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APPLICATION FOR LICENSE FOR MAJOR PROJECT – EXISTING DAM

LAKE LIVINGSTON HYDROELECTRIC PROJECT

DRAFT APPLICANT – PREPARED ENVIRONMENTAL ASSESSMENT (FILED IN LIEU OF EXHIBIT E)

FEDERAL ENERGY REGULATORY COMMISSION FERC PROJECT NO. 12632

VOLUME 2 OF 2

PREPARED FOR:

EAST TEXAS ELECTRICAL COOPERATIVE, INC.

ETEC
East Texas Electric Cooperative

PAUL C. RIZZO ASSOCIATES, INC.
EXPO MART, SUITE 270-E
105 MALL BOULEVARD
MONROEVILLE, PENNSYLVANIA USA 15146

PROJECT NO. 06-3645
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eering & Construction Management
Hydro-Nuclear-Fossil
Geotechnical Engineering
Seismic and Structural Engineering
ydrological & Hydraulic Engineering
Tunnel Engineering
onmental Engineering & Permitting

EAST TEXAS ELECTRIC COOPERATIVE, INC.

LAKE LIVINGSTON HYDROELECTRIC PROJECT
DRAFT APPLICANT-PREPARED ENVIRONMENTAL ASSESSMENT
MAJOR 24-MEGAWATT ELECTRIC GENERATING PROJECT ON EXISTING DAM

FERC PROJECT NO. 12632

DRAFT

PREPARED FOR EAST TEXAS ELECTRIC COOPERATIVE, INC.
BY

PAUL C. RIZZO ASSOCIATES, INC.
EXPO MART, SUITE 270-E
105 MALL BOULEVARD
MONROEVILLE, PENNSYLVANIA 15146
TELEPHONE: (412) 856-9700
TELEFAX: (412) 856-9749
WWW.RIZZOASSOC.COM

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ACRONYMS AND ABBREVIATIONS

AF	acre-feet
ALP	Alternative Licensing Process
APE	area of potential effect
APEA	applicant-prepared environmental assessment
º C	degree Celsius
BMP	best management practice
BOD	biochemical oxygen demand
CFR	Code of Federal Regulations
cfs	cubic feet per second
Chla	chlorophyll a
CMP	Coastal Management Program
Commission	Federal Energy Regulatory Commission
Cooperative	East Texas Electric Cooperative, Inc.
Corps	U.S. Army Corps of Engineers
Council	Texas Coastal Coordinating Council
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
DDT	dichloro-diphenyl-trichloroethane
DO	dissolved oxygen
DOI	U.S. Department of the Interior
EA	environmental assessment
EFH	essential fish habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
º F	degree Fahrenheit
FERC	Federal Energy Regulatory Commission
ft	feet/foot
FPA	Federal Power Act
FWS	U.S. Fish and Wildlife Service
GLO	General Land Office
Gulf Council	Gulf of Mexico Fishery Management Council
GWH	gigawatt-hours
HPA	high probability area
HPMP	historic properties management plan
kV	kilovolt
l	liter
MCL	maximum contaminant level
mg/l	milligrams per liter
ml	milliliters

ACRONYMS AND ABBREVIATIONS
(CONTINUED)

msl	mean sea level
MOA	Memorandum of Agreement
MW	megawatt
NERC	North American Electric Reliability Council
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
National Register	National Register of Historic Places
NWI	National Wetlands Inventory
PA	Programmatic Agreement
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
Project	Lake Livingston Hydroelectric Project
ROW	right-of-way
RPS	renewable portfolio standard
SERC	SERC Reliability Corporation
SH	state highway
SHPO	State Historic Preservation Officer
STP	sewage treatment plant
SWPPP	Storm Water Pollution Prevention Plan
Texas ARL	Texas Archeological Research Laboratory
Texas CEQ	Texas Commission on Environmental Quality
Texas DWR	Texas Department of Water Resources
Texas HC	Texas Historical Commission
Texas HM	Texas Historic Marker
TMDL	total maximum daily load
Texas NRCC	Texas Natural Resources Conservation Commission
Texas PWD	Texas Parks and Wildlife Department
TRA	Trinity River Authority of Texas
Texas SHA	Texas State Historical Association
Texas WDB	Texas Water Development Board
Texas DOT	Texas Department of Transportation
ug/l	micrograms per liter
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
UT	The University of Texas at Austin
WQC	water quality certification

EXECUTIVE SUMMARY

The East Texas Electric Cooperative, Inc. (Cooperative) proposes to construct the 24-megawatt Lake Livingston Hydroelectric Project (Project) that will utilize the existing Lake Livingston Dam and Reservoir located on the Trinity River in southeastern Texas. The dam and reservoir are owned and operated by the Trinity River Authority of Texas (TRA), and the impoundment occupies portions of Polk, San Jacinto, Trinity and Walker Counties. The Cooperative is a wholesale electric provider for ten distribution electric cooperatives in East Texas. The Project would have an estimated annual generation of 124 gigawatt-hours, which would provide hydroelectric generation to meet a portion of Texas's and regional needs for energy, capacity, and resource diversity. Although the entire dam and reservoir would be included in the proposed Project boundary, about 45 acres of land would be occupied by the proposed new generating facilities, ancillary structures and 2.8-mile-long transmission line corridor. This draft Applicant-Prepared Environmental Assessment (APEA) evaluates the potential natural resource benefits, environmental effects, and economic costs associated with licensing the proposed Project.

Proposed Action

The proposed hydroelectric facilities would be located on the east shore of the Trinity River, adjacent to and below the existing Lake Livingston Dam. The existing facilities include the dam, reservoir, spillway, outlet works, a downstream tailwater control weir, service buildings, and a service road. The proposed Project would consist of a headrace channel, an intake structure, an earth embankment, three steel penstocks, a powerhouse built of reinforced concrete housing three turbine/generator units, a riprap-lined tailrace channel, an electric switchyard, a single circuit overhead 138-kV primary transmission line, and new paved or compacted gravel access roads. The existing and proposed Project facilities are described in more detail in ***Section 2.2***, Applicant's Proposal.

The Project would be operated in a run-of-river mode consistent with TRA's existing operational regime for Lake Livingston. The proposed hydropower operations would not affect the quantity and timing of flows in the Trinity River downstream of the Project tailrace. Further, the Project is not expected to modify existing water surface elevations in the reservoir. Nevertheless, the Cooperative proposes measures for the protection and enhancement of environmental resources. Some of these measures would include installing dissolved oxygen (DO) and temperature monitors in the Project headrace area, in the stilling basin between the spillway and the weir (temporarily), and in the Trinity River downstream of the tailrace discharge, implementing a striped bass monitoring program, installing equipment to inject air or oxygen into water diverted for power generation when DO reaches critical levels, developing and implementing a historic properties management plan, and developing and implementing an erosion and

sediment control plan. The complete list of mitigation, protection, and enhancement measures proposed by the Cooperative are presented and described in detail in ***Section 2.2.4***.

Alternatives Considered

The EA analyzes the effects of project construction and operation and recommends conditions for an original license for the Project. In addition to the Cooperative's proposal, we considered two alternatives: (1) Cooperative's proposal with staff-recommended measures (Staff Alternative) and (2) no action – the Project would not be constructed.

Under the Cooperative's proposal with staff-recommended measures, the Project would be operated as proposed by the Cooperative, but would include the following additional or modified measures: [*to be completed by FERC staff*]

Public Involvement and Areas of Concern

Before filing its license application, the Cooperative conducted prefiling consultation under the alternative licensing process. The intent of the Federal Energy Regulatory Commission's (Commission or FERC) prefiling process is to initiate public involvement early in the project planning and encourage citizens, governmental entities, tribes, and other interested parties to identify and resolve issues prior to the formal filing of an application with the Commission. After the Cooperative's Pre-Application Document was filed, we conducted scoping to determine what issues and alternatives should be addressed. We distributed a scoping document on February 27, 2008, and held scoping meetings in the Project vicinity on March 26, 2008. After the Cooperative filed its Application for License, we requested comments, terms, and conditions in response to the Notice of Acceptance of Application for License issued on _____ ___, 2009.

The primary issue associated with licensing the Project is the potential impact on downstream water quality and fishery resources. To assess these potential effects, the Cooperative conducted aquatic resources studies and a water quality modeling study during the pre-application period, and proposes to conduct post-construction monitoring of temperature and water quality at the Project's intake facilities, below the tailrace discharge, and in the stilling basin between the existing spillway and tailwater control weir.

Project Effects

Aquatic Resources

The potential aquatic impacts from the proposed Project are summarized as follows:

- The Project would be operated as a run-of-river facility; therefore, there would be no fluctuations of either Lake shoreline or downriver shoreline over those which would otherwise occur.
- Water quality differences might occur only when the majority of water is diverted through the hydroelectric facility. Changing the location in which the water is released from the spillway to the tailrace may marginally change water quality in the river compared to existing conditions.
- Some flow will be maintained through the spillway gates for maintenance of the fish population upstream of the weir. No significant water quality change in the stilling basin is expected.
- DO near the surface of the Lake would remain well above the stream standard during the majority of the year. For the periods in which DO might fall below the water quality standard, the Cooperative proposes to implement a DO monitoring plan and DO enhancement measures to insure adequate DO levels are maintained in the Trinity River downstream of the dam.
- The discharge through the facility is expected to be below the temperature standard established by Texas Commission on Environmental Quality (Texas CEQ) for Lake Livingston and the downstream river. The Cooperative proposes to work with the Texas Parks and Wildlife Department (Texas PWD) to address any thermal impacts of the Project on striped bass.
- The Cooperative will use Kaplan turbines that will enhance the probability of safe passage of turbine-entrained fish and promote their survival.
- No significant impact on American eel and paddlefish is expected.
- Little change is expected in physical habitat compared to existing conditions.

