2000). The through-screen velocity would be experienced only when a fish is right at the face of the trash rack or passing through the trash rack bars. Through-screen velocity is not likely to be as important a factor in whether a fish becomes impinged or entrained as approach velocity, but may relate to how difficult it is for a fish to remove itself from the trash rack once it is impinged (EPRI, 2000).

[69] Shear stress occurs when force acts parallel to a surface (Gordon *et al*., 2004). Shear stress can be experienced by a fish passing between two water masses of different velocities, or when a fish slides along a solid structure, such as a wall or turbine blade (commonly termed abrasion) (Neitzel *et al*., 2000).

The City proposes to continue to use two separate trash racks at the project under any new license issued. One trash rack is immediately in front of the powerhouse intakes (powerhouse trash rack; figure 3-13) and has 4.2-inch clear bar spacing, with estimated approach velocities and through-screen velocities of 1.57 feet per second (fps) and 1.68 fps, respectively.[70] A second trash rack is located upstream and nearly perpendicular to the powerhouse trash rack (lateral trash rack; figure 3-13) and has 5.6-inch clear bar spacing with estimated approach velocities and through-screen velocities of 1.30 fps and 1.37 fps, respectively. The City does not propose additional measures to reduce mortality related to fish entrainment or impingement. Texas PWD recommends that the City develop a stream mitigation plan in consultation with Texas PWD to mitigate for all impacts to aquatic resources.[71]

[70] Approach velocity and through-screen velocity calculations were included in BIO-WEST's (2018) entrainment study; however, they were based on a maximum hydraulic capacity of 1,161 cfs. On May 23, 2019, the City filed a revised exhibit A that indicates the maximum hydraulic capacity of the project is actually 831 cfs. The, approach velocities and through-screen velocities included in this analysis were recalculated by staff based on a hydraulic capacity of 831 cfs and the same intake areas provided in BIO-WEST (2018).

[71] In a letter filed on August 8, 2018, Texas PWD provided a list of recommendations for the Gonzales Project. Within that list, Texas PWD stated that if project-related activities cause mortality to fish and wildlife species, then the responsible party would be subject to investigation by the Texas PWD Kills and Spills Team and liable for the value of the lost resources under the authority of TPW (Texas Parks and Wildlife) Code Sections 12.001 1 (b) (1) and 12.301. Texas PWD also stated that TPW Code Section 1.011 grants Texas PWD authority to regulate and conserve aquatic animal life of public waters. Title 31, Chapter 57, Subchapter B, Section 57.157 of Texas Administrative Code (TAC) regulates take of mussels which are not limited to state-listed mussels. Section 12.301 of TPW Code identifies liability for wildlife taken in violation of TPW Code or a regulation adopted under TPW Code. These provisions are legal and administrative in nature and are not environmental measures. Accordingly, we do not analyze these provisions in the EA.

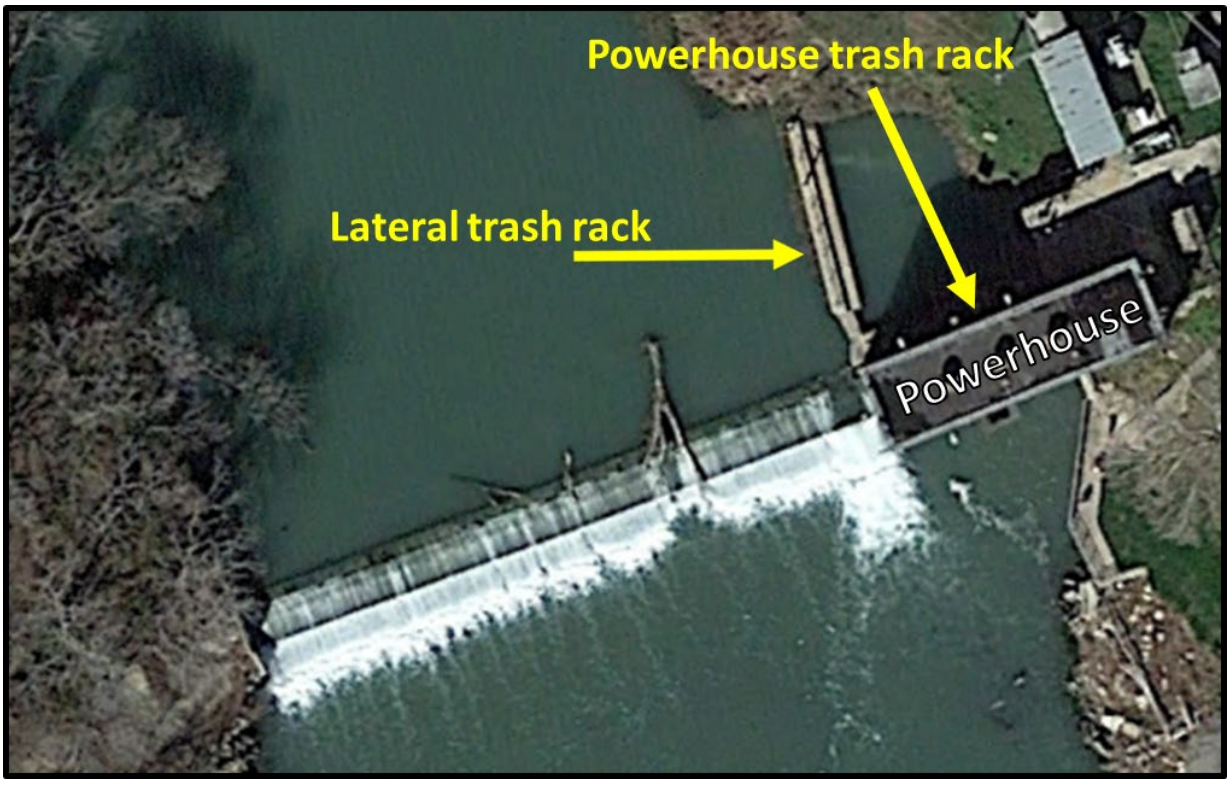

Figure 3-13. Location of project trash racks (Source: Google Earth, 2014; as modified by staff).

Our Analysis

To estimate the risk of impingement, we identified the most common fish species in the project impoundment based on electrofishing and gill net surveys (tables 3-3 and 3-4), and determined which species had body widths greater than the trash rack clear bar spacing (table 3-9) and swim speeds slower than the approach velocities and through-screen velocities at the trash racks (table 3-10). As indicated in table 3-9, none of the most common fish species have body widths greater than the 5.6-inch clear bar spacing at the lateral trash rack. Thus, no fish would be impinged at the lateral trash rack. However, smallmouth buffalo and channel catfish could grow to widths greater than the 4.2-inch clear bar spacing at the powerhouse intake. Nevertheless, the burst swim speeds of smallmouth buffalo and channel catfish exceed the approach velocity and through-screen velocity at the powerhouse intake, indicating that these species could swim to avoid impingement at the powerhouse trash rack. These results indicate there is little to no risk of impingement at the Gonzales Project.

Table 3-9. Minimum fish total lengths excluded by the powerhouse and lateral trash racks, for common or important species found in or near the Gonzales impoundment (Source: BIO-WEST, 2018; as modified by staff).

Species	Surrogate species	Scaling factor for body width	Maximum total length (inches)[a]	Minimum fish total length (inches) excluded by clear bar spacing of 4.2 inches at the powerhouse trash rack	Minimum fish total length (inches) excluded by clear bar spacing of 5.6 inches at the lateral trash rack
American eel	None	0.037	26[b]	NE[d]	NE
Spotted gar	None	0.08	30	NE	NE
Longnose gar	None	0.073	36	NE	NE
Gizzard shad	None	0.12	14	NE	NE
Red shiner	Common shiner	0.107	3[c]	NE	NE
Bullhead minnow	Bluntnose minnow	0.119	3.1[c]	NE	NE
Smallmouth buffalo	None	0.17	26	25	NE
Channel catfish	None	0.156	30	27	NE
Bluegill	None	0.132	7	NE	NE
Longear sunfish	Bluegill	0.132	7[c]	NE	NE
Spotted bass	Smallmouth bass	0.128	17[c]	NE	NE
Largemouth bass	None	0.134	14	NE	NE

[a] Maximum total lengths are based on measurements of fish collected in the project impoundment, unless otherwise noted (BIO-WEST, 2018).

[b] American eel total length is based on an estimate of the average length of the oldest females (i.e., length infinity in the von Bertalanffy age-length model) included in the American eel stock assessment (ASMFC, 2017).

[c] Source: Mettee et al. (1996).

[d] Fish that are NE (not excluded) do not grow to have body widths great enough to be impinged on the project trash racks.

Table 3-10. Burst swim speeds of common or important fish species present in or near the Gonzales impoundment (Source: staff).

Species	Surrogate species	Total length (inches)	Burst swim speed (fps)	Reference
American eel	none	24	2.5 - 4.3	Bell (1991)
	none	30	6.2[a]	Tudorache et al. (2015)
Spotted gar	Northern pike	24	3.1[a]	Jones et al. (1974)
Longnose gar	Northern pike	24	3.1[a]	Jones et al. (1974)
Gizzard shad	Alewife	2.5-3.0	3	Bell (1991)
		10.7 - 12.3	13.6 - 15.9	Dow (1962)[b]
Red shiner	Emerald shiner	2.4	4.0[a]	Bell (1991)
Bullhead minnow	Emerald shiner	2.4	4.0[a]	Bell (1991)
Smallmouth buffalo	Longnose sucker	4 - 16	4.0 - 8.0	Bell (1991)
Channel catfish	none	9	3.9	Venn Beecham et al. (2007)
Bluegill	none	2	1.8[a]	Beamish (1978)
		6	4.3	Webb (1998)
Longear sunfish	Bluegill	2	1.8[a]	Beamish (1978)
		6	4.3	Webb (1998)
Spotted bass	Largemouth bass	2-4	1.2 - 2.8[a]	Larimore and Deuver (1968)[b]
		5.9-10.6	3.0 - 4.3[a]	Beamish (1970)[b]
Largemouth bass	none	2-4	1.2 - 2.8[a]	Larimore and Deuver (1968)[b]
		5.9-10.6	3.0 - 4.3[a]	Beamish (1970)[b]

[a] Burst swim speed was estimated as 2 times the prolonged/critical swim speed (i.e., Bell, 1991).

[b] As cited in Beamish (1978).

In contrast, all species have the potential to be entrained through the lateral trash rack, and all species other than larger smallmouth buffalo and channel catfish have the potential to be entrained through the powerhouse trash rack. However, with the exception of juvenile largemouth bass and spotted bass, all other species in the impoundment have burst swim speeds that exceed the approach velocity and through-screen velocity at the lateral trash rack and powerhouse trash rack. Thus, based on a comparison of burst swim speeds to project intake characteristics (i.e., trash rack clear bar spacing, approach velocity, and through-screen velocity), the risk of entrainment into the powerhouse is low.

To quantitatively evaluate the effects of the project on entrainment and turbine mortality, BIO-WEST (2018) conducted a desktop study to estimate the rate of entrainment and turbine mortality, and we used the information to estimate the number of fish that could be entrained and suffer mortality during project operation. Based on the analysis, we estimate that 8,035 fish could be entrained at the project annually, with 2,971 fish killed[72] annually as they pass through the project (table 3-11). Most of the fish entrained would be small (less than 4 inches) to medium size fish (4 to 8 inches), which generally have higher survival than larger fish at developments that have smaller Francis-type turbines, like the Gonzales Project (EPRI, 1997; Franke et al., 1997). Lower mortality for smaller fish is in part caused by a lower probability of coming into contact with turbine parts compared to larger fish (Therrien and Bourgeois, 2000).

The analysis also indicated that gizzard shad represented about 95.2 percent of all turbine mortality at the project, with bluegill, redear sunfish, and bullhead minnow together representing 4.2 percent of the remaining number of fish killed annually. Other representative species such as red shiner, channel catfish, spotted bass, and largemouth bass, each represented less than 0.1 percent of the total number of fish killed annually at the project. The species mostly likely to suffer turbine mortality at the project (i.e., gizzard shad, bluegill, redear sunfish, bullhead minnow) also exhibit relatively high reproductive rates because of their ability to spawn early and often throughout their lifespan. High reproductive rates give these species' populations a natural mechanism to buffer against any instance (natural or man-made) of high mortality, which makes these species resilient to population declines.

We also estimated the number of adult American eels (silver eels) that might be killed at the project as they migrate downstream and pass through the turbines. Although no eels were collected in the project impoundment during the surveys conducted in 2016 and 2017 (see section 3.3.2.1, *Fishery Resources*), eels have been recently observed upstream of the project impoundment (GBRA and Texas PWD, 2014; Hendrickson *et al*.,

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[72] The mortality estimate is based on the number of fish killed within 48 hours of passing through the turbines.

2015), and if we assume they are still present upstream, they will eventually need to pass downstream of the Gonzales Project to migrate out to spawning grounds in the Sargasso Sea. Thus, to provide a maximum estimate of American eel mortality at the project, we assumed that they occur in the impoundment at the same abundance as the least abundant species collected by electrofishing during the 2016 and 2017 surveys.[73] Based on our analysis, one American eel would be entrained and no eels would be killed at the project annually as they pass through the turbines (table 3-11). Thus, project effects on downstream migrating eels would be minimal, and any effects on the overall American eel population would be even less.[74]

Based on the entrainment analyses above, there is no evidence to suggest that the estimated level of entrainment and turbine mortality would negatively affect the fish populations at the project. In part, this is because the burst swim speeds of the representative fish species exceed the approach velocities at the project. Further, the species most likely to suffer the highest entrainment mortality, as indicated by the desktop analysis (i.e., gizzard shad, bluegill, redear sunfish, bullhead minnow), exhibit relatively high reproductive rates, making them resilient to population declines. Consequently, continued operation of the project would likely have little to no adverse effect on the overall fish community in the Guadalupe River, and any benefits to mitigate the loss of a small number of fish subjected to turbine mortality would be minimal.

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[73] The least abundant species (e.g., yellow bullhead, Guadalupe bass, red ear sunfish) were observed to have a relative abundance of 0.2 fish caught per hour of electrofishing, and represented 0.07 percent of the total relative abundance of all fish caught in the reservoir (table 3-3). Thus, we conservatively assumed that American eel also represented 0.07 percent of the total relative abundance of all fish caught in the reservoir.

[74] Between 4.7 and 109 million silver eels are estimated to spawn in the Sargasso Sea annually (Shepard, 2015).

Table 3-11. Estimated annual entrainment and turbine mortality at the Gonzales Project (Source: staff).

Family	Common name	Surrogate species	Mean entrainment rate for all size classes (fish/r hour per 1,000 cfs of powerhouse capacity)[a]	Estimated annual entrainment[b] (number)	Estimated annual entrainment mortality[c] (number)	Estimated annual entrainment mortality (percent)
Anguillidae	American eel	None	0.1892	1	0	0.0
Lepisosteidae	Spotted gar	Longnose gar	0.0393	4	no data[d]	no data
	Longnose gar	None	0.0393	1	no data	no data
Clupeidae	Gizzard shad	None	23.6054	7,016	2,828	95.2
Cyprinidae	Red shiner	Spotfin shiner	0.0052	25	5	0.2
	Blacktail shiner	Spotfin shiner	0.0052	0	0	0.0
	Ghost shiner	Mimic shiner	0.1433	1	0	0.0
	Mimic shiner	None	0.1433	1	0	0.0
	Bullhead minnow	Fathead minnow	0.2013	122	24	0.8
Catostomidae	Smallmouth buffalo	None	0.0033	0	0	0.0
	Gray redhorse	Redhorse spp.	0.0784	1	0	0.0
Ictaluridae	Yellow bullhead	None	0.0825	0	0	0.0
	Blue catfish	Channel catfish	0.5568	3	0	0.0
	Channel catfish	None	0.5568	53	1	0.0
	Flathead catfish	None	0.0095	0	0	0.0
Fundulidae	Blackstripe topminnow	Banded killifish	0.0712	0	0	0.0
Poeciliidae	Western mosquitofish	Banded killifish	0.0712	10	2	0.1
	Sailfin molly	Banded killifish	0.0712	1	0	0.0
Centrarchidae	Green sunfish	None	0.0119	0	0	0.0

Family	Common name	Surrogate species	Mean entrainment rate for all size classes (fish/r hour per 1,000 cfs of powerhouse capacity)[a]	Estimated annual entrainment[b] (number)	Estimated annual entrainment mortality[c] (number)	Estimated annual entrainment mortality (percent)
	Warmouth	None	0.0681	2	0	0.0
	Bluegill	None	1.6226	560	75	2.5
	Longear sunfish	None	0.5745	207	28	0.9
	Redear sunfish	None	0.169	1	0	0.0
	Spotted bass	Largemouth bass	0.2893	15	4	0.1
	Guadalupe bass	Largemouth bass	0.2893	1	0	0.0
	Largemouth bass	None	0.2893	7	2	0.1
	White crappie	None	0.0358	1	0	0.0
Sciaenidae	Freshwater drum	None	0.1768	1	no data	no data
Total				8,035	2,971	100

[a] Data summarized from EPRI (1997).

[b] Annual entrainment for each species was calculated by the following equation: (mean entrainment rate) × (annual generation for an average water year) × (species percent composition based on electrofishing). Mean entrainment rate is listed in the table. Annual generation for an average water year was in units of 1,000 cfs-hours and was estimated to be 7,280 (1,000 cfs-hours). Annual generation for an average water year was calculated using the following equation: [(maximum hydraulic capacity) × (hours in a year)]/(1,000). Maximum hydraulic capacity of 831 cfs was used to estimate annual generation for an average water year because it was less than the mean flow at the project during each month (see table 3-1).

[c] Annual entrainment mortality was calculated by the following equation: (annual entrainment for each species) × (mean 48-hour mortality rate for each species). Mean 48-hour mortality is based on estimates from 30 hydroelectric projects with Francis-type turbines (EPRI, 1997).

Family	Common name	Surrogate species	Mean entrainment rate for all size classes (fish/r hour per 1,000 cfs of powerhouse capacity)[a]	Estimated annual entrainment[b] (number)	Estimated annual entrainment mortality[c] (number)	Estimated annual entrainment mortality (percent)

[d] Entrainment mortality rates for spotted gar, longnose gar, and freshwater drum were not available for developments having similar characteristics to the Gonzales Project.

American Eel Passage

Hydroelectric dams can impede both the upstream and downstream migration of eels, which can prevent yellow eels from potentially accessing more suitable feeding and growing habitats upstream, and prevent silver eels from migrating out to the Sargasso Sea to spawn. The Gonzales Project dam is the first barrier on the Guadalupe River and does not have upstream or downstream passage structures, and the City does not implement downstream passage operations (e.g., shut-downs). Thus, the Gonzales Project represents a potential impediment to upstream and downstream migration of American eels.

The City does not propose any fish passage measures. Texas PWD recommends that the City develop a stream mitigation plan in consultation with Texas PWD to mitigate for all impacts to aquatic resources.

Our Analysis

Few American eels are present upstream and downstream of the Gonzales Project. Surveys conducted by the City and Texas PWD indicate that the relative abundance of yellow eels is at most, 5.7 eels per hour immediately downstream of the project dam. In comparison, American eel abundance was nearly three times greater (relative abundance of 15.7 eels per hour) immediately downstream of the Toledo Bend Hydroelectric Project (FERC Project No. 2305), which is the first dam located on the Sabine River along the Texas-Louisiana border (BIO-WEST, 2011).[75] Along the East Coast of the U.S., eels are in even greater abundance (Shepard, 2015), and in unimpeded sections of rivers can have relative abundances exceeding 80 eels per hour (e.g., Potomac River; Goodwin and Angermeier, 2003).

In the project impoundment, BIO-WEST (2018) found no eels during the 2016 and 2017 surveys that included setting six eel pots during four nights and conducting 5.25 hours of boat electrofishing. Although American eels are known to be present upstream of the Gonzales Project boundary, and have been documented as recently as 2017 in the San Marcos River (see section 3.3.1.1, *Fishery Resources*), documented occurrences are rare.

Young American eels have the ability to pass upstream of dams by climbing wetted surfaces at leakage locations and dam abutments (Shepard, 2015), and potentially by swimming over dams during high flows. The presence of American eels upstream of the project dam indicates that some upstream passage is occurring at the project. However, collection of young eels immediately downstream of the dam, combined with

[75] The Sabine River enters the Gulf of Mexico about 200 miles northeast of where the Guadalupe River enters the Gulf of Mexico.

the absence of eels in the project impoundment indicates that the project dam may be impeding upstream passage.

Silver eels migrating downstream have the ability to pass over spillways, or through the turbines at hydroelectric facilities that lack specific measures for downstream passage. Silver eels generally migrate downstream during late summer and fall (e.g., August through October) (Shepard, 2015). During this outmigration period, flows at the project exceed the maximum hydraulic capacity (831 cfs) and water passes over the spillway about 46 percent of the time. Thus, eels could pass over the spillway almost 50 percent of the time during the outmigration season. Nevertheless, eels tend to be more attracted to deeper passage routes if they are available (Durif et al., 2003). At the Gonzales Project, the deeper passage route would be through the turbines, which as discussed above, could lead to mortality.

Despite indications that the Gonzales Project may impede the upstream and downstream migration of American eels, the current abundance and historical occurrence indicate that providing upstream or downstream passage would have limited benefits at this time. Eel densities are generally low in rivers along the Gulf Coast of the U.S. compared to the East Coast (Shepard, 2015). In Texas, the current distribution and abundance of eels in rivers is not well documented, but the common perception is that American eels are rare in Texas (Shepard, 2015). There also is no evidence that eels were ever abundant in the Guadalupe River, or that habitats upstream of the dam were ever widely used or necessary for eels to complete their life-cycle. Further, there are over 160 miles of fresh and brackish water habitat downstream of the project in the mainstem of the Guadalupe River alone, where juvenile eels could grow and mature into silver eels. The low abundance of eels downstream of the dam also suggests that habitats in the lower Guadalupe River may be underutilized.

Together, the information above indicates that American eels are not abundant anywhere in the Guadalupe River, habitats upstream of the project have unknown and potentially no unique value to the life-history of eels that occupy the river, and the Guadalupe River from the Gulf of Mexico upstream to the project dam provides suitable, unimpeded, and potentially underutilized habitat for eels. Thus, currently there is no identifiable benefit to providing upstream or downstream passage at the project.

River Shrimp Passage

Like American eels discussed above, river shrimp must migrate between freshwater and brackish/salt water to complete their life-cycle. Hydroelectric dams can impede these migrations and reduce the potential for larvae to drift downstream to brackish/salt water, or reduce the ability for juveniles to migrate upstream to freshwater habitats where they mature into adults. Thus, dams can potentially prevent river shrimp from completing their life-cycle.

The City does not propose any measures related to river shrimp. Texas PWD recommends that the City develop a stream mitigation plan in consultation with Texas PWD to mitigate for all impacts to aquatic resources.

Our Analysis

Although river shrimp historically occurred in the Guadalupe River, the importance of habitat upstream the Gonzales Project is not known. The most recent documented surveys in the Guadalupe River occurred between 1971 and 1974, and indicate that one species of river shrimp was observed upstream of the Gonzales Project and four species were observed downstream. We are unaware of any recent surveys to document the current presence and/or distribution of river shrimp in the Guadalupe River, but we assume they still occur in the Guadalupe River. If river shrimp are present, larvae produced upstream of the project may become entrained behind the project dam as they drift downstream (Bowles et al., 2000), and juveniles migrating upstream may be impeded from moving further into the basin.

Despite the potential for the Gonzales Project to impede the migrations of river shrimp, passage may still occur. For example, at the Gonzales Project, flows exceed the hydraulic capacity of the project and spill over the dam 57 percent of the time during the spring, when larvae are likely drifting downstream.[76] The high probability for the project to spill during the spring likely reduces the potential for any downstream drifting larvae to become entrained behind the dam. Juveniles may also be able to migrate upstream of dams by crawling during low flow (Benstead et al., 1999). Horne and Beisser (1977) observed *M. carcinus* to be present from the mouth of the Guadalupe River to the headwaters of the San Marcos River, indicating this larger species[77] is capable of moving upstream of the Gonzales Project dam. The other three smaller species of river shrimp found in the Guadalupe River have not been observed upstream of the Gonzales Project, and may not be able to migrate past the dam (Horne and Beisser, 1977). However, passage upstream of the project may be unnecessary for all four species, because habitats downstream of the project have the freshwater needed for adults, as well as unimpeded passage for larvae to drift to brackish water where they develop into juveniles and

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[76] Information is limited on the period of larval drift for *Macrobrachium* species in the Guadalupe River, but based on studies conducted in the Atchafalaya River, Louisiana, larvae are likely drifting downstream from late April to June (Bauer and Delahoussaye, 2008, Rome et al., 2009).

[77] *M. carcinus* is the largest (up to 5.9 inches long) of the *Macrobrachium* species found in North America (Hedgpeth, 1949). *M. acanthurus*, *M. olfersii*, and *M. ohione* can reach lengths of 5.9 inches, 3.5 inches, and 3.9 inches, respectively.

subsequently migrate back upstream to freshwater. Thus, river shrimp may be able to complete their life-cycle without ever migrating upstream of the project dam.

Based on the information above, there is no identifiable benefit to providing upstream or downstream passage for river shrimp because: (1) habitats upstream of the project have unknown importance to the river shrimp species that may still occur in the Guadalupe River; (2) at least one species may be able to migrate upstream and downstream of the project; and (3) all species may have the potential to complete their life-cycle downstream of the project without the need to pass upstream.

3.3.2.3 Cumulative Effects on Aquatic Resources

During the 19th Century, several dams were constructed in the Guadalupe River Basin to provide power to saw mills, gristmills, cotton gins, water pumps, and electric light plants (Taylor, 1904). Today, the Gonzales Project dam is among eight dams on the mainstem of the Guadalupe River that were constructed during the 20th Century for hydropower, and in some cases for flood control, irrigation, or recreation, as well. There are also several low-head dams currently located on the San Marcos River. The Gonzales Project dam is the first dam on the mainstem of the Guadalupe River.

The construction of dams in the Guadalupe River Basin during the last 200 years converted a once free-flowing system into a series of impoundments, resulting in decreased flow and increased water depth, which in turn likely led to some lowering of DO and increases in water temperature. Installing hydropower turbines also likely resulted in some fish mortality, and dam structures impeded the migrations of American eels and river shrimp. Today, the Gonzales Project, in combination with the other hydropower and non-hydropower dams that still exist in the Guadalupe River Basin, cumulatively affects water quantity, water quality, downstream aquatic habitat, fish mortality, and passage of American eels and river shrimp.

As discussed in sections above, the City proposes to continue operating the project in a run-of-river mode at inflows between 831 cfs and 3,000 cfs, but would operate with impoundment level fluctuations between the dam crest and a level 1 foot below the crest of the dam when flows are between 200 cfs and 830 cfs. Operating with impoundment level fluctuations at inflows between 200 cfs and 554 cfs, as proposed, would likely cause DO concentrations to fall below the state standard of 5.0 mg/L downstream of the dam, which could negatively affect fish and mussels present, and contribute to negative cumulative effects on water quality in the Guadalupe River. However, if the City were to operate the project in an alternative mode, such that impoundment fluctuations only occur when inflows are greater than 554 cfs and less than 831 cfs, then project operation would minimize water quality degradation, protect aquatic biota downstream of the project, and contribute minimally to cumulative effects on water quality in the Guadalupe River.

As discussed in section 3.3.2.2, *Project Operation*, under existing run-of-river operation, daily flow fluctuations occur at the Gonzales Project because of one or more upstream hydroelectric projects that operate in peaking mode year round. These existing conditions provide water quality and habitat conditions that support the fish and mussels present near the project. Maintaining run-of-river operation would contribute minimally to cumulative effects on aquatic habitat and biota in the Guadalupe River, whereas the City's proposal to operate with impoundment level fluctuations would increase the frequency of flows less than or equal to 277 cfs downstream of the project and create less suitable habitat conditions. The City's proposed impoundment level fluctuations would also allow no flow conditions to occur downstream of the project, creating severely degraded habitat conditions for fish and mussels. Thus, operating the project with the City's proposed impoundment level fluctuations would contribute to adverse cumulative effects in the Guadalupe River. However, if the City were to operate the project such that impoundment level fluctuations only are instituted when inflows are greater than 554 cfs and less than 831 cfs, then project operation would maintain habitat capable of supporting the fish and mussels present downstream, and thereby contribute minimally to cumulative effects.

As discussed in section 3.1, *General Description of the River Basin*, it is reasonably foreseeable that GBRA, the owner of the seven upstream hydropower developments, may modify its operation at the six, non-jurisdictional hydropower facilities upstream from the Gonzales Project. The flow regime in the river indicates that one or more of these upstream hydroelectric projects operates in a daily peaking mode year-round, causing inflow to, and outflow from the Gonzales Project to be variable throughout the day (e.g., see figure 3-1). If these peaking operations continue through the term of any new license issued for the Gonzales Project, then our conclusions regarding the cumulative effects of project operation in the paragraphs above remain unchanged. However, modifications to the GBRA hydropower developments could result in termination of peaking operations at one or more of the upstream projects. If upstream peaking operations were to cease, operating with impoundment level fluctuations at the Gonzales Project could be of less utility. If incoming flow fluctuations were to end, it might be most efficient for the City to operate the project again in run-of-river mode at all times. In such a case, the cumulative effects of run-of-river operation at all flows on aquatic species would be less than that any of the other alternatives under consideration.

Cumulative effects occur from multiple dams within the river basin and include injuries and mortality from turbine passage. Most of the species likely to suffer turbine mortality (i.e., gizzard shad, bluegill, redear sunfish, bullhead minnow) at the Gonzales Project exhibit relatively high reproductive rates, making them resilient to population declines. In addition, American eels, which generally exhibit higher mortality than other species, are rare in the Guadalupe River and were not observed in the Gonzales Project impoundment during recent surveys. Thus, the project's contribution to cumulative effects on fish mortality in the Guadalupe River would be minimal.

The cumulative effects of multiple dams in the river basin also include impeded upstream and downstream passage for American eels and river shrimp. However, eels are not currently abundant and there is no evidence they were ever abundant in the Guadalupe River. Further, the habitat types (i.e., freshwater, brackish, marine) needed to complete the life cycle of American eels and river shrimp are present downstream of the project without impediments to passage. Therefore, the project's contribution to cumulative effects on American eel and river shrimp migrations would minimally affect these species.

3.3.3 Terrestrial Resources

3.3.3.1 Affected Environment

The majority of Gonzales County, where the project is located, is classified in the Post Oak Savannah Ecoregion, a transition zone between the Blackland Prairies to the west, and the Pineywoods to the east, with elevations ranging from 300 to 800 feet above sea level (TAMFS, 2019). Forested areas in the western region of the Post Oak Savannah shift to bottomland habitat adjacent to streams and rivers in the region. Vegetation in this ecoregion is dominated by native bunch grasses and non-woody flowering plants with scattered post oak, live oak, black hickory and blackjack oak trees; however, fire suppression has led to the establishment of eastern red cedar, mixed hard woods, and a thick yaupon holly understory in most areas. Pasture grasses (bluestem, bermuda, and bahia grasses) have also been established for grazing to support the raising of cattle (TAMFS, 2019). Riparian areas along the Guadalupe River are characterized by forested wetlands at lower elevations and riparian forests at higher elevations. Lower wetland areas are often dominated by black willow, and box elder, along with bald cypress.