Geological and Soil Resources

The proposed Project would result in short-term increases in turbidity in the Trinity River near the dam site during construction. Best Management Practices (BMPs), including sedimentation and erosion control plans, will be implemented to control erosion and sediment entering the river.

Terrestrial Resources

Construction of the proposed Project would impact approximately 45 acres of terrain. Most of this area, along the transmission corridor, is pasture land or open field with only a small area of woody vegetation. The hydroelectric generation plant and ancillary facilities would impact a footprint area of about 12 acres, all of which is on lands previously disturbed during the construction of Lake Livingston Dam. This area consists primarily of early successional stage scrub vegetation and maintained lawn, which is not a unique or valuable habitat. Minimal impact on wildlife habitat is expected.

Threatened and Endangered Species

The proposed Project is not anticipated to have any adverse impacts on threatened and endangered species.

Recreation and Land Use

With the exception of the land to be occupied by the proposed hydroelectric and transmission line facilities, there would be no significant long-term impacts on land use within the Project area. Construction of the proposed Project would not displace or otherwise adversely affect existing recreational resources.

Cultural Resources

The proposed Project would not affect any known cultural resources. The Cooperative will implement a Historic Properties Management Plan (HPMP) to avoid or mitigate impacts to historic properties encountered during Project construction or operation.

Aesthetic Resources

The hydroelectric and transmission line facilities will be designed in such a way as to minimize visually aesthetic impacts.

Under the no-action alternative, the Project would not be constructed, environmental conditions would remain the same, additional renewable energy would not be provided through hydropower development at this site, and environmental enhancement measures would not be provided.

Conclusions

Based on our analysis, we recommend licensing the project as proposed by the Cooperative with some staff modifications and additional measures, as described above under Alternatives Considered.

In section 4.1 of the EA, we estimate the annual net benefits of operating and maintaining the project under the three alternatives identified above. Our analysis shows that the annual net benefit would be $_________ for the proposed action; $__________ for the staff alternative; and zero for the no-action alternative.

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

We chose the staff alternative as the preferred alternative because: (1) the project would provide a dependable source of electrical energy for the region (124,000 megawatt-hours annually); (2) the 24 MW of electric energy generated from a renewable resource may offset the use of fossil-fueled, steam-electric generating plants, thereby conserving nonrenewable resources and reducing atmospheric pollution; and (3) the recommended environmental measures proposed by the Cooperative, as modified by staff, would adequately protect and enhance environmental resources affected by the project. The overall benefits of the staff alternative would be worth the cost of the proposed and recommended environmental measures.

MAJOR 24-MEGAWATT ELECTRIC GENERATING PROJECT ON EXISTING DAM

DRAFT APPLICANT-PREPARED ENVIRONMENTAL ASSESSMENT

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

Prepared for East Texas Electric Cooperative, Inc.
by Paul C. Rizzo Associates, Inc.

Lake Livingston Hydroelectric Project
FERC Project No. 12632 – Texas

1.0 INTRODUCTION

1.1 APPLICATION

On [March 31, 2009], East Texas Electric Cooperative, Inc. (Cooperative) submitted an application for original license for the Lake Livingston Hydroelectric Project (Project). By letter order dated February 20, 2008, the Federal Energy Regulatory Commission (Commission or FERC) approved the Cooperative's request to utilize alternative licensing procedures (ALP) under Section 4.34(i) of the Commission's regulations, along with a process plan and schedule and communications protocol for the licensing procedures.

The proposed 24-megawatt (MW) Project will utilize the existing Lake Livingston Dam and Reservoir located on the Trinity River in Polk, San Jacinto, Trinity, and Walker Counties in southeastern Texas. The proposed generation facilities will be located at the east end of the dam, approximately 7 miles southwest of the City of Livingston, Texas. The proposed Project also includes a 138-kilovolt (kV) primary transmission line, approximately 2.8 miles in length, which will connect the hydroelectric generating plant to the Entergy transmission system at a substation near Goodrich, Texas.

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

Under Part I of the Federal Power Act, any entity that proposes to construct or operate a hydroelectric power plant on federal lands, in navigable waters, or in other waters of the United States where the proposed Project will have an effect on interstate commerce, must first obtain a license from the Commission.

The Commission must decide whether to issue a license to the Cooperative for the Project and what conditions should be placed in 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 (e.g., flood control, irrigation and water supply), the Commission must give equal consideration to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of fish and wildlife (including related spawning grounds and habitat), the protection of recreational opportunities, and the preservation of other aspects of environmental quality.

Issuing an original license for the Lake Livingston Hydroelectric Project would allow the Cooperative to generate electricity at the Project for the term of the license, making electric power from a renewable resource available to its customers.

This Draft Environmental Assessment (EA) assesses the effects associated with construction and operation of the Project, alternatives to the proposed 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.

In this draft EA, we assess the environmental and economic effects of constructing and operating the Project: (1) as proposed by the Cooperative; and (2) with our recommended measures. We also consider the effects of the no action alternative. Important issues that are addressed include maintenance of water quality, particularly with respect to dissolved oxygen, and temperature in the spillway stilling basin and tailwater discharge areas, and fish passage.

1.2.2 Need for Power

The proposed Lake Livingston Project would provide hydroelectric generation to meet a portion of Texas's and regional needs for capacity, energy, and resource diversity.

The Project would have an installed generating capacity of 24 megawatts (MW) and is projected to produce an average of 124 Gigawatt-hours (GWH) of energy annually. [1]

The North American Electric Reliability Council (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The proposed Lake Livingston Hydroelectric Project would be located in the southwestern edge of the Delta sub-region of the SERC Reliability Corporation (SERC) of the NERC. According to NERC's 2008 forecast, peak demand requirements for the SERC region are expected to grow at an average annual rate of 1.94 percent from 2008 through 2017 (from 198,522 MW in 2008 to 236,070 MW in 2017). NERC projects resource capacity margins (generating capacity in excess of demand) will decline from approximately 26 percent in 2008 to 10 percent in 2017, based upon data filed in the annual EIA-411 form and supplemented by generation associated with executed interconnection agreements. Over the next ten years, SERC estimates that about 7,700 MW of additional capacity will be brought on line (NERC, 2008).

In 1999, the Texas Legislature enacted SB 7, which restructured electric utilities in the State. SB 7 also created a renewable portfolio standard (RPS) for competitive utilities and established a target for development of an additional 2,000 MW of renewable energy resources, including hydropower, by the year 2008. The Texas Legislature expanded and extended the State's renewable energy targets in 2005 by enacting SB 20. As codified in Texas Utilities Code § 39.904(a), SB 20 establishes a cumulative target for additional electric generating capacity from renewable energy technologies at:

- 2,280 MW of renewable capacity by January 1, 2007;
- 3,272 MW of renewable capacity by January 1, 2009;
- 4,264 MW of renewable capacity by January 1, 2011;
- 5,256 MW of renewable capacity by January 1, 2013; and
- 5,880 MW of renewable capacity by January 1, 2015.

[1] The projected annual energy generation of 124 GWh is based upon a minimum flow of 200 cfs released through the dam's spillway gates. With no minimum flows released, the hydroelectric facilities would be capable of producing approximately 130 GWh annually. As discussed in Section 2.2.4, the Cooperative proposes to conduct post-licensing monitoring to determine the level of minimum flow needed to maintain viable conditions in the spillway stilling basin above the weir. Those flows may vary from 50 to 200 cfs.

In addition, § 39.904(a) establishes a target of 10,000 MW of additional installed renewable energy capacity by January 1, 2025. At least 500 MW of capacity must come from renewable energy sources other than wind energy, including hydro, geothermal, biomass, and solar power. [2] The proposed Lake Livingston Hydroelectric Project would help meet the State's goal for development of new renewable generation resources, particularly non-wind generation.

We conclude that power from the Project would help meet a need for power in the SERC region in both the short and long-term. Additionally, the Project would help meet Texas's statutory goals for development of non-wind renewable generation. The Project provides economic power that displaces nonrenewable, fossil-fired generation and contributes to a diversified generation mix. Displacing the operation of fossil fueled facilities may avoid some power plant emissions and creates an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

A license for the Lake Livingston Hydroelectric Project is subject to numerous requirements under the Federal Power Act and other applicable statutes. The major regulatory and statutory requirements are summarized in ***Table 1*** and described below:

2 To promote renewable energy development and help utilities meet the RPS standards, the Public Utility Commission of Texas (PUCT) established a renewable-energy credit (REC)-trading program that began in July 2001 and will continue through 2019. Under PUCT rules, one REC represents one megawatt-hour (MWh) of qualified renewable energy that is generated and metered in Texas. A capacity conversion factor (CCF) is used to convert MW goals into MWh requirements for each retailer in the competitive market.

Pursuant to meeting the 500 MW non-wind goal contained in S.B. 20 of 2005, the PUCT has elected to award a "compliance premium" for each non-wind REC generated after December 31, 2007. Compliance premiums are functionally equivalent to an REC for the RPS compliance purposes and may only be awarded to non-wind facilities that were installed and certified by the PUCT after September 1, 2005. This method effectively doubles the compliance value of electricity generated by renewable resources other than wind.