The project area and immediate project vicinity contains a mix of managed areas and natural communities. The project boundary includes a meandering, riverine-shaped impoundment upstream of the dam. The impoundment is surrounded by 14.4 miles of vegetated buffer varying in width, consisting of scrub/shrub, riparian wetland and forest habitat, surrounded by pasture and agricultural lands (see figure 1-1). Riparian forest border the majority of the river channel, with tree roots and fallen limbs along the impoundment edges providing most of the instream cover. The City also maintains a portion of the 0.59-acre area along the east bank of the river as grass lawn, which includes the area around the powerhouse and kayak dock. The City does not actively manage vegetation along the west bank of the Guadalupe River, nor does it anticipate any

need to disturb or remove vegetation along the west bank for purposes of continued operation and maintenance of the project.[78]

Wetlands, Riparian and Littoral Areas

National Wetlands Inventory (NWI) data for the area indicate a lack of wetlands within the project boundary, and only a few small palustrine[79] wetlands adjacent to the impoundment and downstream of the dam.[80] We are unaware of any recent wetland maps that include the Gonzales Project area. Approximately 300 surface acres of aquatic impoundment habitat occur within the project boundary. Aquatic habitat within the impoundment consists of a wetted channel approximately 100 to 150 feet in width with steeply sloping banks and occasional piles of woody debris. Depths generally range from 4 to 15 feet, with little shallow water present due to the steeply sloping banks.

The City's habitat and botanical surveys identified distinct woody riparian communities, dominated by various riparian tree species, herbaceous riparian communities dominated by grasses and low-growing herbaceous species, and a littoral community dominated by aquatic plants and sedges in the project boundary (BIO-WEST, 2017b and 2017c). Species tolerant of wet and drier moisture regimes (Facultative) were prevalent in the project area, with a few moisture-preferring species (Obligate Wetland), located closer to the river's edge and species requiring drier conditions (Obligate Upland) persisting farther up slope. Table 3-12 provides a comprehensive list of plant species observed during the botanical surveys and their wetland indicator status.

Woody riparian communities in the project area are located along the steep slopes and other unmowed areas, and support both mature and sapling trees including green ash, box elder, sandpaper tree and pecan, as well as a diverse community of woody shrubs, vines, and herbaceous plants (table 3-12). Herbaceous riparian areas in the 0.59 acre terrestrial habitat within the project boundary are frequently mowed and mainly consist of coastal bermuda grass and short broadleaf herbs, such as horseherb and spreading

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[78] Applicant Response to Request for Additional Information Memo filed November 16, 2018.

[79] Non-tidal wetlands dominated by trees, shrubs, emergent plants, mosses or lichens.

[80] NWI data for the project area are from the 2000's. U.S Fish and Wildlife, *National Wetlands Inventory*, https://fwsprimary.wim.usgs.gov/wetlands/apps/wetlands-mapper/ (last visited Sept. 6, 2019).

fanpetals. No state- or federally-listed plant species were observed within the botanical survey area. The Texas PWD Rare, Threatened, and Endangered Species Database[81] identified 15 plant Species of Greatest Conservation Need that potentially occur in Gonzales County. These plant species do not have an official listing status, but are considered to be declining or rare and in need of attention to recover or prevent the need for listing under state or federal regulations. No Species of Greatest Conservation Need were identified in the project survey area.

The littoral community identified during the habitat surveys is located along a narrow stretch of eroding riverbank upstream of the dam in the vicinity of the kayak dock (figure 3-14). It is a periodically-inundated flat shelf near the water's surface dominated by non-native alligatorweed, a highly invasive species, as well as creeping water primrose and emory sedge both native species. Littoral areas downstream of the powerhouse are covered in rip-rap to prevent erosion and contain little vegetation.

[81] Texas Parks and Wildlife, *Department's Rare, Threatened, and Endangered Species Database*, http://tpwd.texas.gov/gis/rtest/http://tpwd.texas.gov/gis/rtest/ (last visited Sept. 6, 2019).

Table 3-12. Plant species identified during botanical surveys and their wetland indicator status (Source: BIO-WEST, 2017c; as modified by staff).

Vegetation Type	Common Name	Scientific Name	Native (N) /Introduced (I)	Wetland Indicator Status
Trees				
	Green Ash	*Fraxinus pennslyvanica*	N	FAC
	Box Elder	*Acer negundo*	N	FAC
	Japanese Ligustrum	*Ligustrum lucidum*	I	FACU
	Chinaberry	*Melia azedarach*	I	FACU
	Hackberry	*Celtis laevigata*	N	FACU
	Pecan	*Carya illinoensis*	N	FAC
	Sandpaper Tree	*Ehretia anacua*	N	UPL
	American Elm	*Ulmus amercicana*	N	FAC
	Soapberry	*Sapindus drummondii*	N	FACU
	Huisache	*Acacia farnesiana*	N	UPL
	Gum Bumelia	*Sideroxylon lanuginosum*	N	FAC
	Sycamore	*Platanus occidentalis*	N	FAC
Grasses				
	Bermuda Grass	*Cynodon datylodon*	I	FACU
	Johnson Grass	*Sorghum halepense*	I	FACU
	Canadian Wildrye	*Elymus virginicus*	N	FAC
	unknown Panicgrass	*Panicum sp.*		
	Rescue Grass	*Bromus catharticus*	I	UPL
Herbaceous				
	Giant Ragweed	*Ambrosia trifida*	N	FAC
	Spreading Fanpetals	*Sida abutifolia*	N	UPL
	Horseherb	*Calyptocarpus vialis*	N	FAC
	Yerba de Tago	*Eclipta prostrata*	N	FACW
	Sweetscent	*Pluchea camphorata*	N	FACW
	Climbing Hempvine	*Mikania scandens*	N	FACW

Vegetation Type	Common Name	Scientific Name	Native (N) /Introduced (I)	Wetland Indicator Status
	Wood Sorrell	*Oxalis dillenii*	N	FACU
	Common Sunflower	*Helianthus annuus*	N	FACU
	Creeping Water Primrose	*Ludwigia peploides*	N	OBL
	Curly Dock	*Rumex sp.*	I	FAC
	Smartweed	*Persicaria sp.*	N	OBL
	Silverleafed Nightshade	*Solanum eleagnifolium*	N	UPL
	Bastard Cabbage	*Rapistrum rugosum*	I	UPL
	Pink Evening Primrose	*Oenothera speciosa*	N	UPL
	Black-eyed Susan	*Rudbeckia hirta*	N	UPL
Vines				
	Green Briar	*Smilax sp.*	N	FACU
	Japanese Honeysuckle	*Lonicera japonica*	I	UPL
	Mustang Grape	*Vitis mustangensis*	N	UPL
	Poison Ivy	*Toxicodendron radicans*	N	FAC
	Dewberry	*Rubus trivialis*	N	FACU
	Purple Clematis	*Clematis pitcheri*	N	FACU
	Virginia Creeper	*Parthenocissus quinquefolia*	N	FACU
	Carolina Snailseed	*Cocculus carolinus*	N	FACU
Littoral				
	Alligator Weed	*Alternanthera philoxeroides*	I	OBL
	Frogfruit	*Phyla nodiflora*	N	FAC
	Emory Sedge	*Carex emoryi*	N	OBL

(State of Texas 2016 Wetland Plant List, USACE). N = native; I = introduced; OBL = Obligate Wetland; FACW = Facultative Wetland; FAC = Facultative; FACU = Facultative Upland; UPL= Obligate Upland

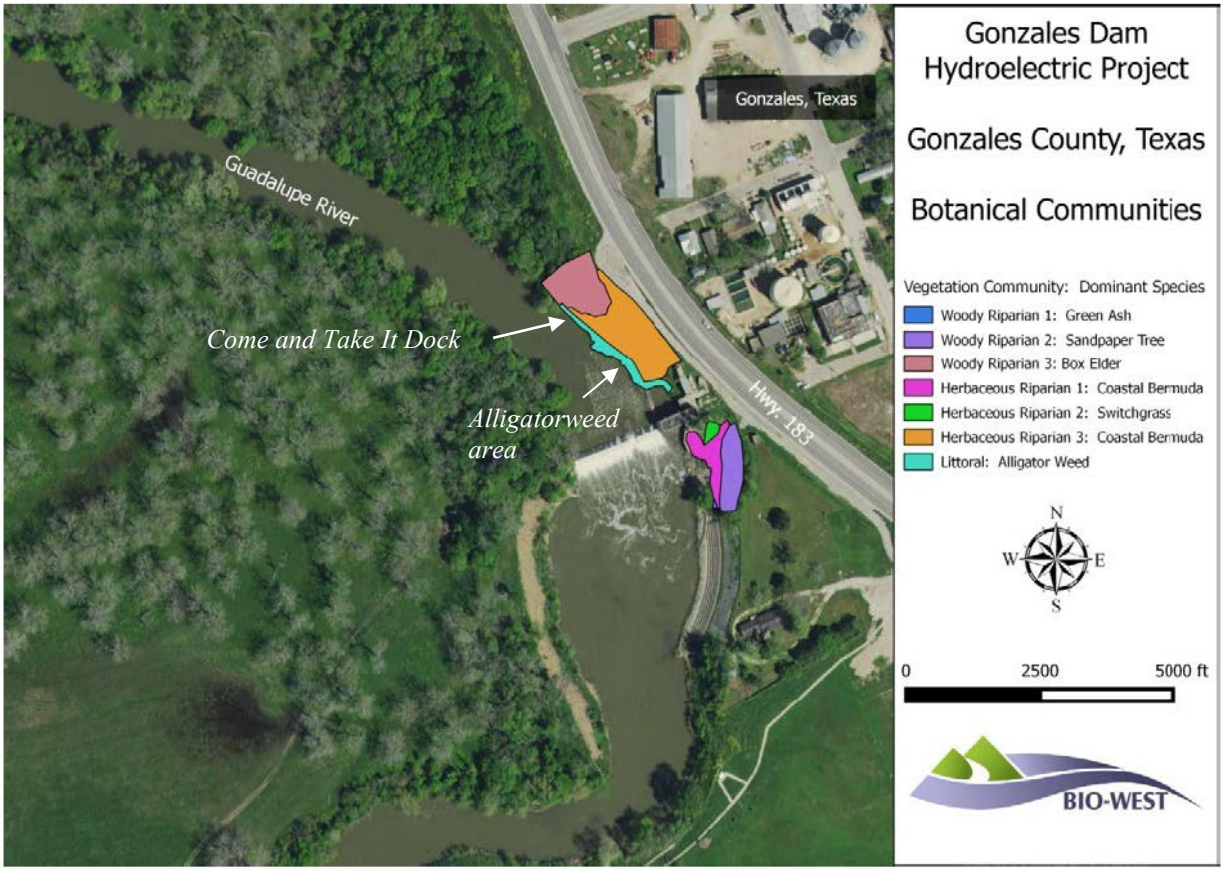

Figure 3-14. Map showing extent of alligatorweed identified within the Gonzales Project area in the vicinity of the "Come and Take It" kayak dock (Source: BIO-WEST, 2017c; as modified by staff).

Non-native Invasive Vegetation

There are 12 prevalent invasive species in the Post Oak Savannah ecoregion (TIPPC, 2019). A variety of these non-native plant species were documented during the botanical surveys in the terrestrial habitat in the project boundary (table 3-12). Two non-native species, Japanese ligustrum and chinaberry trees were common, but not dominate in the project's riparian area surveyed. These species often occur in riparian areas of central Texas, particularly near urban areas and towns. Non-native coastal bermuda grass was dominant within the mowed herbaceous communities in the terrestrial habitat surveyed, and is common in lawn areas as well as cattle and hay pastures throughout the region.

As discussed above, alligatorweed was identified in a littoral area upstream of the dam (BIO-WEST 2017c; figure 3-14). Alligatorweed is an emergent perennial plant

native to South America (USDA, 2019b) and is listed as a noxious weed[82] in Texas. This species can grow in upland sites, but prefers saturated soils along shorelines of lakes, ponds, streams, ditches, and wetlands. It spreads from fragments and by seeds dispersed by water, wildlife, and people. Alligatorweed forms dense mats that grow into open water habitats, shading out native plant species and reducing DO in the water under the mat which, in turn, decreases the quality of the habitat for fish and wildlife. Mats of alligatorweed can also inhibit navigation and recreational use (FWS, 2018).

Wildlife

Terrestrial wildlife habitat within the project boundary is limited to the 0.59 acre area around the powerhouse, and wildlife observations were focused in this area. However, a variety of avian, reptile, and amphibian species were documented in both the terrestrial portions of the project area and the aquatic habitat of the impoundment (figure 3-15, BIO-WEST 2017a). A total of 14 amphibian and reptile (herpetofauna) species were observed within the project area during surveys including: three species of turtles (Texas spiny softshell, Texas river cooter, and Cagle's map turtle); four species of lizard (little brown skink, green anole, Texas spiny lizard, and Texas spotted whiptail); four species of snake (blotched watersnake, Texas ratsnake, banded watersnake, and western cottonmouth); and, three frogs species (green tree frog, southern leopard frog, and Blanchard's cricket frog). The southern leopard frog, and Blanchard's cricket frog were documented in the littoral area habitat upstream of the dam.

Thirty-four bird species were observed in the project area during surveys (table 3-13). Birds were documented flying overhead, in riparian areas along the edge of the impoundment, and several species were observed foraging in the impoundment such as wood duck, blue-winged teal, green heron, great blue heron, and the green kingfisher.

[82] A noxious weed is defined as any plant or plant product that can directly or indirectly injure or cause damage to crops, livestock, poultry or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment.

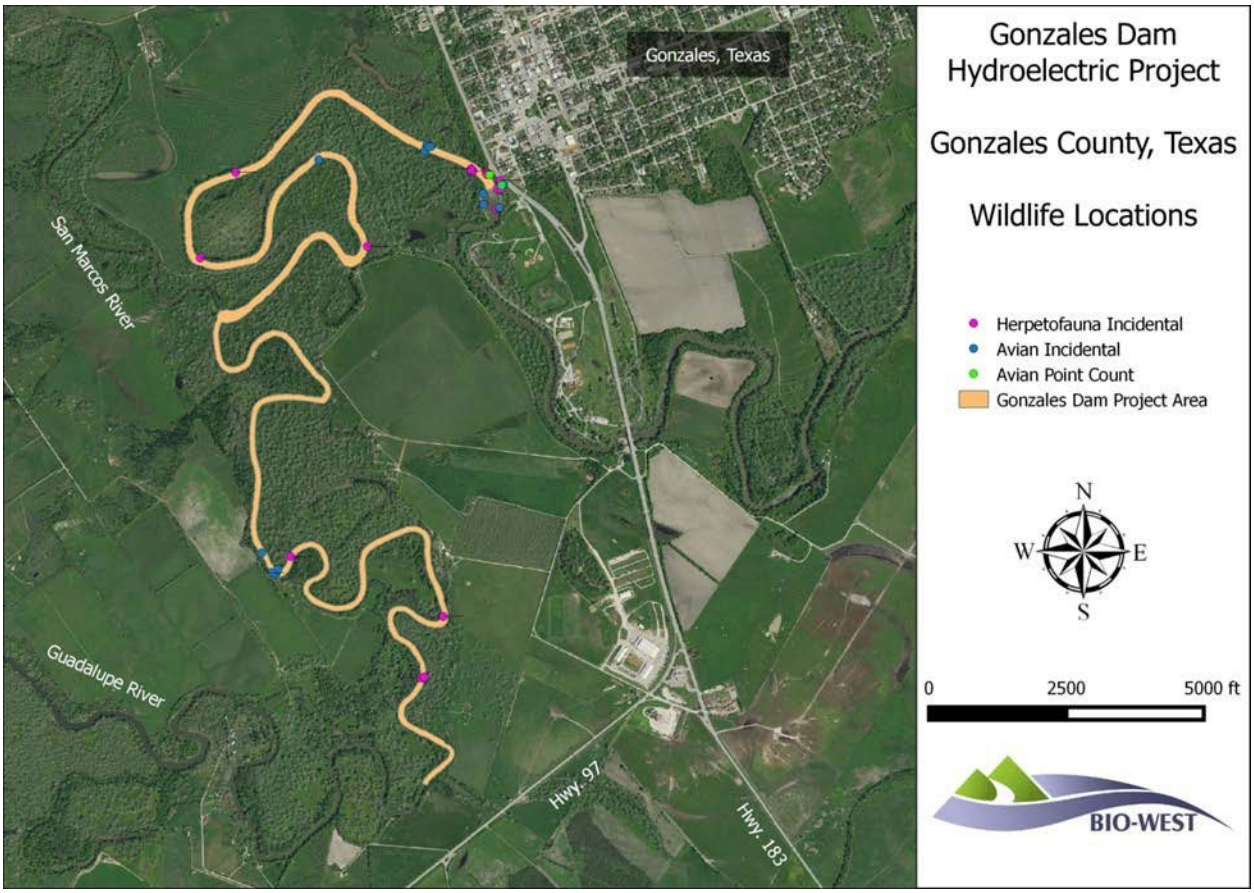

Figure 3-15. Locations of amphibian, reptile and avian fauna identified from the project area (Source BIO-WEST 2017a; as modified by staff).