Table 1. Major Statutory and Regulatory Requirements for the Lake Livingston Hydroelectric Project

REQUIREMENT	AGENCY	STATUS
Section 18 of the FPA (fishway prescriptions)	FWS, NMFS	[pending]
Section 10(j) of the FPA	FWS, Texas Parks & Wildlife	[pending]
Clean Water Act, § 401 water quality certification	Texas CEQ	Application for certification received ______, 2009; due ____________.
Endangered Species Act consultation	FWS, NMFS	Commission determined Project not likely to adversely affect listed species [FWS-NMFS sign-off pending]
Coastal Zone Management Act Consistency	Texas Coastal Coordination Council (staffed by Texas General Land Office)	Project determined not subject to Texas Coastal Management Program (8/23/07)
Section 106, National Historic Preservation Act consultation	Texas Historical Commission (SHPO)	Consultation concluded; programmatic agreement and HPMP to be implemented.

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 Secretaries of Commerce or the U.S. Department of the Interior. The Commission issued a solicitation for preliminary terms, conditions, and recommendations, including Section 18 prescriptions, with its Notice of Acceptance of Application for License on ____, 2009. The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) [did not file any fishway prescriptions pursuant to Section 18 in response to the Commission's request for terms, conditions, and recommendations]. [*Tentative – pending agencies' response*]

1.3.1.2 Section 10(j) Recommendations

Under Section 10(j) for 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 proposed 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.

On ______ ___, 2009, FWS and Texas PWD timely submitted recommended conditions under Section 10(j) as summarized in ***Section 5.4***, Recommendations of Fish and Wildlife Agencies. In ***Section 5.4***, we also discuss how we address the agency recommendations and comply with Section 10(j).

1.3.2 Clean Water Act

Under the Section 401 of the Clean Water Act (CWA), a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the CWA. On _______, 2009, the Cooperative applied to the Texas Commission on Environmental Quality (Texas CEQ) for 401 water quality certification (WQC) for the Lake Livingston Project. The Texas CEQ received this request on _________ ___, 2009. The Texas CEQ has not yet acted on the request. The WQC is due by _________ ___, 2010.

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. There are five federally listed fauna species[3] and two federally listed flora species[4] that may occur in one or more of the four counties occupied by the proposed Project. Several species designated as candidates for federal listing also have been identified as potentially occurring in the four-county area. None of the listed or candidate species has been specifically identified as being present within the proposed Project boundary or in the area of impact downstream of the hydropower facilities. Nor has any critical habitat been designated within those areas. Our analysis of potential Project effects on threatened and endangered species is presented in ***Section 3.3.4***, Threatened and Endangered Species.

Based on the best available information, we conclude that the proposed construction, operation, and maintenance of the Lake Livingston Hydroelectric Project, with our recommended measures, are not likely to adversely affect any of the above-referenced federally listed species. Formal consultation with FWS is therefore unnecessary. We requested FWS concurrence with our conclusion by letter dated ______ ___, 2009. FWS concurred with our determination on ______ ___, 2009.

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[3] Piping Plover (*Charadrius melodus*); Red-cockaded Woodpecker (*Picoides borealis*); Louisiana black bear (*Ursus americanus luteolus*); Black bear (*Ursus americanus*, treated as Threatened in East Texas by similarity of appearance to Louisiana black bear); and Red wolf (*Canis rufus*).

[4] Texas prairie dawn (*Hymenoxys texana*); and Texas trailing phlox (*Phlox nivalis ssp texensis*).

1.3.4 Coastal Zone Management Act

Under Section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 U.S.C. § 1456(3)(A), the Commission cannot issue a license for a Project within or affecting a state's coastal zone unless the state's CZMA agency concurs with the license 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 180 days of its receipt of the applicant's certification.

The Texas Coastal Coordinating Council (Council) administers the State's Coastal Management Program (CMP), which was federally approved by National Oceanic and Atmospheric Administration (NOAA) in 1997. The Council consists of the heads of the State's resource agencies and four gubernatorial appointees representing local governments, agriculture, coastal business, and coastal citizens, and is staffed by the Texas General Land Office (GLO).

On the Trinity River, the upper boundary of the Texas CMP is the border between Chambers and Liberty Counties, approximately 7.5 miles upstream from the northern extent of Trinity Bay and more than 120 river miles below Lake Livingston Dam. During pre-filing consultation, a Council representative informed the Cooperative's consultant that, because of the proposed hydropower Project's lack of proximity to the CMP boundary and its planned run-of-river operation, the Project is not subject to the CMP (E-mail from E. Fisher, Director of Coastal Stewardship, GLO, to D. Wittliff, P.E., GDS Associates, August 23, 2007). Therefore, the Project is not subject to the Texas Coastal Management Program review and no consistency certification is needed for the licensing.

1.3.5 National Historic Preservation Act

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

In response to the Cooperative's December 21, 2007, request, the Commission on February 19, 2008, designated the Cooperative as the Commission's non-federal representative for purposes of conducting informal consultation under Section 106 of the NHPA. Pursuant to Section 106, and as the Commission's designated non-federal representative, the Cooperative consulted with the Texas Historical Commission (Texas HC), which acts as the State Historic Preservation Officer (SHPO), as well as representatives of the Alabama-Coushatta Tribe, to locate, determine National Register eligibility, and assess potential adverse effects to historic properties associated with the Project.

In a letter dated January 7, 2008, to the Cooperative's environmental consultant, PBS&J, the SHPO stated that the transmission line study area (which then included seven alternative routes) has a high probability for containing significant cultural resources, as several prehistoric sites have been recorded in surveyed portions of the study area. The SHPO recommended that a professional archeologist survey the proposed transmission corridor, and that the investigation should include a pedestrian survey along with shovel testing and/or backhoe trenching, depending upon the specific Project impacts.

The SHPO also submitted a letter to the Commission Secretary dated January 28, 2008, commenting on the proposed Project and the applicant's request to utilize alternative licensing procedures. In that correspondence, the SHPO noted that the construction work proposed near the dam would occur within previously disturbed areas, and therefore, the SHPO does not recommend an archeological survey in that area. The SHPO further noted that more detailed information was required with regard to the location of Project features, including the proposed transmission route. The SHPO requested that, in order to determine the exact Area of Potential Effect (APE), the proposed Project structures should be plotted on USGS 7.5' topographic maps.

On January 28, 2009, the Cooperative's consultant, PBS&J, supplied the SHPO with the requested Project layout on USGS 7.5' topographic maps. PBS&J further noted that the Cooperative had been designated as the Commission's non-federal representative under Section 106, and requested the SHPO's input regarding requirements for any necessary archeological surveys, tribal coordination, or further investigations needed to comply with the NHPA.

By letter dated March 6, 2009, the SHPO responded to PBS&J's January 29, 2009, correspondence. The SHPO reiterated that the proposed transmission right-of-way has a high probability for containing significant resources, and that several pre-historic sites have been recorded within the project area. The SHPO expressed his understanding that an archeological survey will be conducted prior to transmission facilities construction, and that such survey should meet or exceed the minimum standards set forth in *Archeological Survey Standards For Texas*, available on the Texas HC's website.[5]

In a July 2007 meeting with representatives of the Alabama-Coushatta Tribe, tribe members voiced no objection to the Project but requested that the Cooperative keep the tribe informed of any archeological or cultural finds uncovered during the construction of the power plant or transmission lines.

[5] http://www.thc.state.tx.us/rulesregs/rulesregsword/surveystandards02.doc (accessed March 18, 2009).

Of the seven primary alternative transmission routes considered, the Cooperative selected as its preferred transmission route the one containing the fewest archeological high probability areas (HPAs). As discussed below in ***Section 3.3.6***, Cultural Resources, the Cooperative should be able to prevent significant adverse impacts to historic properties by a combination of avoidance of such sites during construction and implementing appropriate measures to preserve historic properties in the event they are encountered during Project construction. The Cooperative submitted a draft Historic Properties Management Plan (HPMP) on ____________, 2009, which we recommend that the Commission approve with Staff proposed modifications discussed below.

To meet the requirements of Section 106, the Commission intends to execute a Programmatic Agreement (PA) for the protection of historic properties from the effects of the construction and operation of the Lake Livingston Project. The terms of the PA would ensure that the Cooperative addresses and treats all historic properties identified within the project's area of potential effects through the finalization of the existing draft HPMP.

1.3.6 Wild and Scenic Rivers Act

There are no Wild and Scenic River designations or Wilderness areas within the proposed Project boundary or in the area impacted by the Project. The Rio Grande is the only river in Texas designated as Wild and Scenic (Wild 95.2 miles, Scenic 96.0 miles) under the Federal Wild and Scenic Rivers Act (16 U.S. Code §§ 1271 – 1287).

1.3.7 Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fishery Conservation and Management Act requires federal agencies to consult with NOAA Fisheries on all actions that may adversely affect Essential Fish Habitat (EFH). NOAA Fisheries, in coordination with the Gulf of Mexico Fishery Management Council (Gulf Council), has designated EFH in the Gulf of Mexico and its estuaries for Red Drum, Reef Fish, Coastal Migratory Pelagics, Shrimp, Stone Crab, Spiny Lobster, and Coral. None of the EFH designations extends into the Trinity River above the estuarine area at the top of Trinity Bay, near Wallisville. Given the proposed Project's substantial distance from any EFH and the proposed run-of-river mode of operation, we conclude that licensing the Project, as proposed by the Cooperative with staff-recommended measures, would not adversely affect EFH. As such, no consultation is required with NOAA Fisheries.

1.4 PUBLIC REVIEW AND CONSULTATION

The Commission's regulations (18 CFR, Section 4.38) require that applicants consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, the ESA, the National Historic Preservation Act, and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing this EA, we conducted scoping to determine what issues and alternatives should be addressed. We distributed a scoping document to interested agencies and others on February 27, 2008, with a request to provide written comments by April 25, 2008. The scoping document was noticed in the Federal Register on March 5, 2008 (73 Fed. Reg. 11912). Two scoping meetings, both advertised in several local newspapers of general circulation[6], were held on March 26, 2008, in Livingston, Texas, to request oral comments on the Project. A court reporter recorded all comments and statements made at the scoping meetings, and these are part of the Commission's public record for the Project. In addition to comments provided at the scoping meetings, the following entities provided written comments:

Commenting Entities	**Date Filed**
Federal Emergency Management Agency	April 7, 2008
U.S. Fish & Wildlife Service	April 24, 2008
Universal Ethician Church	April 24, 2008
Texas Parks & Wildlife Dept.	April 25, 2008

1.4.2 Interventions

On [______], 2009, the Commission issued a notice that the Cooperative had filed an application for original license for the Lake Livingston Hydroelectric Project. This notice set [date], 2009, as the deadline for filing protests, comments, and motions to intervene. In response to the notice, the following entities filed motions to intervene:

Intervenors	Date Filed
[name]	[date]
[name]	[date]
[name]	[date]

[6] The notice of the scoping meetings was published in *The Polk County Enterprise; The San Jacinto News-Times*; *The Trinity Standard*; and *The Corrigan Times*.

1.4.3 Comments on the Preliminary Draft APEA

Prior to preparing its preliminary draft Applicant-Prepared Environmental Assessment (APEA), the Cooperative held a series of face-to-face meetings and conference calls with interested resource agencies, beginning in May 2007. Following completion of its aquatic resources studies and water quality modeling, (discussed below in Section 3.3.2), the Cooperative held an additional set of meetings with Texas CEQ, and Texas PWD, (the Cooperative also offered to meet with FWS, but was unable to schedule a meeting prior to circulating its preliminary draft APEA) . The Cooperative provided copies of a preliminary draft APEA to interested resource agencies, tribes, and Commission staff on February 17, 2009. Comments on the preliminary draft APEA were received from Texas PWD (on March 17, 2009); Texas CEQ Water Rights Permitting & Availability Section (March 16, 2009), and Trinity River Authority (March 5, 9, and 11, 2009).

1.4.4 Comments on the License Application and APEA

On March [31], 2009, the Cooperative submitted its license application, together with a revised draft APEA in lieu of an Environmental Exhibit (Appendix E). On ________, 2009, the Commission issued a Notice of Acceptance and solicitation of preliminary fish and wildlife conditions, prescriptions, comments, and interventions. In addition to the interventions listed in ***Section 1.4.2*** above, the following entities submitted proposed conditions, prescriptions, or comments in response to the notice:

Commenting Entities	Date Filed
[name]	[date]
[name]	[date]
[name]	[date]

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

The no-action alternative represents denial of the license application. Under the no-action alternative, the Project would not be built, and the environmental resources in the Project area would not be affected.

2.2 APPLICANT'S PROPOSAL

2.2.1 Project Facilities

As proposed by the Cooperative, the Project would include the following existing and new facilities:

2.2.1.1 Existing Facilities

The proposed Project would utilize the existing Lake Livingston Dam, owned and operated by the Trinity River Authority of Texas (TRA), located on the Trinity River at River Mile 129.2, in San Jacinto and Polk Counties, approximately 7 miles southwest of the City of Livingston, Texas. The dam consists of a basic earth embankment section, approximately 14,400-feet (ft)-long, with stabilizing upstream and downstream berms of varying dimensions. Its height averages 55 feet, but varies from 45 to 60 feet over most of its length and reaches a maximum height of 90 feet in the old river channel. The crest of the dam is at elevation 145.0 feet and is 24-feet-wide. A single-lane paved road along the crest provides maintenance access along the dam.

The existing spillway for the Lake Livingston Dam is located within the main embankment about 1,400 feet from the east abutment. The spillway is a concrete structure approximately 546-feet-long, with an ogee crest at elevation 99.0 feet, housing 12 tainter gates, each 40-feet-wide by 35-feet-high.

The dam impounds Lake Livingston, which has a water surface area of approximately 83,000 acres and a gross storage capacity of about 1,750,000 acre-feet (AF) at normal water surface elevation of 131.0 feet mean sea level (msl). The average depth of the lake is 23 feet with a maximum depth of 90 feet. Lake Livingston has more than 450 miles of shoreline extending into San Jacinto, Polk, Walker, and Trinity Counties.

Other existing facilities include outlet works, consisting of a 90-foot-high concrete vertical inlet tower with five sluice gates at various levels, a 550-foot-long by 10-foot-diameter conduit, a 170-foot-long stilling basin, and a concrete broad-crested weir; a tailwater control weir approximately 200 feet downstream from the spillway; several service buildings; and a service road.

2.2.1.2 New Facilities

The proposed hydroelectric facilities will be located on the east shore of the Trinity River, adjacent to and below Lake Livingston Dam. The principal new facilities include (a) an approximately 300-foot-long, riprap-lined headrace channel; (b) an intake structure of reinforced concrete, complete with trashracks, closure gates with individual operators, stoplogs, and venting; (c) an earth embankment, connecting the intake structure to the dam; (d) three steel penstocks, each approximately 12 feet in diameter and 750 feet in length; (e) a powerhouse built of reinforced concrete housing three turbine/generator units, a service bay, and all auxiliary mechanical and electrical equipment for station operation; (f) three new vertical-shaft Kaplan turbines with direct drive synchronous propeller turbines (adjustable blade runners with wicket gates) with direct drive synchronous generators, each having a capacity rating of approximately 8 MW; (g) a riprap-lined tailrace channel, approximately 1,200 feet in length; (g) an electric switchyard located to the east of the powerhouse; (h) a single circuit overhead 138-kV primary transmission line, approximately 2.8 miles in length, with a 100-ft wide right-of-way (ROW), connecting the proposed Project to the Entergy electric grid at an existing substation near Goodrich, Texas; and (i) approximately 2,500 feet of new paved or compacted gravel access roads.

2.2.2 Project Safety

As part of the licensing process, the Commission would review the adequacy of the proposed Project facilities. Special articles would be included in any license issued for the Project as appropriate. Commission staff would inspect the licensed Project both during and after construction. Inspection during construction would concentrate on adherence to Commission-approved plans and specifications, special license articles relating to construction, and accepted engineering practices and procedures. Operational inspections would focus on the continued safety of the structure, identification of unauthorized modifications, efficiency and safety of operations, compliance with the terms of the license, and proper maintenance. In addition, any license issued would require an inspection and evaluation every five years by an independent consultant and submittal of the consultant’s safety report for Commission review.

2.2.3 Project Operation

The proposed Project would be operated on a run-of-river basis, utilizing water releases that TRA would otherwise make through the spillway gates to maintain the reservoir surface elevation at approximately 131 feet msl and/or to satisfy demands by downstream water right holders. When scheduled releases do not exceed the power plant's hydraulic capacity, a minimum-flow release (described in ***Section 2.2.4***) will be discharged through one of the spillway gates to maintain adequate oxygenation in the spillway stilling basin. When scheduled releases exceed the power facility's hydraulic capacity, the excess flows will be released through the spillway gates.

Because the proposed Project would operate within the constraints of TRA's existing reservoir operations, the quantity and timing of flows in the Trinity River downstream of the Project tailrace will be unaffected by the proposed hydropower operations. Further, the hydropower Project is not expected to modify existing water surface elevations in the impoundment.

2.2.4 Environmental Measures

The Cooperative proposes the following mitigation, protection, and enhancement measures:

- Develop, execute, and submit for Commission approval a Memorandum of Agreement (MOA) with the Trinity River Authority governing Project operations, with the objective of maintaining net reservoir releases and surface elevations in accordance with existing operational protocols.
- When total reservoir releases are less than the hydraulic capacity of the power plant (approximately 4,500 cubic feet per second (cfs)), minimum flows of 50 to 200 cfs will be released through the spillway tainter gates to maintain water quality in the stilling basin above the weir. The Cooperative, in consultation with Texas CEQ and Texas PWD, will conduct post-operational monitoring and testing using continuous dissolved oxygen (DO) and temperature monitors to determine the level of flows necessary to protect aquatic life in the stilling basin.
- The Cooperative will install continuous dissolved oxygen (DO) and temperature monitors in the Project headrace area, in the stilling basin between the spillway and the weir, and in the Trinity River downstream of the tailrace discharge. The monitoring probes in the stilling basin will be placed in a temporary location. The stilling basin monitoring location is not anticipated to be a permanent monitoring location. The devices will be capable of remote monitoring and will be equipped to provide alarms to the Project operator when DO or temperature conditions reach critical levels as determined in consultation with Texas Parks and Wildlife and Texas CEQ.
- The Cooperative will install equipment to inject air or oxygen into water diverted for power generation and will operate such equipment when DO reaches critical levels as determined in consultation with Texas Parks and Wildlife and Texas CEQ.