Table 3-13. Bird species identified during wildlife surveys in the project area (Source: BIO-WEST, 2017a; as modified by staff).

Species	
American goldfinch	Green heron
Bald eagle	Green kingfisher
Barn swallow	House sparrow
Barred owl	Mississippi kite
Black vulture	Mourning dove
Black-and-white Warbler	Northern Mockingbird
Black-capped Chickadee	Northern Parula
Blue-winged Teal	Painted Bunting
Carolina wren	Red-shouldered hawk
Cedar waxwing	Red-tailed hawk
Crested caracara	Scissor-tailed flycatcher
Eurasian collared dove	Snowy egret
European starling	Turkey vulture
Great blue heron	White-eyed vireo
Great egret	Wood duck
Great kiskadee	Common nighthawk
Great-tailed Grackle	Killdeer

Special Status Species

Habitat within the project boundary was also assessed for suitability and presence of any federally- and state-listed endangered, threatened, or candidate species in the project vicinity. Table 3-14 includes the twelve state- and federally-listed species identified from the Texas PWD database known to occur in Gonzales County and that may occur in the project area. Federally-listed species are discussed further in section 3.3.4 *Threatened and Endangered Species*.

Table 3-14. Terrestrial special status species known to occur in Gonzales County and that may occur in the project area. (Sources: The City of Gonzales, Texas Parks and Wildlife Department; as modified by staff).

Common Name (*Scientific Name*)	**Federal Status**	**State Status**	**Habitat/Distribution Notes**
Reptiles			
Cagle's Map Turtle[83] (*Graptemys caglei*)	--	ST	Occur in scattered sites on the Guadalupe, San Marcos, and Blanco Rivers in Texas. Use shallow areas with gravel and cobble substrates as well as transition areas between shallow riffles and deeper pool habitats to forage (Texas PWD, 2019a).
Texas Tortoise (*Gopherus berlandieri*)	--	ST	Range extends from South-Central Texas in the United States southward into the Mexican states of Coahuila, Nuevo Leon, and Tamaulipas. Feed heavily on the fruit of the common prickly pear and on other mostly succulent plants available to them (Texas PWD, 2019a).
Texas Horned Lizard (*Phrynosoma cornutum*)	--	ST	Range from the south-central United States to northern Mexico, throughout much of Texas, Oklahoma, Kansas and New Mexico. Found in arid and semiarid habitats in open areas with sparse plant cover. Dig for hibernation, nesting and insulation purposes, and are commonly are found in loose sand or loamy soils (Texas PWD, 2019a).
Timber Rattlesnake (*Crotalus horridus*)	--	ST	Found in upland woods and rocky ridges in the eastern United States; the eastern third of Texas. Prefer moist lowland forests and hilly woodlands or thickets near permanent water sources such as rivers, lakes, ponds, streams and swamps where tree stumps, logs and branches provide refuge (Texas PWD, 2019a).

[83] All information about Cagle's map turtle in this section is from 71 Fed Reg 53,755-53,835 (September 12, 2006) unless otherwise noted.

Common Name (*Scientific Name*)	**Federal Status**	**State Status**	**Habitat/Distribution Notes**
Birds			
American peregrine falcon (*Falco peregrinus anatum*)	--	ST	Nest in the western United States, Canada, and Mexico, and is one of two subspecies to occur through Texas. Spend the nonbreeding season near their breeding areas or move only moderately southward. In Texas, they are found primarily in the Trans-Pecos region, including Big Bend National Park, and the Chisos, Davis, and Guadalupe mountain ranges (Texas PWD, 2019a). The other subspecies, the Arctic peregrine falcon are highly migratory and use the Texas coast as a stopover during spring and fall migrations.
Bald eagle (*Haliaeetus leucocephalus*)	BGEPA	ST	Typically forage over water and other open habitats and nest from October to July in Texas. Nests are constructed primarily by the female, with the male assisting. Nests constructed of large sticks, with softer materials such as leaves, grass, and Spanish moss used as nest lining and typically used for a number of years, with the birds adding nest material every year (Texas PWD, 2019a).
Least Tern (Interior population) (*Sterna antillarum*)	E	SE	Breed along inland river systems in the United States and wintering along the Central American coast and the northern coast of South America from Venezuela to northeastern Brazil. Sand and gravel bars within a wide unobstructed river channel, or open flats along shorelines of lakes and impoundments, provide favorable nesting habitat. Egg-laying begins in late May, and breeding season is usually complete by late August. Occurs at three Texas impoundments- along the Rio Grande River, on the Canadian River in the northern Panhandle, on the Prairie Dog Town Fork of the Red River in the eastern Panhandle, and along the Red River (Texas/Oklahoma boundary) into Arkansas (Texas PWD, 2019a).

Common Name (*Scientific Name*)	**Federal Status**	**State Status**	**Habitat/Distribution Notes**
Piping Plover (*Charadrius melodus*)	T	ST	Breed on sandy beaches and lakeshores. Migrate through the Great Lakes along the river systems through the Bahamas and West Indies. Found along the Atlantic Coast from Canada to North Carolina and along the shorelines of Lakes Michigan and Superior. Gulf Coast beaches from Florida to Mexico, and Atlantic coast beaches from Florida to North Carolina provide winter grounds. Texas is the wintering home for 35 percent of the known population, arriving in late July or early August, and remaining for up to nine months (Texas PWD 2019b).
Red Knot (*Calidris canutus rufa*)	T		Long-distance migrant shorebird commonly found along sandy, gravel, or cobble beaches, tidal mudflats, salt marshes, shallow coastal impoundments and lagoons, and peat banks in North America. Breed in the Canadian Arctic to migration stopover areas along the Atlantic and Gulf coasts of North America, to wintering grounds throughout the southeastern U.S., the Gulf coast, and South America. Habitats used in migration and wintering areas are generally coastal marine and estuarine habitats with large areas of exposed intertidal sediments. Forage on beaches, oyster reefs, and exposed bay bottoms and roost on high sand flats, reefs, and other sites protected from high tides along the Texas coast (FWS, 2015).
Whooping Crane (*Grus Americana*)	E	SE	Breed in the wetlands in northern Canada and spend the winter in the Texas coastal plains in salt flats and marshes from November through March. Migration occurs throughout the central portion of the state during October and November, and again in April (Texas PWD, 2019a).

Common Name (*Scientific Name*)	**Federal Status**	**State Status**	**Habitat/Distribution Notes**
Wood Stork (*Mycteria Americana*)	T	ST	Nest in swamps or on islands surrounded by open water. Only known breeding colonies north of Mexico occur in Florida (primarily in the Everglades) and coastal Georgia, South Carolina, and North Carolina. Usually observed from late May to mid-October and appear irregularly on the upper and central coasts and on the lower coast and Rio Grande delta, and inland from July to September, especially in eastern Texas. Small flocks are seen rarely along the coast in winter (Texas A&M, 2019).
Mammals			
Red Wolf (*Canis rufus*)	E	SE^{+}	Formerly known throughout the eastern half of Texas as well as coastal prairies. Considered extirpated from the state of Texas. Only a small experimental population roams in their native habitats in eastern North Carolina, and the remaining individuals are maintained in captive breeding facilities throughout the United States (FWS, 2019c).

-- — Not listed
E — Federally Listed Endangered
T — Federally Listed Threatened
BGEPA — Protected by the Bald and Golden Eagle Protection Act
SE — State Listed Endangered (Texas)
SE^{+}—Considered Extirpated (Texas)
ST — State Listed Threatened (Texas)

3.3.3.2 Environmental Effects

Effects of Project Operation and Maintenance on Vegetation and Wildlife

As discussed in section 2.2.2, *Proposed Project Operation,* the City proposes to continue operating the project in a run-of-river mode at inflows between 831 cfs and 3,000 cfs. At inflows below 831 cfs, the project would cease run-of-river and operate the powerhouse at a steady flow rate using 3, 2, or 1 generating units, depending upon inflow to the impoundment. The impoundment would fluctuate between the dam crest and one foot below the dam crest (see table 2-1). The project would not operate at inflows less than 200 cfs or above 3,000 cfs. Maintenance drawdowns up to 1 foot below the crest of the dam could occur whenever the trash racks or dam require debris removal.

The City does not propose any measures related to terrestrial resources. Texas PWD recommends the use of no-till drilling, hydromulching and/or hydroseeding as alternatives to plastic mesh netting for any soil stabilization or revegetation of disturbed areas in the project boundary to reduce risks to snakes and other wildlife. Texas PWD also recommends that the City avoid any vegetation clearing during the general migratory bird nesting season of March 15 to September 15. If clearing must be done during the migratory nesting season for project operation and maintenance, Texas PWD recommends migratory bird surveys prior to any vegetation disturbance. If nests are encountered, a buffer of no less than 25-feet in diameter should remain around the nest until all young have fledged. Additionally, if heron or egret rookeries are encountered in the project area, Texas PWD recommends: 1) avoiding or minimizing disturbance during the migratory nesting (from early February to late August); 2) a primary 300-meter (984 feet) buffer area from the rookery periphery to avoid any vegetation clearing to protect the rookery species and their habitat; and 3) a secondary 1,000-meter buffer (3,281 feet) from the rookery periphery to avoid clearing activities or construction using heavy machinery during the breeding season (courting and nesting).

Our Analysis

Hydropower project operation and maintenance activities can affect wetlands, littoral and riparian habitat, and associated wildlife by modifying the natural flows through a river basin and converting segments of streams from riverine to regulated lacustrine environments. Under run-of-river conditions (i.e., at flows between 831 cfs and 3,000 cfs), the project would maintain existing flow fluctuations, and minimize water level and flow disruption downstream of the project. The project's littoral and riparian habitat are adapted to fluctuations associated with the inflow to the project impoundment and the run-of-river outflow from the project, and would not be affected by continued run-of-river operation.

The project impoundment provides habitat for a variety of wildlife that occur in riparian, littoral, and open-water habitats, as evidenced by the species observed during

the City's 2016-2017 inventory surveys. Continued run-of-river operation would maintain the existing frequency and duration of flow at the project, thereby preserving existing habitat and benefitting the amphibians, reptiles, and birds that occur in available habitat in the project area. This includes the southern leopard frog and Blanchard's cricket frog, observed in the littoral area upstream of the dam, and the Cagle's map turtle, wood duck, blue-winged teal, green heron, great blue heron, and the green kingfisher observed foraging in the project impoundment.

Unlike run-of-river operation, the City's proposal to operate with impoundment fluctuations of up to 1 foot below the crest of the dam when inflow is below 831 cfs, could result in more frequent fluctuations in the project impoundment (section 3.2.2.2, *Project Operation*). Although lowering the impoundment would expose littoral and riparian habitat along the river's edge, the gradual lowering and subsequent raising of impoundment surface levels by 1 foot are not expected to affect the vegetation or wildlife that occur there (see also discussion in *Effects of Invasive Non-Native Plants*).

Under the City's proposal, flows downstream of the project could be reduced significantly (see figure 3-7) when inflow is less than 831 cfs and the project's impoundment is refilling to maintain generating capacity. This mode of operating could have negative effects on downstream littoral habitat and associated wildlife. Additionally, reduced flows, or an absence of flow, in and downstream from the tailrace during the raising of impoundment surface levels would have a negative impact on water quality, potentially affecting not only aquatic biota, but also the wildlife species that depend on this habitat, including turtles (e.g., Texas spiny softshell, Texas river cooter, and Cagle's map turtle) and the wading birds (e.g., egret and heron) that are known to occur in the project area. If allowed to persist for long periods of time, the reduction in, or absence of, flow downstream of the dam could potentially harm wetland and riparian species, such as those species found upstream of the dam (see table 3-12).

The Gonzales Project impoundment may need to be drawn down periodically for scheduled or unscheduled maintenance. The City does not propose conditions under which maintenance drawdowns would occur. If maintenance drawdowns occurred during low-flow periods, we expect that downstream habitat could suffer similar negative effects as those described above for low-flow operations. However, maintenance drawdowns would be temporary and infrequent[84] relative to low flow operations. Project maintenance is essential and, except in emergency situations, could be scheduled to minimize effects on downstream habitat.

[84] Attachment 2 of letter filed by the City on November 16, 2018.

Vegetation Management

The City proposes to continue to manage vegetation in terrestrial habitat at the Gonzales Project as it has historically. Regular vegetation management activities at the project include trimming and mowing vegetation around project facilities and riparian areas around recreational facilities in the project boundary. No new vegetation management measures are proposed. Non-native aquatic invasive plant management is discussed in more detail below (see *Effects of Invasive Non-Native Plants*).

As previously discussed, the Texas PWD's recommendations to protect wildlife include alternatives for soil stabilization and the revegetation of disturbed areas, time-of-year restrictions for vegetation clearing during the migratory bird nesting season, and migratory bird surveys and buffer zones around breeding birds, including heron and egrets rookeries, in the vicinity of the project if clearing is required during the nesting season.

Our Analysis

Along a majority of the project's shoreline, the upland areas of the Guadalupe River are privately owned and managed by the owners. Although no new construction or major ground disturbance is proposed for the Gonzales Project, the City plans to continue managing a majority of the terrestrial habitat in the project boundary on the east side of the river, including maintaining riparian habitat near the shoreline as mowed lawn, which is characterized by a few common, non-native herbaceous species (see below for discussion on the invasive non-native plants). The City also removes or trims vegetation within the project boundary as needed.

The Texas PWD recommends that the City limit tree or woody vegetation trimming or removal to outside the migratory bird nesting season of March 15 to September 15. Additionally, if heron or egret rookeries are present in the project area, Texas PWD recommends avoidance of rookeries from early February to late August. If it is necessary to disturb vegetation during the breeding season, the Texas PWD recommends that the City conduct bird surveys prior to any vegetation disturbance, and establish buffer zones if nests are encountered. Implementing these avoidance strategies prior to vegetation maintenance would minimize harm to breeding birds and their eggs and young during prime breeding months, if they are present.

Effects of Invasive Non-Native Plants

Alligatorweed is a prolific non-native plant and a Texas noxious weed that is present in the littoral area of the project impoundment. Alligatorweed competes with native riparian and aquatic species, reducing the quality of fish and wildlife habitat where it becomes established. Large mats of alligatorweed can form and impede access to the shore. Once established, mats can obstruct navigation and become fragmented and

spread during in-water activities, such as recreation at the kayak dock. Fluctuations in the impoundment levels may also create conditions facilitating its spread. The City does not propose any specific measures to control alligatorweed.

No measures to control alligatorweed were recommended by resource agencies or other stakeholders.

Our Analysis

While mats of alligatorweed in the project area are not extensive, alligatorweed is established in the littoral area of the project impoundment, including near the kayak dock, and could be spread into other areas by users of the dock. If the mats near the dock expand, they could interfere with safe use of the facility or pose potential threat to project operation because the powerhouse intakes are located directly downstream from the kayak dock. The fact that the weed mats are not extensive provides a cost-effective opportunity to manage alligatorweed in a limited area before it becomes a larger issue at the project.

Removal or treatment of the alligatorweed in the vicinity of the kayak dock and the reestablishment of native vegetation along the shoreline could reduce the spread of the weed and prevent a future problem at the dock itself, while providing beneficial habitat for wildlife that occupy this area. Mechanical, chemical and biological treatment methods have been used to control alligatorweed. The introduced alligatorweed flea beetle (*Agasicles hygrophila*), along with other introduced insects, have successfully provided biological control for alligatorweed in Florida, Louisiana and Texas (Thayer and Pfingsten 2019).

Fluctuation of the impoundment as part of the City's proposed project operation has the potential to stress existing riparian communities, potentially causing vegetation dieback and exposing shorelines to colonization of non-native species. Periodic monitoring for alligatorweed following its initial removal or treatment, done in consultation with the Texas PWD, could be implemented to detect its spread or detect any new invasive species in the area of the kayak dock and powerhouse intakes.

Effects on Special Status Species

The applicants do not propose any measures related to the protection of terrestrial state-listed threatened or endangered species. In addition, no stakeholders recommended specific measures to protect these special status species.

Our Analysis

Two state-listed threatened species identified in the Texas PWD database were observed during the City's species inventory surveys: the bald eagle (*Haliaeetus leucocephalus*) and Cagle's map turtle (*Graptemys caglei*). Federally listed species are

discussed in more detail in section 3.3.4, *Threatened and Endangered Species*. Suitable habitat for many of these special status species does not occur within the project boundary, or the species may be present within the project boundary for only brief periods of time (e.g., foraging, migration). The bald eagle was observed flying over the impoundment during the project inventory surveys. It is protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, which prohibit the "take" of eagle eggs, nests, and offspring, and can also include substantially disturbing normal breeding and feeding activities, except as permitted by regulation. No eagle nests were documented in the biological surveys, and the City does not plan to disturb any woody vegetation in the project boundary. Therefore, the proposed operation and maintenance of the project is not expected to affect the bald eagle.

Cagle's map turtle is a regionally endemic species only found in the Guadalupe River drainage of central Texas. It was observed on two occasions within aquatic habitat of the impoundment during inventory surveys conducted by the City. Cagle's map turtles feed on aquatic insects and mollusks, using shallow areas with gravel and cobble substrates as well as transition areas between shallow riffles and deeper pool habitats to forage. Loss and degradation of riverine habitat from large and small impoundments (dams and impoundments) and human activity (collection and target shooting) were identified as primary threats to the Cagle's map turtle. Dams may also restrict turtle movement resulting in fragmented populations. However, because of the stable population size, the increased protection from the Texas PWD, and a lack of foreseeable threats from additional impoundment construction, the federal listing of Cagle's map turtle was found not to be warranted by the FWS in 2006.[85] However, it is listed as endangered with the International Union for Conservation of Nature and Natural Resources (ICUN) as the species is now restricted to a single stretch of about 120 km of the lower Guadalupe River, where the population appears to be under continuing threat from habitat degradation, disturbance and water diversion (van Dijk, 2011).

Unlike run-of-river operation, the City's proposal to operate with impoundment fluctuations up to 1 foot below the crest of the dam when inflow is less than 831 cfs and greater than 200 cfs could result in an increase in the magnitude of the fluctuations downstream, expose littoral habitat and associated biota, and affect the species that use this area to forage. While Cagle's map turtles were observed in the impoundment during the City's inventory surveys, similar surveys were not conducted downstream of the dam. Sediment conditions in impoundments generally do not support gravel and cobble substrates where the turtles feed, and the relatively small changes in habitat in the impoundment when the surface elevation is fluctuating would likely have minimal effects on the Cagle's map turtle's use of this area.

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[85] 71 Fed Reg 53,755-53,835 (September 12, 2006).

Proposed operational impoundment fluctuations could result in flow reductions or no flow downstream of the dam when raising the impoundment surface levels. Reduced flow, or no flow would decrease the volume of water downstream and likely degrade water quality (as discussed in section 3.3.2.2, *Project Operation*), which could negatively affect the food (aquatic insects and mollusks) and habitat of Cagle's map turtle. In contrast, maintaining sufficient flow downstream of the project would help protect downstream habitat and the aquatic biota on which the turtles depend.

3.3.4 Threatened and Endangered Species

3.3.4.1 Affected Environment

On February 19, 2019, FWS' IPaC system indicated that four bird species may occur in Gonzales County, Texas and could potentially occur within the project area: the endangered least tern (interior population) (*Sterna antillarum*) and whooping crane (Grus Americana); and the threatened piping plover (*Charadrius melodus*) and red knot (*Calidris canutus rufa*) (FWS, 2019a; table 3-14). No critical habitat for any of the federally listed threatened and endangered species occurs within project-affected lands. Additionally, three of the four federally listed species (least tern, red knot, and piping plover), only need to be considered for wind-related projects within their migratory routes; therefore, these species are not evaluated further for this project (FWS, 2019a). A review of FWS' IPaC system on September 11, 2019, indicates that there are no changes to the federally listed threatened and endangered species may occur within the vicinity of the project (FWS, 2019b). Two candidate mussel species (i.e., the golden orb and the Texas pimpleback) were on the original species list. However, the golden orb is no longer listed as a candidate species on the updated list (see section 3.3.2.1, *Special Status Mussel Species*).

The whooping crane is a long-lived species, only occurring in North America. Current estimates suggest a maximum longevity in the wild of at least 30 years. Whooping cranes currently exist in the wild at 3 locations and in captivity at 12 sites. There is only one self-sustaining wild population, the Aransas-Wood Buffalo National Park population, which nests in Wood Buffalo National Park and adjacent areas in Canada, and winters in coastal marshes in Texas at Aransas. A small, captive-raised, non-migratory population resides in central Florida, and a small migratory population of individuals, introduced beginning in 2001, migrates between Wisconsin and Florida.

Two additional federally listed species, the wood stork (*Mycteria Americana*) and the red wolf (*Canis rufus*), are listed as potentially occurring in Gonzales County in the Texas DPW database. The wood stork may migrate through the project area, but none were not observed during the City's 2016-2017 surveys, and it is unlikely that they spend any considerable time in the project area, as suitable shallow wetland habitat is not available. The red wolf's historic distribution included the eastern half of Texas as well as coastal prairies; however, it is considered extirpated from the state. Based on current

known distribution, only a small experimental population roams in their native habitats in eastern North Carolina (FWS, 2019c).

3.3.4.2 Environmental Effects

As discussed in section 3.3.1.2, *Project Operation and Maintenance*, the City proposes to continue operating the project in a run-of-river mode, except during low flow conditions and maintenance, when the impoundment surface elevation could fluctuate up to 1 foot below the crest of the dam.

Resource agencies and other stakeholders did not file recommendations regarding protection of federally listed terrestrial species in response to the Commission's REA Notice.

Our Analysis

None of the six federally protected terrestrial species identified by FWS or the Texas PWD database were observed during the 2016-2017 biological surveys conducted by the City. Preferred or suitable habitats for the whooping crane and wood stork do not occur within the project boundary. Moreover, the whooping crane is extremely rare with limited distribution, and the red wolf is consider extirpated in Texas, and based on current known distribution only a small experimental population occurs in their native habitat in eastern North Carolina. Therefore, we conclude that relicensing the project would have no effect on any of these federally listed species.

3.3.5 Recreation and Land Use

3.3.5.1 Affected Environment

Regional and Local Recreation

The City of Gonzales is located in south central Texas, between the urban areas of San Antonio and Houston. Gonzales County, where the project is located, is home to water-based activities like recreational boating, tubing, and fishing, and land-based activities, such as hiking, camping, sightseeing, bird watching, and picnicking. Within Gonzales County, several public parks provide access to the Guadalupe River and its tributaries, including:

- Palmetto State Park, which is located on the Guadalupe River upstream from the project between Luling and Gonzales. The park provides camping, picnicking, hiking, fishing, birding, nature study, pedal boat and canoe rentals.

- Independence Park, which is managed by the City of Gonzales, and is located off of Highway 183 on the banks of the Guadalupe River, just downstream from the project. The park includes covered pavilions, sports fields, a

swimming pool, and RV Park, rodeo facilities, a 9-hole golf course, and a 2.35-mike hiker/biker trail.

- River Trail Park, which is managed by the City of Luling, and is located on the San Marcos River, which joins the Guadalupe River within the project boundary. River Trail Park provides an entry point for the Zedler Mill Paddling Trail as well as picnic and swimming facilities.

- Southside Park, which is owned by the City of Luling, is also located along the San Marcos River. This site includes a club house, swimming pool, and picnic areas along the river.

Recreation at the Project

The City operates two recreation facilities within the project boundary: a tailrace fishing area, located just below the powerhouse, and a kayak dock, located just above the dam. Public parking for both facilities is available along Highway 183 to the west of the project (see figure 3-16).

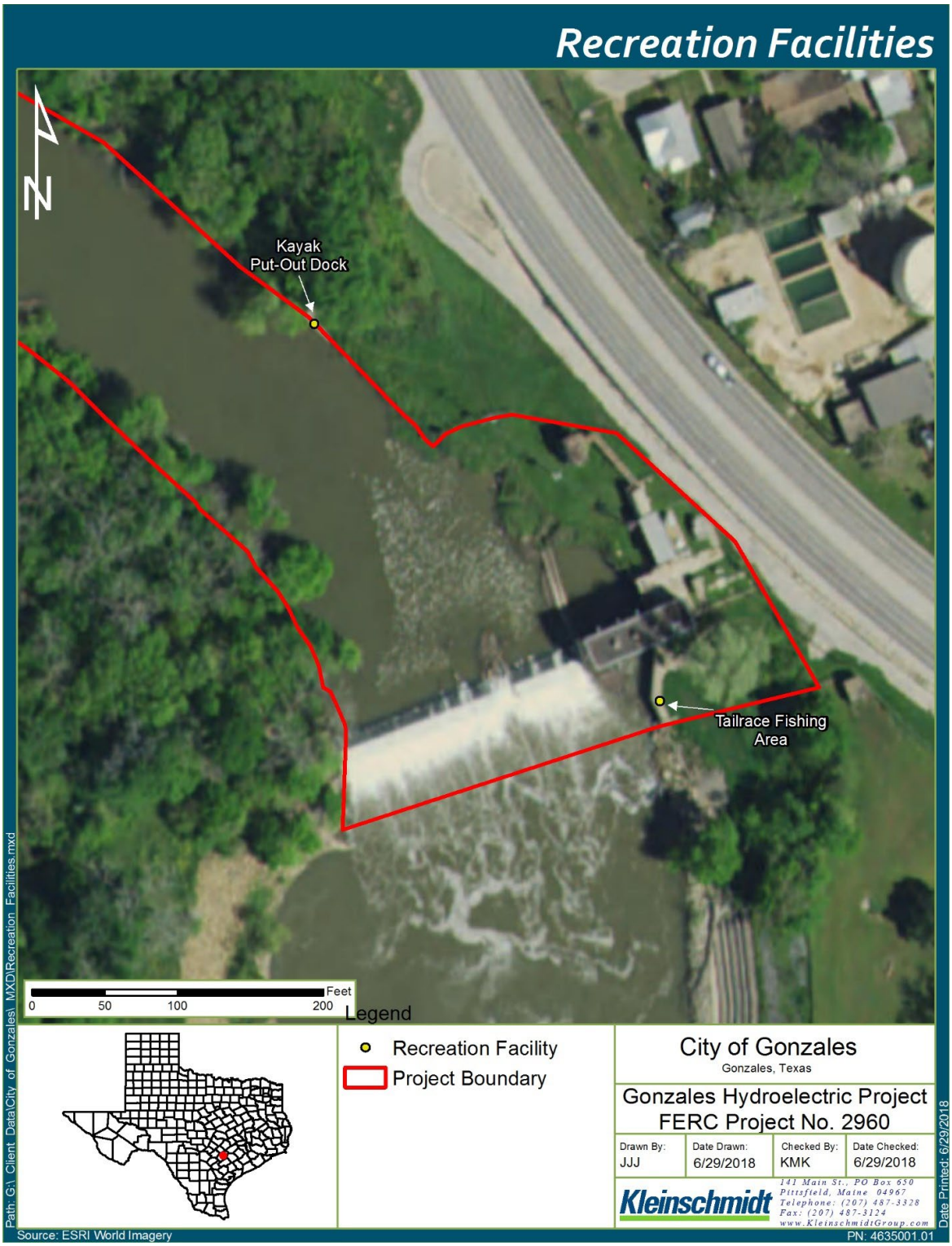

Figure 3-16 Project recreation facilities (Source: license application).

The tailrace fishing area is a concrete platform that provides access to the project's tailrace. The platform is accessed from a series of stairs from the project's access road. The City estimates that average annual usage of the tailrace fishing area is approximately 500 recreation days/year.

The project's kayak dock is the terminus of the "Come and Take It" Paddling Trail, which runs from Lake Wood Park and flows 11 miles downstream to the take-out point at the project's kayak dock. The take-out is signed and well-advertised as part of the paddling trail. A separate paddling trail, the "Independence Padding Trail," is a 2.6-mile circular route that begins and ends at the Highway 183 bridge in Independence Park, with a turnaround point immediately downstream from the project. The Texas Water Safari, a 260-mile race from the San Marcos to Seadrift on the Texas Coast, utilizes portions of both trails. At Gonzales Dam, participants portage across private property on river right. For through-paddling at other times, it is recommended that paddlers take out at the project's kayak dock and transport their boats along Highway 183 to put in downstream at Independence Park (TWS, 2019).

Land Use

The majority of the land in the vicinity of the project is pasture/hay, shrub/scrub, and deciduous forest. Gonzales County is one of the leading agricultural counties in Texas, with beef and poultry production being the dominant sources of income. Other agricultural products produced in the county include hogs, corn, grain, hay, pecans, mushrooms, and cactus. Gonzales County also has rich mineral production, including bentonite clay, sand, gravel, oil and gas.

Within the project area, and adjacent to the project boundary, land use consists of deciduous forest and developed low-to medium-density residential and commercial areas. Lands within the project boundary are managed for project operation and maintenance, with recreation access at the kayak dock and tailrace fishing area. Open water composes much of the project boundary, with little upland area.

3.3.5.2 Environmental Effects

Recreation

The City proposes to continue to operate and maintain the existing tailrace fishing area and the kayak dock and to install signage as required by section 8.2(a) of the Commission's regulations. No comments regarding recreation access or facilities were received in response to the Commission's notice that the application was ready for environmental analysis.