- The Cooperative, in consultation with Texas PWD, will develop and implement a striped bass monitoring program to evaluate the impact of Project operations on the striped bass fishery below Lake Livingston Dam.
- The Cooperative, in consultation with the SHPO, will develop and submit for Commission approval a HPMP in accordance with current Commission HPMP guidelines, for the purpose of protecting historic properties during Project construction or operation. Among other provisions, the HPMP will require the Cooperative to conduct an archeological survey of the approved transmission line route, that meets or exceeds the minimum standards for such surveys prescribed by the SHPO, prior to ground-disturbing activity associated with the transmission line construction.
- The Cooperative will develop an erosion and sediment control plan during the detailed Project design phase and before construction on the Project begins that is consistent with applicable state and local soil conservation standards, including any Storm Water Pollution Prevention Plan (SWPPP) required by Texas CEQ.
- Clearing for the transmission ROW will be performed in a manner that will maximize the preservation of natural habitat and the conservation of natural resources and will take into account soil stability, the protection of natural vegetation, sensitive habitats, the protection of adjacent resources such as natural habitat for plants and wildlife, and the prevention of silt deposition in watercourses.
- Survey the transmission line route during the appropriate seasons (i.e., when plants are conspicuous) and before construction begins to determine the presence of federally or state-listed rare plants, and consult with Texas Parks and Wildlife and FWS if such plants are found.
- If endangered or threatened wildlife habitat is encountered during construction, obtain guidance from FWS prior to any further clearing or construction activities.
- The transmission facilities will be constructed in accordance with current standards to reduce the risk of avian injury or mortality, including "Suggested Practices for Avian Protection on Power Lines: The State of the Art in 2006" (APLIC, et al. 2006).
- If it is necessary to modify or remove existing service buildings or other structures during Project construction, the Cooperative's biologists will first conduct a field investigation to determine whether such structures are occupied by Rafineque's big-eared bats or Southeastern myotis. If either species of bat is encountered, the Cooperative will consult with FWS and Texas Parks and Wildlife prior to modification of the structure.

- After the Project’s tailrace channel location and design have been finalized, the Cooperative, in consultation with TRA, FWS, Polk County, and Texas Parks and Wildlife, will study the demand for and feasibility of providing handicapped-accessible public fishing access on the east bank of the Trinity River below the Project tailwater discharge and outside the Restricted Area below the dam.

2.2.5 Modifications to Applicant’s Proposal—Mandatory Conditions

[*Pending – to be completed*]

2.3 STAFF ALTERNATIVE

[*To be completed by FERC Staff*]

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

No reasonable action alternatives have been identified other than the Cooperative’s proposal and the Staff alternative recommended in this EA.

Before submitting its license application, the Cooperative considered several alternative power plant configurations, as well as a number of alternative transmission line routes. Alternative locations for the Project intake and discharge facilities were considered but were eliminated based on logistical and dam safety concerns raised by the dam’s owner, TRA. Several smaller and larger installed generating capacities were evaluated, ranging from 16 MW to 32 MW, but the three-unit, 24-MW plant configuration was selected as the most efficient and economically feasible alternative.

The Cooperative studied a total of nine discreet transmission routes, but selected the preferred route based on a combination of environmental factors and landowner preferences. The proposed route is the shortest of the alternatives studied and contains the least amount of high-probability area for locating historic properties.

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 (aquatic, recreation, etc.). Under each resource area, current conditions are first described, followed by our analysis of the environmental effects associated with the proposed action and alternatives. Staff conclusions and recommended measures are discussed in ***Section 5.2***, Comprehensive Development and Recommended Alternative, of this EA.

Unless otherwise indicated, the sources of our information are the license application, the draft Applicant Prepared Environmental Assessment, additional information filed by the Cooperative, and supplemental filings from the applicant and other entities.

3.1 GENERAL SETTING

The proposed Project would be located adjacent to and below the existing Lake Livingston Dam in southeastern Texas on the Trinity River, several miles from the town of Livingston. Currently, the dam is equipped with spillway gates for the release of water from Lake Livingston Reservoir, which is backed and contained behind the dam. The Project seeks to improve the usefulness of the reservoir through the diversion of up to approximately 4,500 cfs of water through a power station and then back to the original watercourse.

The Trinity River Authority (TRA) operates the dam and reservoir. The TRA has developed the Trinity River Master Plan, whose purpose is to plan for the conservation, management, and use of the soil and water resources of the Trinity River Basin in an efficient, economical, and environmentally sound manner. The Plan provides for coordination of all the interests of the region in maintaining water quality, serving water rights holders, and providing flood control. Each year TRA also produces a Basin Highlights Report describing the water quality conditions for ten subwatersheds of the Trinity River, including the Lake Livingston Dam and the river segments downstream and upstream of the dam. Every fifth year, a Basin Summary Report is produced which includes an in-depth analysis of the water quality data. These data are summarized below in ***Section 3.3.2***, Aquatic Resources.

3.1.1 Site Location, Description, and Land Features

Lake Livingston Dam is located approximately seven miles southwest of the City of Livingston, Texas (60 miles north-northeast of Houston), in Polk and San Jacinto Counties. The dam is 14,400-ft-long, up to 90-ft-high, and over 300-ft- wide at the base. The dam is located at river mile 129.2 on the Trinity River and backs up the Trinity River forming the 83,000 acre Lake Livingston Reservoir. The topography of the proposed Project is characterized by rolling and hilly terrain consisting of alternating sands and shales of Eocene and Miocene age (TRA, 1983). The Trinity River crosses the state, winding in a slightly easterly direction from the headwaters in the north central part of Texas, approximately 500 miles south to the Gulf of Mexico in the vicinity of Galveston. The Trinity River Basin, and Lake Livingston Reservoir specifically, are an integral part of and a critical resource for maintaining the state's water supply and provides opportunity for recreation and continued economic growth. Major river basins of Texas, including Trinity River Basin, are shown in ***Figure 1***.

The Project area is defined in ***Section 2.2***. Although the footprint of the powerhouse and associated facilities are adjacent to the dam, a larger study area was identified to address possible impacts associated with facility operations. This larger study area includes all of Lake Livingston and the Trinity River up to 30 miles downstream of the dam to Romayor. The four counties surrounding the study area are Polk, San Jacinto, Trinity, and Walker Counties. PBS&J was contracted by the Cooperative to conduct certain field studies and analyses such as the transmission line study (***Attachment A***) and the aquatic study (***Attachment B***).

The transmission corridor for the proposed 24-MW hydroelectric facility is located in Polk County to the east and southeast of the proposed power plant. The Cooperative's new transmission facilities would include a new substation adjacent to the hydroelectric generating station and a new single-circuit 138-kV electric transmission line. As detailed in PBS&J's Environmental Assessment and Alternative Route Analysis for the Lake Livingston-Rich 138-kV Transmission Line Project (***Attachment A***), the new transmission line would connect the proposed substation with Sam Houston Electric Cooperative, Inc.'s existing Rich Substation, located approximately 1.6 miles northwest of Goodrich. The new line will be approximately 2.8-miles-long and will be built utilizing single-pole construction within a ROW 100 ft in width. The study area for this transmission line Project was approximately 3.2-miles-long by 1.9- miles-wide and encompassed approximately six square miles in Polk and San Jacinto Counties.