Our Analysis

Although not required by the existing license, the City maintains the tailrace fishing area and kayak dock for public recreation. The kayak dock is identified and signed as part of the "Come and Take It" kayak trail, which encourages recreation use of the river. No comments have been received from the public or Texas PWD to indicate that additional recreation facilities are warranted. In combination with other municipal and State-owned parks along the Guadalupe River, the City's proposal to continue maintaining the existing facilities would ensure adequate public access to the Guadalupe River.

As discussed in section 3.3.3, *Terrestrial Resources*, invasive alligatorweed is present in the water and along the shoreline near the kayak dock. If the alligatorweed is allowed to establish mats, the growth could affect the dock's usability by preventing boat access to the shoreline as paddlers travel downstream. Controlling the spread of alligatorweed is an important maintenance activity to facilitate use of the dock. A plan to monitor and control this invasive aquatic species, in conjunction with regular maintenance of the recreation facilities would ensure the dock's usability.

If the City's existing recreation facilities are approved as part of the project in a subsequent license, the City would be required to install signage consistent with 8.2(a) of the Commission's regulations. Section 8 signage, along with the paddling trail's existing directional an safety signage would ensure that the recreation facilities were visible to fishers and boaters.

Land Use

The City proposes to modify the project boundary to enclose the project impoundment as required by the Commission's regulations.

Our Analysis

The modification of the project boundary proposed by the City is administrative only, and is necessary to enclose the project's impoundment, which was not included in the exhibit K maps approved by the existing license. The City notified landowners, adjacent to the proposed project boundary, of the change on July 27, 2018 and no comments were received. The City is not proposing any changes to the management of lands within the existing project boundary, and upland areas around the impoundment would be unaffected by under run-of-river operations. Therefore, continued operation of the project, as proposed by the City, would have no effect on land use resources.

3.3.6 Cultural Resources

3.3.6.1 Affected Environment

Areas of Potential Effects

Pursuant to section 106 of the NHPA, the Commission must take into account whether any historic property within a project's area of potential effects (APE) could be affected by the project. The Advisory Council on Historic Preservation defines an APE as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. We define the APE for the Gonzales Project as: (1) lands enclosed by the project boundary; and (2) lands or properties adjoining the project boundary where authorized project uses may cause changes in the character or use of historic properties, if historic properties exist.

Cultural History Overview

The pre-history of Texas can be broadly divided into three distinct periods: the Paleoindian Period (11,000-8,000 years before present [BP]); the Archaic Period (8,000-1,200 years BP); and the Late Prehistoric (1,200-350 years BP). The Historic Period begins in approximately 1534, with the first arrival of European explorers to the region (Bonine, *et al*., 2013).

The Paleoindian peoples who inhabited the Guadalupe Basin in the late Pleistocene and early Holocene relied heavily on hunting now-extinct megafauna. In Texas, the Paleoindian period is represented by projectile points including Clovis and Scottsbluff. Paleoindian sites are often found in older fossil floodplains and upland sandstone terraces, rather than colluvial gravel deposits or modern floodplains. These findings may be a result of geologic processes and alluvial changes in the Guadalupe River Channel that have either destroyed or deeply buried Paleoindian sites. (Bonine, *et al*., 2013).

The people of the Archaic period hunted modern species of game including deer and rabbit, and gathered edible roots, nuts and fruits. A multitude of types of projectile points and tools of bone, stone, and shell are characteristic of this period. By far, the largest number of archaeological sites reported in the Guadalupe Basin are from this period (Hester, 1975). Most archaeological sites in the basin are campsites, located away from the existing river channel. As with the Paleoindian Period, many sites may have been deeply buried or destroyed by changes in the Guadalupe River Channel (Bonine, *et al.*, 2013).

The Late Prehistoric Period is characterized by increasing innovation, including the bow and arrow, ceramics, and in some parts of Texas, the beginnings of agriculture

(Hester, 1975). Bison, deer, and antelope were all hunted during this period. The increased use of ceramics may indicate a change in subsistence patterns, including maize cultivation along with a more traditional hunter-gatherer strategy (Bonine, *et al*., 2013).

The Historic Period is marked by the arrival of Europeans to the region. The first European to travel through the area was Álvar Núñez Cabeza de Vaca in 1534, after a shipwreck off the gulf coast. Other explorers to the area include René Robert Cavelier, Sieur de La Salle and his French troops in 1685 (on reconnaissance missions from Fort St. Louis), and Governor Alonso De León in 1689 and 1690 (Bonine, *et al.*, 2013).

The City of Gonzales was surveyed by James Kerr as the capital of the DeWitt Colony, established in Mexican Texas by Green DeWitt in 1825 (Bonine, *et al.*, 2013). The original settlement was abandoned in 1826, and rebuilt in 1827 at its present location. DeWitt's colony was made up of families and single men, most of whom had farms along the Guadalupe River. The population of Dewitt Colony grew rapidly from the small group of initial settlers to 166 families by 1831. In 1830, the Mexican government passed a law prohibiting further immigration from the United States to Texas, and Dewitt was unable to continue recruiting colonists. When his contract expired on April 15, 1831, all lands in his colony reverted to the Mexican government (Roell, 1994).

As the westernmost point of Anglo-American settlement and the closest town to San Antonio de Béxar, the City of Gonzales was the center of much of the Texas revolutionary activity. On October 2, 1835, Texans led by John H. Moore resisted Mexican dragoons sent to retrieve the town cannon. Challenging the Mexicans to "come and take it," the Texans rallied around the gun and fought the battle of Gonzales, the first skirmish of the Texas Revolution. Upon the conclusion of the Texas Revolution, in 1837 the Republic of Texas incorporated the City of Gonzales and established Gonzales County (Hardin, 2010).

Project History

The dam and hydroelectric facilities at the Gonzales Project were originally constructed in 1925 by Central Power and Light of Corpus Christi, Texas. Central Power and Light abandoned the project in 1965. In 1980, the City received a license to operate the project from the Commission. At that time, the City replaced the generating equipment and rehabilitated the powerhouse. In 2019, the City completed another rehabilitation of the powerhouse and generating equipment.

Historic Properties

There are no known archeological sites or historic architectural resources that would be affected by continued operation of the Gonzales Project. As discussed

previously, the project was used for hydropower generation from 1925 to 1965, and was rehabilitated in 1980 and 2019.

3.3.6.2 Environmental Effects

As part of pre-filing consultation, the City requested that the Texas SHPO review its proposal for relicensing the Gonzales Project. By letter filed October 13, 2015, the Texas SHPO concluded that no historic properties would be affected by relicensing the project. The City also consulted with tribes that have the potential to be affected by the project. By letter filed October 13, 2015, the Alabama-Coushatta Tribe of Texas requested that any license issued for the project incorporate protection measures addressing inadvertent discovery of human remains or archaeological resources during continued operation of the project.

Our Analysis

Based on the assessment of the Texas SHPO and the information in the record for this proceeding, continued operation of the proposed project would not affect known historic properties. However, it is possible that unknown archaeological or historic resources may be discovered in the future as a result of project operation or other project-related construction or maintenance activities. If such resources are discovered, immediately stopping work and consulting with the Texas SHPO and Alabama-Coushatta Tribe of Texas to define appropriate treatment would prevent any further harm to previously unidentified resources. Further, if the City contemplates making changes to authorized project operations or conducting land-clearing, or land-disturbing activities, the City should reinitiate consultation with the Texas SHPO and Alabama-Coushatta Tribe of Texas to determine if measures are needed to protect cultural resources.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the project would continue to operate in its current manner. There would be no requirement for the City to continue to operate and maintain the existing recreation facilities at the project.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the Gonzales Project's use of the Guadalupe River for hydropower purposes to see what effect 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*.,[86] the Commission compares the current project cost to an estimate of the cost of obtaining the same amount of energy and capacity using a likely alternative source of power for the region (cost of alternative power). In keeping with Commission policy as described in *Mead*, 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 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 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 4-1 summarizes the assumptions and economic information we use in our analysis. This information, except as noted, was provided by t in its license application and subsequent submittals. We find that the values provided by the applicant are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs, net investment (the total investment in power plant facilities to be depreciated), estimated future capital investment required to maintain and extend the life of plant equipment and facilities, relicensing costs, and normal operation and maintenance cost.

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[86] See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (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 4-1: Parameters for economic analysis of the Gonzales Project (Sources: the City and staff).

Parameter	Value
Period of analysis (years)	30
Term of financing (years)	20
Energy value ($/MWh)	128.06[a]
Capacity value ($/kilowatt-year)[b]	195
Net investment[c]	$8,039,941
Operation and maintenance ($/year)[d]	$136,125
Federal income tax rate (percent)[e]	0
Local tax rate (percent)[e]	0
Interest rate/discount rate (percent)	8.00
Dependable capacity (kilowatts)	513[f]

[a] Source: The City's revised exhibit A, filed May 23, 2019.
[b] Based on the Energy Information Administration's 2018 Annual Energy Outlook.
[c] Remaining undepreciated net investment, rehabilitation cost and relicensing cost. Value provided by the applicant was updated to 2019.
[d] Includes insurance costs. Value provided by the applicant was updated to 2019.
[e] Applicant is a municipality and tax exempt.
[f] Staff estimated the dependable capacity by multiplying the capacity by the plant factor.

4.2 COMPARISON OF ALTERNATIVES

Table 4-2 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: no action, the City's proposal, and the staff alternative.

Table 4-2: Summary of the annual cost of alternative power and annual project cost for the alternatives for the Gonzales Project (Source: staff).

	No Action	City's Proposal	Staff Alternative
Installed capacity (MW)	.9	.9	.9
Annual generation (MWh)	4,500	4,500	4,500
Dependable capacity (MW)	0.513	0.513	0.513
Annual cost of alternative power ($/MWh)	$676,305 150.29	$676,305 150.29	$676,305 150.29
Annual project cost ($/MWh)	$740,318 164.51	$743,374 165.19	$744,851 165.52
Difference between the cost of alternative power and project cost ($/MWh)	$64,013 (14.23)	($67,069) (14.90)	($68,546) (15.23)

4.2.1 No-action Alternative

Under the no-action alternative, the Gonzales Project would continue to operate as it does now. With an installed capacity of 0.9MW, the project generates an estimated average of 4,500 MWh of electricity annually. The average annual cost of alternative power would be $676,305, or about $ 150.29/MWh. The average annual project cost would be $740,318, or about $164.51/MWh. Overall, the project would produce power at a cost that is $64,013, or $14.23/MWh, more than the cost of alternative power.

4.2.2 Applicants' Proposal

Based on an installed capacity of 0.9 MW and an estimated average annual generation of 4,500 MWh, the cost of alternative power would be $676.305, or about $150.29/MWh. The average annual project cost would be $743,374, or $165.19/MWh.

Overall, the project would produce power at a cost that is $67,069, or $14.90/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 the applicant's proposal.[87] Table 4-3 presents the staff-recommended additions, deletions, and modifications to the applicant's proposed environmental protection and enhancement measures and the estimated cost of each.

Based on an installed capacity of .900 MW and an average annual generation of 4,500 MWh, the cost of alternative power would be $676,305, or about $150.29/MWh. The average annual project cost would be $744.851, or $165.52/MWh. Overall, the project would produce power at a cost that is $68,546, or $15.23/MWh, more than the cost of alternative power.

4.3 COST OF ENVIRONMENTAL MEASURES

Table 4-3 gives the cost of each of the environmental measure for the project considered in our analysis. All costs in table 4-3 are in 2019 dollars. 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.

[87] Given the City's recent generator rewind and change from manual to automated operation, not recommending the low flow drawdown and refill protocol should not significantly reduce the project's generation.

Table 4-3: Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of continuing to operate the Gonzales Project (Sources: Staff and the City of Gonzales).

Enhancement/Mitigation Measures	Entity	Capital Cost	Annual Cost	Levelized Annual Cost
Geology and Soils				
Avoid stabilization materials that could entangle snakes and other wildlife and use no-till drilling, hydromulching, and/or hydroseeding as alternatives to plastic mesh netting to stabilize exposed soils.	Texas PWD	-- [a]	-- [a]	-- [a]
Aquatic Resources				
Continue operating the project in a run-of-river mode, except during maintenance and inflow less than 831 cfs, when reservoir surface elevations may fluctuate up to 1 foot below the crest of the dam	The City	$0	$0	$0
Operate the project in run-of-river mode, except at inflows between 555 cfs and 830 cfs, when the project may be operated with impoundment fluctuations between the crest of the dam and a level 1 foot below the crest of the dam.	Staff	$0	$0[a]	$0

Enhancement/Mitigation Measures	Entity	Capital Cost	Annual Cost	Levelized Annual Cost
Develop an operation compliance monitoring plan that impoundment includes a description of the existing monitoring system, and provisions for reporting water level data, generation data, and deviations from run-of-river operation.	Staff	$5,000	$0	$376
Conduct maintenance drawdowns when flows are between 555 cfs and 830 cfs.	Staff	$0	$0	$0
Develop a stream mitigation plan in consultation with Texas PWD to mitigate for all impacts of the project to aquatic resources.	Texas PWD	--[a]	--[a]	--[a]
Terrestrial Resources				
Develop an aquatic invasive vegetation management plan, in coordination with Texas PWD, to address existing alligatorweed, and the potential for new invasive species in the littoral area between the kayak dock and intakes.	Staff	$5,000	$0	$376
Conduct a survey and establish a buffer area around nests prior to tree or woody vegetation disturbance, during the general migratory bird nesting season of February 1 to September 15.	Staff	$0	$725[b]	$725

Enhancement/Mitigation Measures	Entity	Capital Cost	Annual Cost	Levelized Annual Cost
Recreation and Land use				
Continue operation and maintenance of the existing tailrace fishing area and kayak dock, including signage for recreation and public safety.	The City, Staff	$750	$3,000	$3,056
Cultural Resources				
Notify and consult with the Texas SHPO and Alabama-Coushatta Tribe of Texas if (a) any unknown archaeological or historic resources are discovered during project operation or other project-related activities or (b) if the City contemplates making changes to authorized project operations or conducting land-clearing, or land-disturbing activities.	Staff	$0[c]	$0[c]	$0

Note: Costs provided by the applicant are indexed to 2019 dollars.

[a] Insufficient information is available to estimate a cost; therefore, no cost is included for this measure.

[b] The anticipated level of effort is one person day per year to complete the survey. The estimated cost for the survey is based on one day of field studies and $75/hour and $125/day per diem.

[c] Staff estimates that there would be no additional cost for this measure.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a) 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 will 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 licensing the Gonzales Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review and evaluation of the environmental and economic effects of the proposed action and its alternatives, we selected the staff alternative as the preferred alternative for the Gonzales Project. We recommend this alternative because: (1) issuing a new license for the project would allow the City to continue to operate the project and provide a beneficial and dependable source of electric energy; (2) generation from the Gonzales Project, with an installed capacity of 900 kW of electric capacity, comes from a renewable resource that does not contribute to atmospheric pollution; (3) the public benefits of this alternative would exceed those of the no-action alternative; and (4) the recommended measures would protect aquatic resources.

In the following section, we make recommendations as to which environmental measures proposed by the City, or recommended by agencies or other entities, should be included in any license issued for the project. In addition to the City's proposed environmental measures listed below, we recommend additional staff-recommended environmental measures to be included in any license issued for the project.

5.1.1 Measures Proposed by the Applicant

Based on our environmental analysis of the City's proposal in section 3.0, *Environmental Effects*, and the costs presented in section 4.0, *Developmental Analysis*, we recommend the following environmental measures proposed by the City to protect and enhance environmental resources, and believe these measures would be worth their cost. Therefore, we recommend the following proposed measures in any license issued for the project:

- Continue to operate and maintain the existing tailrace fishing area and kayak dock, including recreation and public safety signage.