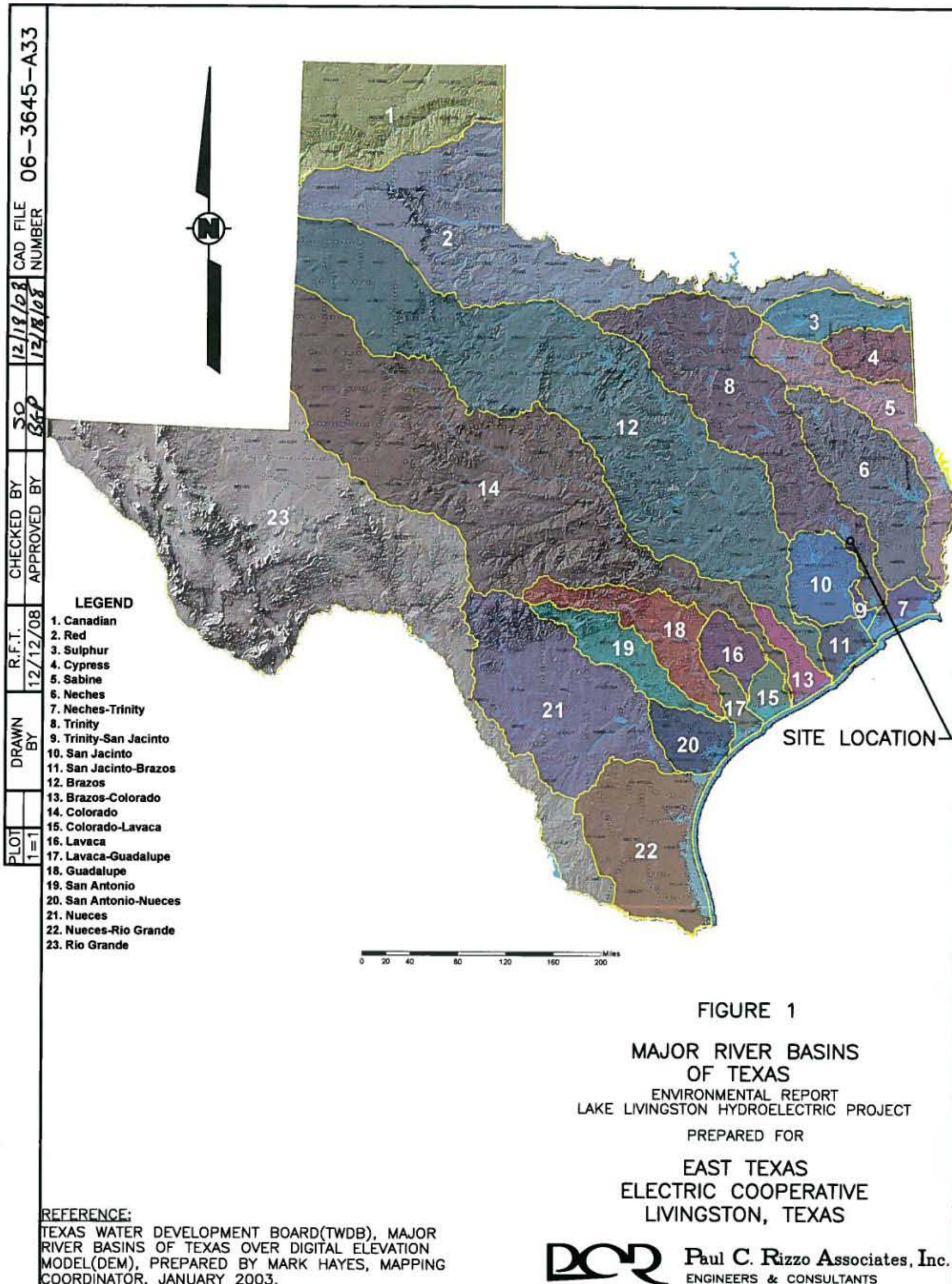


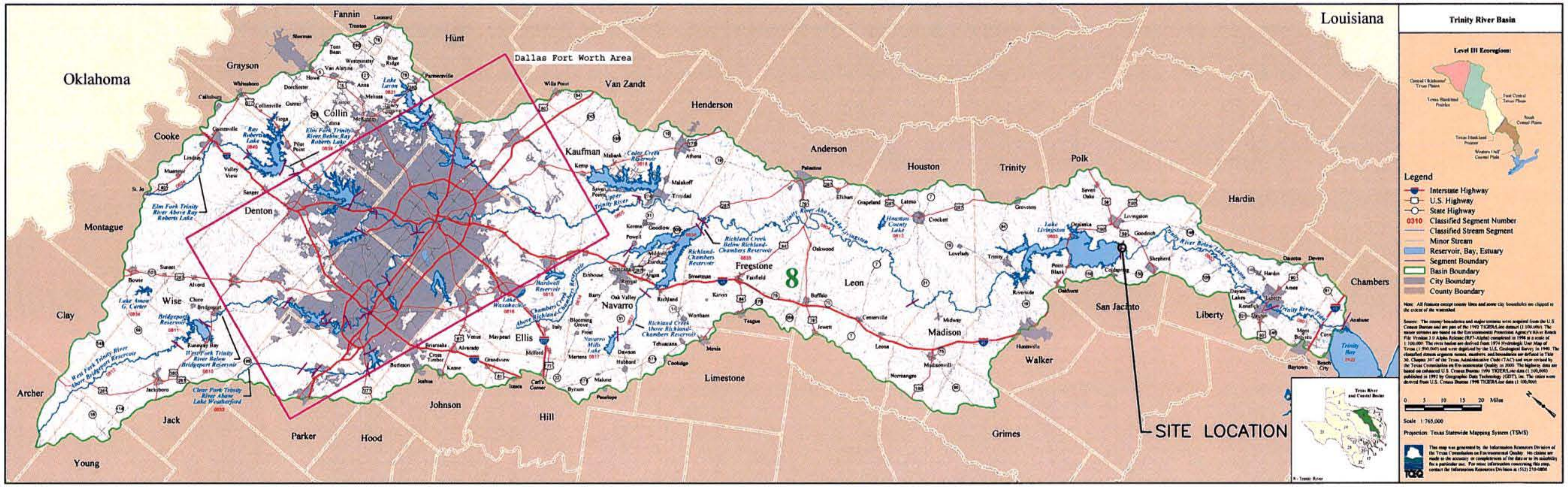
Figure 1. Major River Basins of Texas

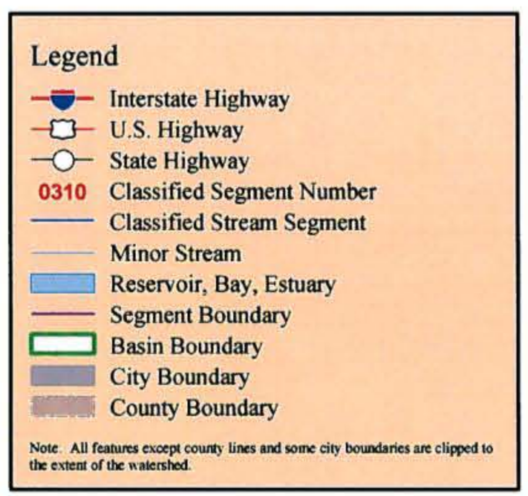
The Trinity River Drainage Basin is located in Drainage Basin 08, which is divided into 41 classified segments (Texas CEQ, 2008a). The Lake Livingston Reservoir and Dam are located in Segment 0803 (***Figure 2***). The drainage basin covers an area of 17,969 square miles of east Texas from Gainesville in the north to Trinity Bay in the south (Texas DWR, 1983). The Trinity Bay is an arm of Galveston Bay, the largest of the estuaries on the Gulf of Mexico lying between the Mississippi and Rio Grande Rivers. The Trinity River is the major source of fresh water inflow to Galveston Bay. The overall length of the Trinity River Basin is approximately 360 miles, making it the longest river having its entire course in Texas. The main stream begins at the junction of the Elm and West Forks at Dallas and meanders some 500 river miles before reaching Trinity Bay (TRA, 2007a). In total, the Trinity River Basin encompasses all or part of 34 counties in Texas.

Major reservoirs in the basin include Lake Bridgeport, Eagle Mountain Lake, and Lake Worth on the West Fork; Lake Weatherford and Benbrook Lake on the Clear Fork; Ray Roberts Lake and Lewisville Lake on the Elm Fork; Lavon Lake and Lake Ray Hubbard on the East Fork; and Lake Livingston on the main stem. In addition, 11 major reservoirs exist on smaller tributaries, mostly in the Dallas/Fort Worth area (Texas CEQ, 2008b). The detailed information for the existing water supply reservoirs in the Trinity River Basin is provided in the table titled "Water Supply Lakes and Lakes Over 5,000 AF in the Trinity River Basin" in the 2003 Trinity River Basin Master Plan (TRA, 2003). The tabulated information includes the start date, surface area, volume, owner/operator, yield, primary uses, and water right permit holders for each reservoir/lake. The map showing the locations of the major water supply reservoirs in the basin is also provided in the 2003 Master Plan (TRA, 2003).

Water supplies in the Trinity River Basin are predominantly from surface water impoundments. The basin contains over 40 water bodies with a total of more than seven million AF of storage (TRA, 2001). The Trinity River provides water to over half of the population of Texas and serves two major population centers: Dallas/Fort Worth in the north and Houston to the south (TRA, 2007a).

Construction in close proximity to the lake is regulated by TRA (TRA, 1993a, 1993b). ***Figure 3*** provides an enhanced aerial view of the lake region land use features. The region remains rural in character even though it is within 100 miles of the very populated Dallas-Ft. Worth and Houston metropolitan areas. There are some more densely developed areas in the vicinity, but they are located away from the lake, typically adjacent to the region's major roadways and intersections.





Source: The county boundaries and major streams were acquired from the U. S. Census Bureau and are part of the 1992 TIGER/Line dataset (1:100,000). The minor streams are based on the Environmental Protection Agency's River Reach File Version 3.0 Alpha Release (RF3-Alpha) completed in 1998 at a scale of 1:100,000. The river basins were derived from 1974 Hydrologic Unit Map of Texas (1:500,000) and were digitized by the U.S. Geological Survey in 1990. The classified stream segment names, numbers, and boundaries are defined in Title 30, Chapter 307 of the Texas Administrative Code (TAC) and were revised by the Texas Commission on Environmental Quality in 2000. The highway data are based on U.S. Census Bureau 1990 TIGER/Line data (1:100,000) published in 1992 by Geographic Data Technology (GDT), Inc. The cities were derived from U.S. Census Bureau 1998 TIGER/Line data (1:100,000).

REFERENCE:

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY (TCEQ), WWW.TCEQ.STATE.TX.US, ACCESSED DECEMBER 11, 2008

1	ENLARGED LEGEND	
APPROVED BY: BG	DATE: 2/3/2009	
REVISIONS		

PLOT 1=1	DRAWN BY	R.F.T. 12/12/08	CHECKED BY SO 12/18/08	APPROVED BY BGP 12/18/08	CAD FILE NUMBER 06-3645-B22 1

FIGURE 2

TRINITY RIVER BASIN DRAINAGE AREA

ENVIRONMENTAL REPORT
LAKE LIVINGSTON HYDROELECTRIC

PREPARED FOR

EAST TEXAS ELECTRIC COOPERATIVE
LIVINGSTON, TEXAS

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

Figure 2. Trinity River Basin Drainage Area

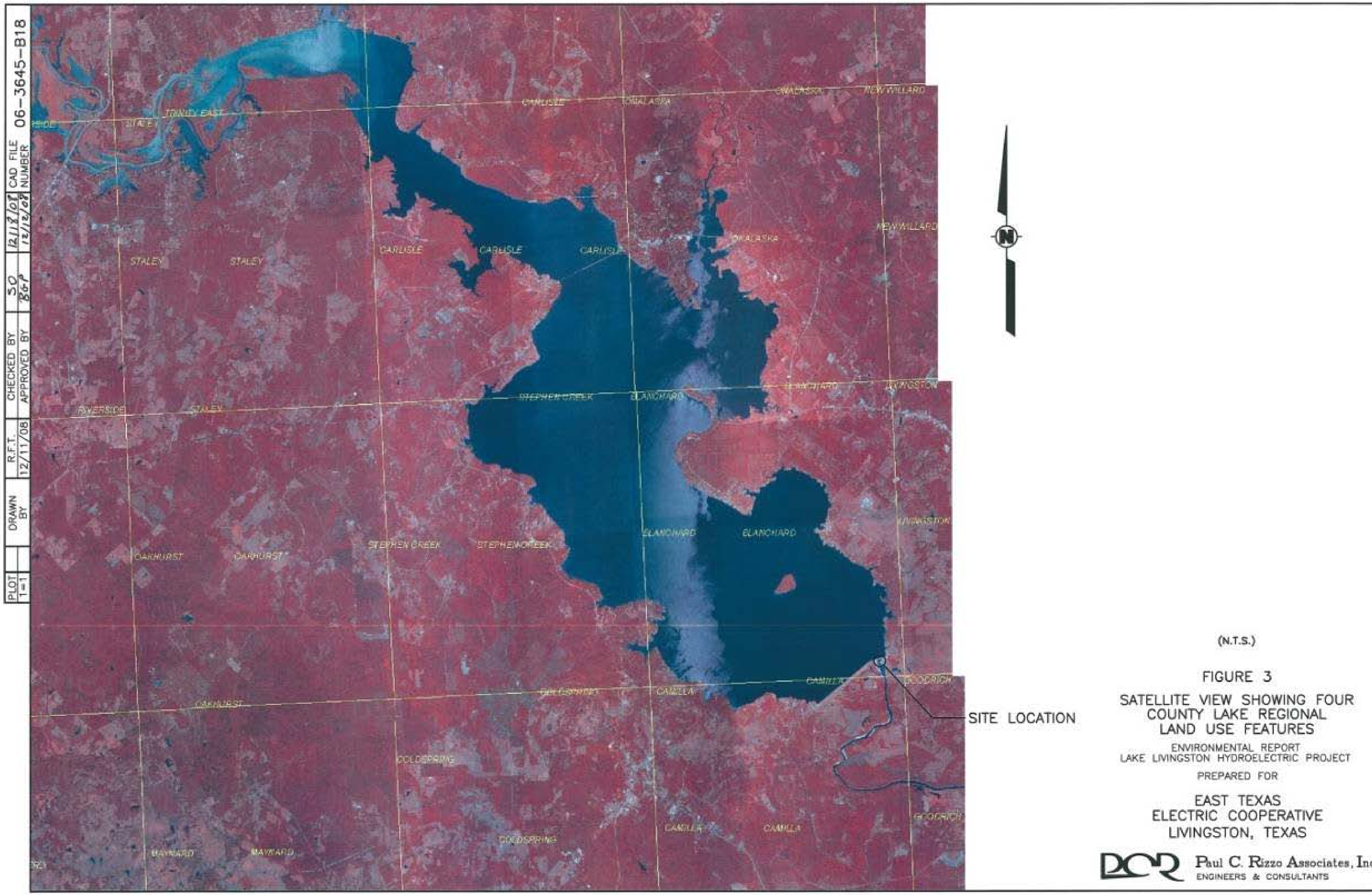


Figure 3. Satellite View Showing Four County Lake Regional Land Use Features

Major highways servicing the dam and surrounding communities include Interstate 45 to the west (connecting the Houston and Dallas metropolitan areas) and U.S. Highway 59 to the east (connecting Houston to Lufkin) (***Figure 4***). Access to the dam is from either Farm-to-Market Rd (FM) 222 (western abutment) or FM 1988 (eastern abutment) and TRA authorization is required to access the dam. TRA's Lake Livingston headquarters is adjacent to the eastern abutment.

PBS&J identified the major transportation feature within the transmission line study area as FM 1988, which connects the northwest corner and the southeast corner of the study area, and FM 3278 (and bridge), situated in the western portion of the study area that connects FM 1988 to areas west of the Trinity River (***Attachment A***).

3.1.2 Climate

The study area is located in the south temperate, and more humid, section of Texas, approximately 100 miles from the Gulf Coast. It is characterized by long, warm, and humid summers, and short, mild winters. Summer temperatures are moderated by prevailing southeast (Gulf of Mexico) winds. Rainfall in the watershed varies from 30 to 40 inches in the upper basin to 40 to 50 inches in the lower basin (Texas SHA, 2008a). Annual monthly precipitation averages over 3.5 inches, except for the months of May and June, which average over 5 inches (SRCC, 2004). The average annual net precipitation (mean annual rainfall minus an annual evaporation) is approximately 6.5 inches (TRA, 2007a). Occasionally there are light winter snows.

Precipitation during the 100-year 24-hour storm event is reported to be between 9 and 12 inches over the range of the drainage basin. The estimated 6 hour Probable Maximum Precipitation Event is approximately 30 inches (USDA, 1961).

Generally, stream flows in the Trinity River Basin follow the rainfall pattern of the area. Precipitation ranges from moderate rainfall in the headwaters area of around 30 inches per year to heavy tropical precipitation approaching 50 inches per year typical on the Gulf Coast (TRA, 2007a).

Lake Livingston regional climate data were recorded for the years 1946 to 2000 by the Huntsville meteorological station, which is located approximately 12 miles from Lake Livingston, and summarized by the Southeast Regional Climate Center (SERCC). According to this climate summary, mean maximum temperatures occur in August and September exceeding just over 94 degrees Fahrenheit (º F). The record high of 108º F occurred on October 5, 2000. Mean minimum temperatures occur in January averaging 41.5° F with a record low of 2º F occurring on December 23, 1989. The last freeze in spring occurs by March 7; the first fall freeze occurs no earlier than November 27. The growing season averages 265 days (SERCC, 2007).

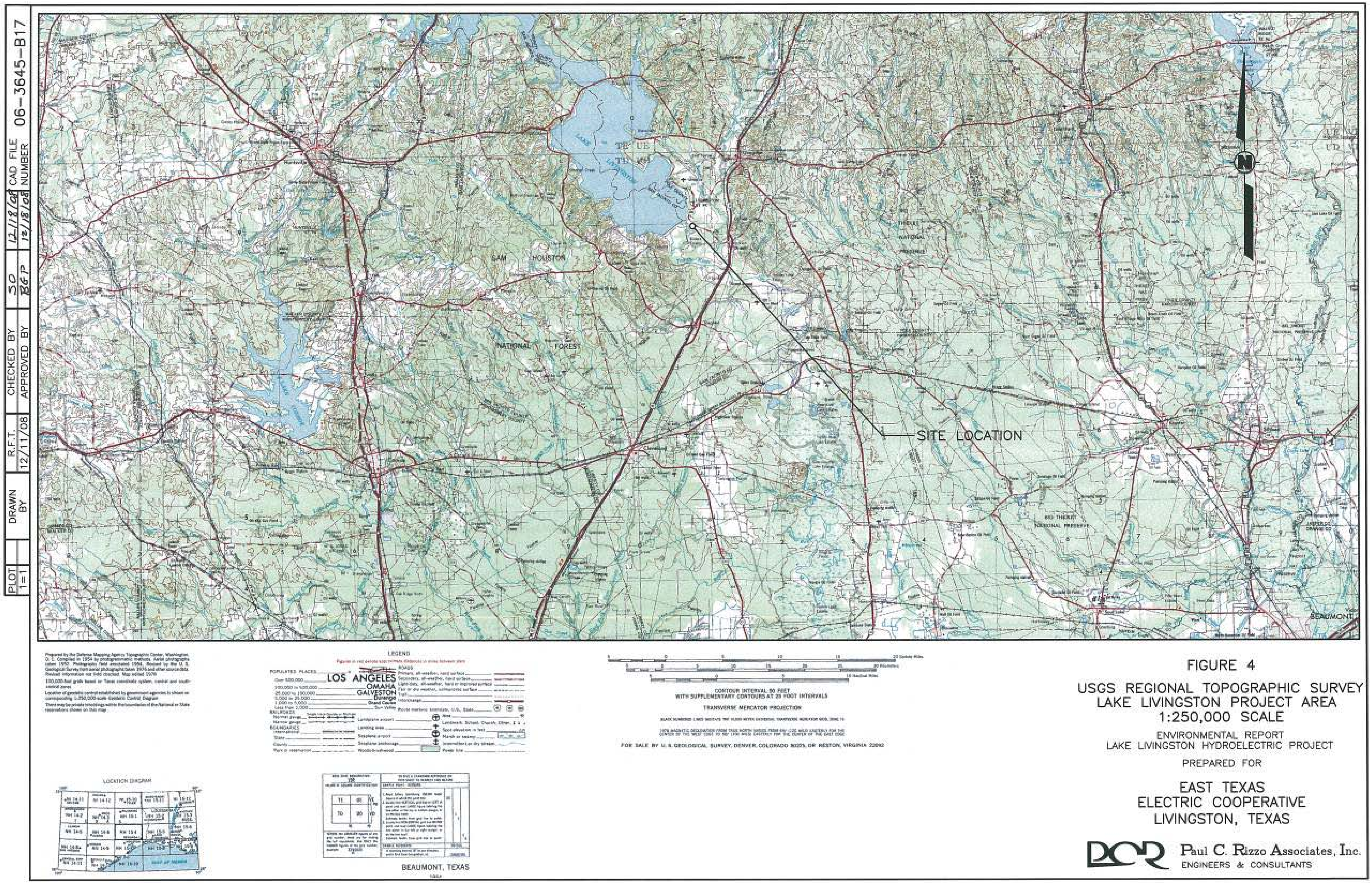


Figure 4. **USGS Regional Topographic Survey Lake Livingston Project Area 1:250,000 Scale**

3.1.3 Commercial and Industrial Economic Development

3.1.3.1 Commercial Land Use

Commercial land use in the region is diverse, ranging from highly developed urbanized areas to open grazing lands, pine forest, and coastal wetlands. A higher amount of rainfall in the Trinity River Basin makes the River Basin productive for timber and forest products. Commercial land use in the vicinity of the Project is more rural and focused on recreation and other activities specifically associated with the lake. Development around Lake Livingston is controlled to enhance the environment and minimize habitat loss. Residential development is allowed but controlled to protect water resources. Much of the development is related to property development for recreation, vacation, second home ownership, and retirement.