5.1.2 Additional Staff-recommended Measures

Under the staff alternative, the project would be operated with the City's proposed measures, as identified above, and the following additions or modifications:

- Operate the project in a run-of-river mode, except at inflows less than 831 cfs and greater than 554 cfs, when the project may be operated with impoundment fluctuations between the crest of the dam and a level 1 foot below the crest of the dam.

- Develop an operation compliance monitoring plan that specifies the methods that will be used to monitor and document project operation and impoundment surface elevations.

- Conduct routine maintenance drawdowns when inflows are between 555 cfs and 830 cfs to protect water quality and aquatic habitat upstream and downstream of the project.

- Develop an aquatic invasive vegetation management plan that includes: (a) best management practices (BMPs) to remove or control alligatorweed and to allow native vegetation to reestablish in the littoral area extending from the kayak dock to the powerhouse intakes; (b) periodic monitoring for alligatorweed and other invasive plants in the littoral area extending from the kayak dock and powerhouse intakes; (c) criteria that would determine when control measures should be implemented; and (d) a schedule for filing monitoring reports and any recommended control measures with the Commission.

- For each tree trimming or woody vegetation disturbance event that occurs at the project during the migratory bird nesting season of February 1 through September 15: (1) conduct a survey prior to the event in the projected area of the trimming or disturbance to determine the presence of active migratory bird nesting and fledging, and (2) if migratory birds are nesting or fledging at or near the area of the planned trimming or disturbance activity, do not conduct any trimming or disturbance activity, (a) within 25 feet in diameter from any migratory bird nest until all young have fledged and (b) do not conduct any trimming or vegetation disturbance within 300 meters (984 feet) of any heron or egret rookery periphery, and from February 1 through August 31, do not use heavy machinery within 1,000 meters (3281 feet) of any heron or egret rookery periphery.

- Notify and consult with the Texas SHPO and Alabama-Coushatta Tribe of Texas if (a) any unknown archaeological or historic resources are discovered

during project operation or other project-related activities or (b) if the City contemplates making changes to authorized project operations or conducting land-clearing, or land-disturbing activities.

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

Project Operation

The City proposes to continue operating the project in a run-of-river mode at inflows between 831 cfs and 3,000 cfs, but would operate with impoundment level fluctuations between the dam crest and a level 1 foot below the crest of the dam when flows are between 200 cfs and 830 cfs.

Run-of-river Operation

As discussed in section 3.3.2.2, *Project Operation*, operating the project in a run-of-river mode at inflows between 831 cfs and 3,000 cfs would maintain DO and water temperature at a levels similar to existing conditions in the project impoundment and downstream. Run-of-river operation currently supports the fish and mussels that occur near the project, including the Texas pimpleback, a federal candidate freshwater mussel that is present about 1.4 miles downstream of the project.

Operating with Impoundment Level Fluctuations

Under current operations, holding the impoundment elevation stable at the dam crest requires frequent adjustments to the project's generating units when inflows are below the maximum hydraulic capacity of the powerhouse (831 cfs) because of daily inflow fluctuations caused by upstream, non-project peaking operations. Presumably, to reduce the need to adjust flow through the individual generating units in response to varying inflows, the City proposes to use its recent (August 2019) power plant automation to vary the impoundment surface elevation up to 1 foot below the dam crest at inflows between 200 cfs and 830 cfs. During these inflow conditions, between one and three turbine units would automatically shut down when the impoundment surface elevation approaches 1 foot below the crest of the dam to allow the impoundment to refill to the crest of the dam (table 2-1). Operating with impoundment level fluctuations could allow the City to more efficiently use the fluctuating inflows for improved generation.

Water Quality

As discussed in section 3.3.2.2, *Project Operation, Impoundment Water Quality*, under existing run-of-river conditions, DO and water temperature are maintained at levels that support the fish and mussels present. However, operating with impoundment level fluctuations would cause retention times in the impoundment to increase when outflows from the project are reduced relative to inflow to allow the impoundment to refill (table

2-1). Increased retention times could in turn cause water temperature to increase and DO to decrease to unsuitable levels.

As discussed in section 3.3.2.2, *Project Operation*, operating with impoundment level fluctuations would result in periods when flows downstream of the project would be reduced to lower levels than occur under existing operation at the same inflows. When inflows are between 278 cfs and 554 cfs, the City proposes to reduce flows in the tailrace from 554 cfs to 277 cfs to allow the impoundment to refill to the crest of the dam. Our analysis indicates that proposed operation would increase the frequency of flows less than or equal to 277 cfs from 12 percent under existing conditions to 25 percent, which could increase the frequency of low DO events (less than 5.0 mg/L). When inflows are between 200 cfs and 278 cfs, the City also proposes to reduce flows in the tailrace from 277 cfs to 0 cfs. Our analysis indicates that the incidence of no flow events would also increase from 0 percent under existing conditions, to 4 percent under the City's proposed operation. Thus, operating with impoundment level fluctuations at inflows between 554 cfs and 200 cfs would likely negatively affect water quality, and negatively affect the fish and mussels downstream, including the federal candidate Texas pimpleback mussel, relative to current operations where the impoundment surface elevation is maintained at the dam crest while the project is generating.

Aquatic Habitat

As discussed in section 3.3.2.2, *Project Operation, Impoundment Aquatic Biota and Habitat*, under existing run-of-river operation, where the City holds the impoundment elevation near the crest of the dam, water levels are relatively stable to the benefit of fish and other aquatic biota that rely on nearshore habitat for feeding and cover However, as discussed above, when operating with impoundment level fluctuations, downstream flows would be reduced to lower levels than occur under existing operation at the same inflows. Reduced flows have the potential to dewater habitat and stagnate water, causing reductions in habitat and water quality, and exposing fish and mussels to conditions that could reduce growth, reproduction and survival. Like the effects on water quality discussed above, the negative effects to downstream habitat would primarily occur when operating with impoundment level fluctuations at inflows between 554 cfs and 200 cfs. As discussed in section 3.3.2.2, *Project Operation*, operating with impoundment level fluctuations at inflows between 278 cfs and 554 cfs would create less suitable habitat conditions compared to existing conditions, based on the Tennant Method. In addition, operating with impoundment level fluctuations at inflows between 200 cfs and 278 cfs would cause periods of no flow downstream of the project. No flow conditions never occur under existing run-of-river operation, and if allowed, would increase stagnation, decrease DO, and increase the amount of dewatered habitat, which would negatively affect the fish and mussels present downstream of the project.

Based on the information above, operating with impoundment level fluctuations at inflows less than 555 cfs and greater than or equal to 200 cfs would negatively affect

aquatic resources downstream of the project. To reduce the negative effects of the City's proposed operation at inflows between 200 cfs and 554 cfs, the City could continue to operate in run-of-river mode at all inflows. The City could also operate under an alternative that allows impoundment level fluctuations at inflows between 555 cfs and 830 cfs and requires run-of-river operation at all other flows (table 3-8). This alternative operation would eliminate most of the expected negative effects of operating with impoundment level fluctuations at inflows less than 555 cfs, especially the negative effects of allowing no flow downstream.

Therefore, we do not recommend that the City operate with impoundment level fluctuations at inflows less than 555 cfs and greater than or equal to 200 cfs. Instead, we recommend the City operate the project in run-of-river, except during times when inflow is greater than 554 cfs and less than 831 cfs, during which the project could operate with impoundment level fluctuations of up to 1 foot below the crest of the dam. This mode of operation would not preclude the City from operating the project in run-of-river mode at all times, should it wish to do so. Because project operations under the City's proposal with staff's modification would generally follow the impoundment inflow peaks and troughs, as currently occurs, we estimate that the loss of generation relative to operations under existing conditions, would be minimal.

Maintenance Drawdowns

The City proposes to implement maintenance drawdowns by lowering the impoundment up to 1 foot below the crest of the dam when needed, but the City does not propose any limits on when the maintenance drawdowns could occur. As discussed in *Project Operation,* increasing and decreasing the impoundment surface elevation at inflows between 555 cfs and 830 cfs, would have the least impact on aquatic resources in the impoundment and downstream of the project. As discussed above in this section, we do not recommend operating with impoundment level fluctuations when inflows are between 555 cfs and 830 cfs, because of the potential for negative effects on aquatic resources downstream from the project. Increasing and decreasing the surface elevation of the impoundment between the crest of the dam and a level 1 foot below the crest of the dam for maintenance would affect flow and water levels in the same way as the proposed operational impoundment fluctuations. Consequently, conducting maintenance drawdowns when inflows are between 555 cfs and 830 cfs would also be most protective of aquatic resources. Therefore, we recommend that any maintenance drawdowns occur when flows are between 555 cfs and 830 cfs. There is no additional cost associated with this measure.

Operation Compliance Monitoring Plan

The City proposes to continue operating the project in run-of-river mode at inflows between 831 cfs and 3,000 cfs, but would operate with impoundment fluctuations between the dam crest and a level 1 foot below the crest of the dam when flows are

between 200 cfs and 830 cfs. As described above, we recommend that the City either continue to operate in run-of-river mode at all times, or operate in run-of-river mode at inflows greater than 830 cfs and less than 555 cfs with the ability to operate with impoundment level fluctuations between the dam crest and a level 1 foot below the crest of the dam when flows are between 555 cfs and 830 cfs. As discussed in section 3.3.2.2, *Project Operation*, such project operation would provide good water quality and habitat conditions at the project and support the fish and mussels in the project vicinity.

To ensure the project is operated as proposed, the City proposes to continue monitoring compliance with project operation using an automated computer system that: (1) continuously monitors and records the water levels in the impoundment and tailwater using laser sensors; and (2) shuts down generators and closes wicket gates when impoundment water levels approach 1 foot below the crest of the dam.

As discussed in section 3.3.1.2, *Operation Compliance Monitoring*, the automated turbine shut-off system and the continuous monitoring and recording of water levels upstream and downstream of the dam would allow the City to verify that run-of-river operations are maintained throughout the term of the license during normal operating conditions. Developing a formal project operation compliance monitoring plan would provide a mechanism for calibrating the monitoring system, reporting operational data and deviations, and facilitating administration of the license, which would ensure the protection of resources that are sensitive to water level fluctuations.

For reasons discussed above, we recommend that the City develop an operation compliance monitoring plan with provisions to: (1) provide a detailed description of the existing automated monitoring system used to monitor water levels in the impoundment and downstream of the dam; (2) provide the methods of calibrating the monitoring system; and (3) document compliance with project operation by recording, maintaining, and reporting water level and generation data, including deviations from run-of-river operation. We estimate that the annual levelized cost of developing an operation compliance monitoring plan would be $376, and conclude that the benefits of the plan outweigh the cost.

Aquatic Invasive Vegetation Monitoring and Control Plan

Alligatorweed is a prolific invasive weed that occurs in the littoral area of the project impoundment. It competes with native vegetation, reducing habitat quality for fish and wildlife where it becomes established. Mats may grow and cover extensive areas, which may impede boating and access to the shore. Disturbance to the littoral area where the alligatorweed occurs (e.g., use of the kayak dock and erosion of the riverbank), may fragment and spread alligatorweed to other locations within the project boundary or downstream of the project. The City does not propose any measures to monitor or control the spread of alligatorweed or other invasive plants that may become established in the project area.

Developing and implementing an aquatic invasive vegetation management plan would help to minimize the spread and adverse effects of alligatorweed during project operation, maintenance, and project-related recreation activities while the problem is still limited to the littoral area, which is accessible for vegetation maintenance. We recommend that the City develop an aquatic invasive vegetation management plan that includes provisions for identifying specific BMPs that should be taken to limit the spread of this species (e.g., allowing native vegetation to reestablish in the littoral and adjacent shoreline habitat) in areas around the kayak dock and powerhouse intakes. We also recommend periodic monitoring for alligatorweed in the same area, which will also facilitate the early detection of any new invasive plant introductions. Such monitoring would allow the City, the Texas PWD, and the Commission to determine when, and if, correction measures may be needed.

To be effective, the monitoring program should define the monitoring schedule, document any changes in invasive species composition and distribution between monitoring events, and include criteria that would determine when corrective actions may be required. Based on our review and analysis contained in section 3.3.3, *Terrestrial Resources*, the benefits of implementing an aquatic invasive vegetation management plan with the measures outlined above are worth the estimated levelized annual cost of $376.

Vegetation Management

The City proposes to continue managing a majority of the terrestrial habitat in the project boundary along the east side of the river, including trimming and mowing. We recommend that the City conduct migratory bird surveys and establish the Texas PWD's recommended buffer areas around nests prior to any tree or woody vegetation removal or trimming, if vegetation disturbance is done during the general migratory bird nesting season of March 15 to September 15, and from February through August if heron or egret rookeries are present. Implementing this recommendation would protect breeding and rearing migratory birds in the project area and is worth the estimated levelized annual cost of $725.

Cultural Resources

There are no known historic properties within the proposed project's APE. However, there is a possibility that unknown archaeological or historic resources may be discovered due to project operation or other project-related activities. To ensure proper treatment of any unknown cultural resources that may be discovered at the project, we recommend that, in the case of any such discovery, the City notifies and consults with the Texas SHPO and Alabama-Coushatta Tribe of Texas and: (1) cease project-related activities and determine if the discovered archaeological or historic resource is eligible for the National Register; (2) determine if continued operation of the project would adversely affect the resource; and (3) if the resource would be adversely affected, obtain

guidance from the Texas SHPO on how to avoid, lessen, or mitigate for any adverse effects. Also, we recommend that the City informs the Commission of any discovery of unknown cultural resource, and any measures proposed if the resource is eligible for the National Register and is adversely affected by project construction or operation.

Should the City contemplate making changes to authorized project operations or conducting land-clearing, or land-disturbing activities, additional consultation with the Texas SHPO and Alabama-Coushatta Tribe is warranted. In that case, we recommend that consultation should occur prior to the start of any ground-disturbing activities. There is no additional estimated cost associated with these measures.

5.1.3 Measures Not Recommended by Staff

Shoreline Stabilization during Construction

Texas PWD recommends that during construction, the City avoid soil stabilization materials that could entangle snakes and other wildlife. Texas PWD further recommends that the City use no-till drilling, hydromulching, and/or hydroseeding as alternatives to plastic mesh netting to stabilize exposed soils. The City does not propose construction or other ground-disturbing activities. Therefore, soil stabilization methods as recommended by Texas PWD are unwarranted at this time.

Stream Mitigation Plan

Texas PWD recommends that the City develop a stream mitigation plan in consultation with Texas PWD to mitigate for all impacts to aquatic resources. The City does not propose any mitigation measures. However, the City does propose to continue operating the project in a run-of-river mode, except during low flow conditions and maintenance, when impoundment fluctuations up to 1 foot below the crest of the dam could occur. The project would also continue to have a powerhouse trash rack and a lateral trash rack to minimize impingement and entrainment of fish.

As discussed above, we have not identified any project effects that would require mitigation, beyond ensuring that the City maintains compliance with its proposed operation (see section 5.1.2, *Additional Staff-recommended Measures*). Therefore, we do not recommend that the City develop a stream mitigation plan in consultation with Texas PWD to mitigate for all impacts to aquatic resources.

5.2 UNAVOIDABLE ADVERSE EFFECTS

Some entrainment mortality is likely unavoidable for adult eel migrating downstream, but based on the low abundance of eels in the Guadalupe River, any impacts would be minimal. Entrainment also is likely unavoidable for some resident fish species. Most adult fish could avoid involuntary entrainment, but entrainment of some small fish

(e.g., gizzard shad, bluegill, redear sunfish, bullhead minnow) could still occur. Additionally, during operational impoundment fluctuations and maintenance drawdowns, some dewatering of shallow water nests is likely unavoidable for a small number of sunfish or bass that might spawn in water less than or equal to 1 foot in the impoundment.

5.3 FISH AND WILDLIFE AGENCY RECOMMENDATIONS

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission should include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, and enhancement of fish and wildlife resources affected by the project. No agency submitted fish and wildlife recommendations pursuant to section 10(j) of the FPA.

5.4 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2)(A) of the FPA, 16 U.S.C. § 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. We reviewed 12 qualifying comprehensive plans that are applicable to the Gonzales Project, located in Texas. No inconsistencies were found.

The following is a list of qualifying comprehensive plans relevant to the Gonzales Project:

Gulf States Marine Fisheries Commission. 2006. The striped bass fishery of the Gulf of Mexico, United States: A regional management plan. Ocean Springs, Mississippi. March 2006.

Texas Parks and Wildlife Department. 1988. The Texas wetlands plan: addendum to the 1985 Texas outdoor recreation plan. Austin, Texas. May 1988.

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Texas State Soil and Water Conservation Board. 1981. Soil and water conservation: the Texas approach. Temple, Texas. August 1981.

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6.0 FINDING OF NO SIGNIFICANT IMPACT

If the Gonzales Project is relicensed with our recommended measures, the project would continue to operate with little effect on aquatic or terrestrial resources, while providing public recreation access to the Guadalupe River.

Based on our independent analysis, issuance of a subsequent license for the Gonzales Project, with additional staff-recommended measures, would not constitute a major federal action significantly affecting the quality of the human environment.

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_____. 2017c. Appendix B – Inventory of Botanical Resources, Gonzales Dam Hydroelectric Project, Gonzales County, Texas. Filed November 27, 2017.

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APPENDIX A

Draft License Articles

Article 3XX. *Project Modification Resulting from Environmental Requirements.* If environmental requirements under this license require modification that may affect the project works or operations, the licensee must consult with the Commission's Division of Dam Safety and Inspections (D2SI) — Atlanta Regional Engineer. Consultation must allow sufficient review time for the Commission to ensure that the proposed work does not adversely affect the project works, dam safety, or project operation.

Article 4XX**.** *Project Operation*. The licensee must operate the project in a run-of-river mode, except at inflows greater than 554 cfs and less than 831 cfs, when the project may be operated with impoundment fluctuations between the dam crest (elevation 260 feet above mean sea level) and a level 1 foot below the crest of the dam. When operating in a run-of-river mode, the licensee must maintain a target impoundment elevation at the dam crest and at all times act to minimize the fluctuation of the impoundment surface elevation by maintaining a discharge from the project such that the average daily outflow approximately equals the average daily inflow.

Planned Deviations

Run-of-river operation and the impoundment level fluctuation limit may be temporarily modified for short periods, of up to 3 weeks, after mutual agreement among the licensee, the U.S. Fish and Wildlife Service, the Texas Parks and Wildlife Department, and the Texas Department of Environmental Quality (collectively resource agencies). After concurrence from the resource agencies, the licensee must file a report with the Secretary of the Commission as soon as possible, but no later than 14 calendar days after the onset of the planned deviation. Each report must include: (1) the reasons for the deviation and how project operations were modified; (2) the duration and magnitude of the deviation; (3) any observed or reported environmental effects; and (4) documentation of consultation with the resource agencies. For planned deviations exceeding 3 weeks, the licensee must file an application for a temporary amendment of the operational requirements of this license, and receive Commission approval prior to implementation.

Unplanned Deviations

Run-of-river operation and the impoundment level fluctuation limit be temporarily modified if required by operating emergencies beyond the control of the licensee (*i.e.*, unplanned deviations). For any unplanned deviation that lasts longer than 3 hours **or** results in visible environmental effects such as a fish kill, a turbidity plume, bank erosion, or downstream flooding, the licensee must file a report as soon as possible with the

resource agencies, and with the Commission no later than 14 calendar days after the onset of each such incident. The report must include (1) the cause of the deviation; (2) the duration and magnitude of the deviation; (3) any pertinent operational and/or monitoring data; (4) a timeline of the incident and the licensee's response; (5) any comments or correspondence received from the resource agencies, or confirmation that no comments were received from the resource agencies; (6) documentation of any observed or reported environmental effects; and (7) a description of measures implemented to prevent similar deviations in the future.

For unplanned deviations lasting 3 hours or less that do not result in visible environment effects, the licensee must file an annual report, by March 1, describing each incident that occurred during the prior January 1 through December 31 time period. The report must include for each 3 hour or less deviation: (1) the cause of the deviation; (2) the duration and magnitude of the deviation; (3) any pertinent operational and/or monitoring data; (4) a timeline of the incident and the licensee's response; (5) any comments or correspondence received from the resource agencies, or confirmation that no comments were received from the resource agencies; and (6) a description of measures implemented to prevent similar deviations in the future.

Article 4XX. *Maintenance drawdowns*. The commencement of maintenance drawdowns must occur when inflows are less than 831 cfs and greater than 554 cfs. Maintenance drawdowns must not exceed one foot below the dam crest.

Planned Deviations

The commencement of maintenance drawdowns may be temporarily modified after mutual agreement among the licensee, the U.S. Fish and Wildlife Service, the Texas Parks and Wildlife Department, and the Texas Department of Environmental Quality (collectively resource agencies). After concurrence from the resource agencies, the licensee must file a report with the Secretary of the Commission as soon as possible, but no later than 14 calendar days after the onset of the planned deviation. Each report must include: (1) the reasons for the deviation and how project operations were modified; (2) the duration and magnitude of the deviation; (3) any observed or reported environmental effects; and (4) documentation of consultation with the resource agencies. For planned deviations exceeding 3 weeks, the licensee must file an application for a temporary amendment of the operational requirements of this license, and receive Commission approval prior to implementation.

Unplanned Deviations

The commencement of maintenance drawdowns may be temporarily modified if required by operating emergencies beyond the control of the licensee (*i.e.*, unplanned deviations). For any unplanned deviation that lasts longer than 3 hours **or** results in visible environmental effects such as a fish kill, a turbidity plume, bank erosion, or

downstream flooding, the licensee must file a report as soon as possible with the resource agencies, and with the Commission no later than 14 calendar days after the onset of each such incident. The report must include (1) the cause of the deviation; (2) the duration and magnitude of the deviation; (3) any pertinent operational and/or monitoring data; (4) a timeline of the incident and the licensee's response; (5) any comments or correspondence received from the resource agencies, or confirmation that no comments were received from the resource agencies; (6) documentation of any observed or reported environmental effects; and (7) a description of measures implemented to prevent similar deviations in the future.

For unplanned deviations lasting 3 hours or less that do not result in visible environment effects, the licensee must file an annual report, by March 1, describing each incident that occurred during the prior January 1 through December 31 time period. The report must include for each 3 hour or less deviation: (1) the cause of the deviation; (2) the duration and magnitude of the deviation; (3) any pertinent operational and/or monitoring data; (4) a timeline of the incident and the licensee's response; (5) any comments or correspondence received from the resource agencies, or confirmation that no comments were received from the resource agencies; and (6) a description of measures implemented to prevent similar deviations in the future.

Article 4XX. *Operation Compliance Monitoring Plan*. Within 90 days of license issuance, the licensee must file for Commission approval, an operation compliance monitoring plan that describes how the licensee will document compliance with the operational and maintenance drawdown requirements of this license.

The plan must include, at a minimum:

(1) a detailed description of how the licensee will document compliance with the operational and maintenance drawdown requirements of the license required by Article 4XX and Article 4XX, including use of the existing automated monitoring system to monitor water levels in the impoundment and downstream of the dam;

(2) the method of calibrating the automated monitoring system;

(3) the recording frequency for water level monitoring;

(4) a provision to maintain a log of project generation data;

(5) procedures for recording, maintaining, and reporting the monitoring data to the Commission and agencies;

(6) a provision for reporting deviations from the operational requirements of this license to the Commission as soon as possible, but no later than 10 days after discovery, along with proposed actions that will be taken to avoid recurrence of the deviation.

The licensee must prepare the plan after consultation with the the U.S. Fish and Wildlife Service, the Texas Parks and Wildlife Department, and the Texas Department of Environmental Quality. The licensee must include with the plan, documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how agency comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

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

Article 4XX. *Aquatic Invasive Vegetation Management Plan*. Within one year of license issuance, the licensee must file with the Commission, for approval, a plan to monitor and control aquatic invasive species (and/or noxious weeds) within the project boundary in the littoral area between the project's kayak dock and powerhouse intakes. The purpose of this plan is to minimize the spread of alligatorweed or other aquatic invasive species that may affect use of the project's kayak dock and intakes. The plan must include, but not necessarily be limited to, the following:

(1) a description of the treatment area(s) that includes the acreage(s) to be treated and a map of existing aquatic invasive species (and/or noxious weed) populations (i.e., alligatorweed);

(2) a description of the techniques (i.e., manual, mechanical, and chemical) to be followed to control invasive (and/or noxious) species and best management practices to be followed to minimize the subsequent reintroduction and spread of these species, including the reestablishment of native vegetation;

(3) a schedule for filing reports with the Commission on the control efforts conducted under this article; and

(4) an implementation schedule.

The licensee must prepare the plan after consultation with the Texas Parks and Wildlife Department. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the

plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

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

Article 4XX. *Vegetation Management.* For each tree trimming or woody vegetation disturbance event that occurs at the project during the migratory bird nesting season of February 1 through September 15, the licensee must conduct a survey prior to the event in the projected area of the trimming or disturbance to determine the presence of active migratory bird nesting and fledging.

If the licensee determines through the survey that migratory birds are actively nesting or fledging at or near the area of the planned trimming or disturbance activity, the license must not conduct any trimming or disturbance activity:

(a) within 25 feet in diameter from any migratory bird nest until all young have fledged; and

(b) within 300 meters (984 feet) of any heron or egret rookery periphery.

In addition, during the period from February 1 through August 31, the licensee must not use heavy machinery within 1,000 meters (3281 feet) of any heron or egret rookery periphery.

The licensee must maintain documentation of: (1) each trimming and woody vegetation event, including the dates of the event; and (2) each survey and associated results.

Article 4XX. *Recreation Facilities*. The licensee must continue to operate and maintain the tailrace fishing area and kayak dock, including associated recreation and safety signage.

Article 4XX. *Protection of Previously Undiscovered Cultural Resources.* If the licensee discovers any unidentified cultural resources during construction, operation, or maintenance of project works or other facilities at the project, the licensee must stop all land-clearing and land-disturbing activities in the vicinity of the resource and consult with the Texas State Historic Preservation Officer (SHPO) and Alabama-Coushatta Tribe of Texas to determine the need for any cultural resource studies or measures. If no studies or measures are needed, the licensee must file with the Commission documentation of its consultation with the Texas SHPO and Alabama-Coushatta Tribe of Texas.

If a discovered cultural resource is determined to be eligible for the National Register of Historic Places (National Register), the licensee must file for Commission approval a historic properties management plan (HPMP) prepared by a qualified cultural resource specialist after consultation with the Texas SHPO. In developing the HPMP, the licensee must use the Advisory Council on Historic Preservation and the Federal Energy Regulatory Commission's *Guidelines for the Development of Historic Properties Management Plans for FERC Hydroelectric Projects*, dated May 20, 2002. The HPMP must include the following items: (1) a description of each discovered property, indicating whether it is listed in or eligible to be listed in the National Register; (2) a description of the potential effect on each discovered property; (3) proposed measures for avoiding or mitigating adverse effects; (4) documentation of consultation; and (5) a schedule for implementing mitigation and conducting additional studies. The Commission reserves the right to require changes to the HPMP.

The licensee must not resume land-clearing or land-disturbing activities in the vicinity of a cultural resource discovered during construction, until informed by the Commission that the requirements of this article have been fulfilled.

Article 4XX. *Protection of Cultural Resources.* Prior to implementing any project modifications not specifically authorized by this license, including but not limited to, land-clearing or land-disturbing activities, or changes to project operation or facilities, the licensee must consult with the Texas State Historic Preservation Officer (SHPO) and Alabama-Coushatta Tribe of Texas to determine the effects of the activities and the need for any cultural resource studies or measures. If no studies or measures are needed, the licensee must file with the Commission documentation of its consultation with the Texas SHPO and Alabama-Coushatta Tribe of Texas.

If a project modification is determined to affect an historic property, the licensee must file for Commission approval a Historic Properties Management Plan (HPMP) prepared by a qualified cultural resource specialist after consultation with the Texas SHPO. In developing the HPMP, the licensee must use the Advisory Council on Historic Preservation and the Federal Energy Regulatory Commission's *Guidelines for the Development of Historic Properties Management Plans for FERC Hydroelectric Projects*, dated May 20, 2002. The HPMP must include the following items: (1) a description of each historic property; (2) a description of the potential effect on each historic property; (3) proposed measures for avoiding or mitigating adverse effects; (4) documentation of the nature and extent of any consultation; and (5) a schedule for implementing mitigation and conducting additional studies.

The Commission reserves the right to require changes to the HPMP. The licensee must not implement any project modifications, other than those specifically authorized in this license, until informed by the Commission that the requirements of this article have been fulfilled.

Article 411. *Use and Occupancy*. (a) In accordance with the provisions of this article, the licensee must have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain types of use and occupancy, without prior Commission approval. The licensee may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the licensee must also have continuing responsibility to supervise and control the use and occupancies for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the licensee for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the licensee must take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, canceling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The type of use and occupancy of project lands and waters for which the licensee may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities that can accommodate no more than 10 water craft at a time and where said facility is intended to serve single-family type dwellings; (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline; and (4) food plots and other wildlife enhancement. To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the licensee must require multiple use and occupancy of facilities for access to project lands or waters. The licensee must also ensure, to the satisfaction of the Commission's authorized representative, that the use and occupancies for which it grants permission are maintained in good repair and comply with applicable state and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the licensee must: (1) inspect the site of the proposed construction, (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (3) determine that the proposed construction is needed and would not change the basic contour of the impoundment shoreline. To implement this paragraph (b), the licensee may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the licensee's costs of administering the permit program. The Commission reserves the right to require the licensee to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modification of those standards, guidelines, or procedures.

(c) The licensee may convey easements or rights-of-way across, or leases of project lands for: (1) replacement, expansion, realignment, or maintenance of bridges or roads where all necessary state and federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69-kV or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project impoundment. No later than January 31 of each year, the licensee must file three copies of a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed.

(d) The licensee may convey fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary state and federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary federal and state water quality certification or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary federal and state approvals have been obtained; (5) private or public marinas that can accommodate no more than 10 water craft at a time and are located at least one-half mile (measured over project waters) from any other private or public marina; (6) recreational development consistent with an approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is five acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from project waters at normal surface elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year. At least 60 days before conveying any interest in project lands under this paragraph (d), the licensee must file a letter with the Commission, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked Exhibit G map may be used), the nature of the proposed use, the identity of any federal or state agency official consulted, and any federal or state approvals required for the proposed use. Unless the Commission's authorized representative, within 45 days from the filing date, requires the licensee to file an application for prior approval, the licensee may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraph (c) or (d) of this article:

(1) Before conveying the interest, the licensee must consult with federal and state fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the licensee must determine that the proposed use of the lands to be conveyed is not inconsistent with any approved report on recreational resources of an Exhibit E; or, if the project does not have an approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include the following covenants running with the land: (i) the use of the lands conveyed must not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; (ii) the grantee must take all reasonable precautions to ensure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project; and (iii) the grantee must not unduly restrict public access to project waters.

(4) The Commission reserves the right to require the licensee to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised Exhibit G drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project must be consolidated for consideration when revised Exhibit G drawings would be filed for approval for other purposes.

(g) The authority granted to the licensee under this article must not apply to any part of the public lands and reservations of the United States included within the project boundary.