3.1.3.2 Oil, Gas, and Mineral Resources

The Mid-Continent oil field extends over several states including Oklahoma, Kansas, Louisiana, and Texas. Portions of this oil field are found within the Trinity River Basin and other parts of East Texas.

The study area has been explored for oil (including a historic well now located beneath Lake Livingston). The area produces some oil and gas, although it is not known as a high production area like other parts of East Texas. The oil and gas wells are mostly located in the area around Goodrich, Livingston, and Schwab City in Polk County, while exploratory dry holes are observed throughout the area. There are also a number of pipelines in the general region of the dam but not near or traversing the immediate location of the proposed Project (Railroad Commission of Texas, 2008a).

There are some mineral, mining, and related processing activities within the Trinity River Basin, including cement, sand, gravel, and high quality silica sand productions. No major mineral production or processing occurs in the four-county Lake Region (Texas SHA, 2008b). There are four surface coal and lignite mines located within the Trinity River Drainage Basin area, none of which is in the study area (Railroad Commission of Texas, 2008b).

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality regulations for implementing 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 or person undertakes such other actions. Cumulative effects can result from individually minor, but collectively significant, actions taking place over a period of time including hydropower and other land and water development activities.

We have identified water quality and fishery resources as having the potential to be cumulatively affected by the proposed Project in combination with other past, present, and foreseeable future activities. Water quality might be cumulatively impacted since the Project may affect DO levels and temperature in the Trinity River downstream of the Lake Livingston Dam, and other discharges in the upper and lower Trinity River Basin may indirectly contribute to this impact. Fishery resources might also be impacted as a result of the cumulative impacts on DO and temperature.

3.2.1 Geographic Scope

The geographic scope of analysis for cumulatively impacted resources defines the boundaries of the effects of the proposed Project on the identified resources. For water quality and fishery resources, the geographic scope is defined as the Trinity River reach from the head of the Lake Livingston Reservoir to the Trinity River downstream of Lake Livingston Dam extending approximately 30 miles to Romayor. The activities ongoing throughout the Trinity River Basin, such as residential, industrial, agricultural, and recreational activities, could impact the water quality in the reservoir, and these water quality changes, along with the changes that might occur due to the proposed Project, could affect the water quality in the river downstream of the dam. In turn, fisheries downstream of the river could be impacted.

3.2.2 Temporal Scope

The temporal scope of the cumulative impacts analysis includes past, present, and future actions and their effects on identified resources that might be cumulatively affected. Based on the term of the license, the temporal scope looks 30 to 50 years into the future, concentrating on the water quality and fisheries impacts from reasonably foreseeable future actions.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

3.3.1 Geological and Soil Resources

3.3.1.1 Affected Environment

The Upper Trinity Basin has rolling topography and relatively narrow stream channels. Soils in the region are deep to shallow clay, clay loam, and sandy loam. Higher levels of precipitation and suitable soil support elms, sycamores, willows, oaks, junipers, mesquites, and grasses (Texas SHA, 2008a). The maximum elevation in the Upper Trinity River is 1,522 ft msl in an area northwest of Fort Worth. From this area, which averages over 1,000 feet msl, the land gradually slopes down to sea level along the southeasterly route of the River (TRA, 2007a).

The middle and lower Trinity Basin areas are characterized by gently rolling to flat terrain with wide, shallow, stream channels, and a broad floodplain. Clay and sandy loams predominate and support water-tolerant hardwoods, conifers, and grasses (Texas SHA, 2008a). Soils have been influenced by geologically recent Cenozoic clay and sand sediments, producing the light colored and dark gray sands or sandy loams found in the area. These soils are somewhat acidic and tend to be poorly drained. Soils around the lake are classified as Alfisols. These are generally light in color, thinly layered, loamy, and somewhat leached near the surface. With increasing depth, soils become more clayey, basic, and less permeable. Layers rich in carbonate and other salts may occur in deeper strata.

Around the study area, topographic elevation varies from 0 to 500 feet and does not influence vegetation substantially. Pine-hardwood forests, young forests/ grasslands, and other native and/or introduced grasses dominate the vegetation in the area (***Figure 5***). Topography is characterized by rolling and hilly terrain consisting of alternating sands and shales of Eocene and Miocene age. ***Figure 6*** depicts a 1:12,000 scale topographic survey of the region. Rock outcrops in the area are of sedimentary origin. Most of the material consists of loams, fine sand, clay, fine sandy loam, and loamy fine sand. Relatively young strata of Cretaceous, Tertiary, and Quaternary rocks overlay older Paleozoic rocks in the province (TRA, 1983).

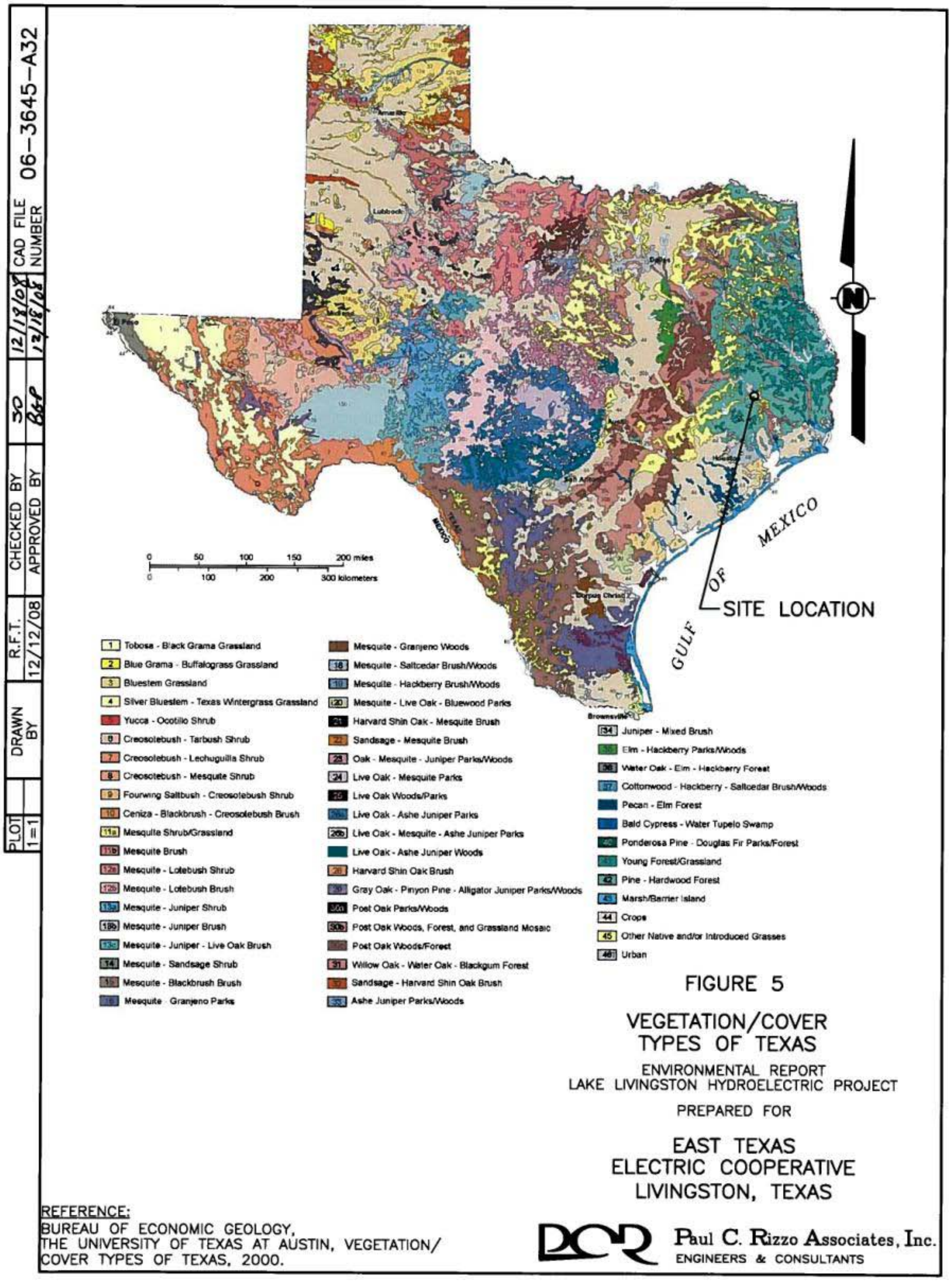


Figure 5. Vegetation/Cover Types of Texas

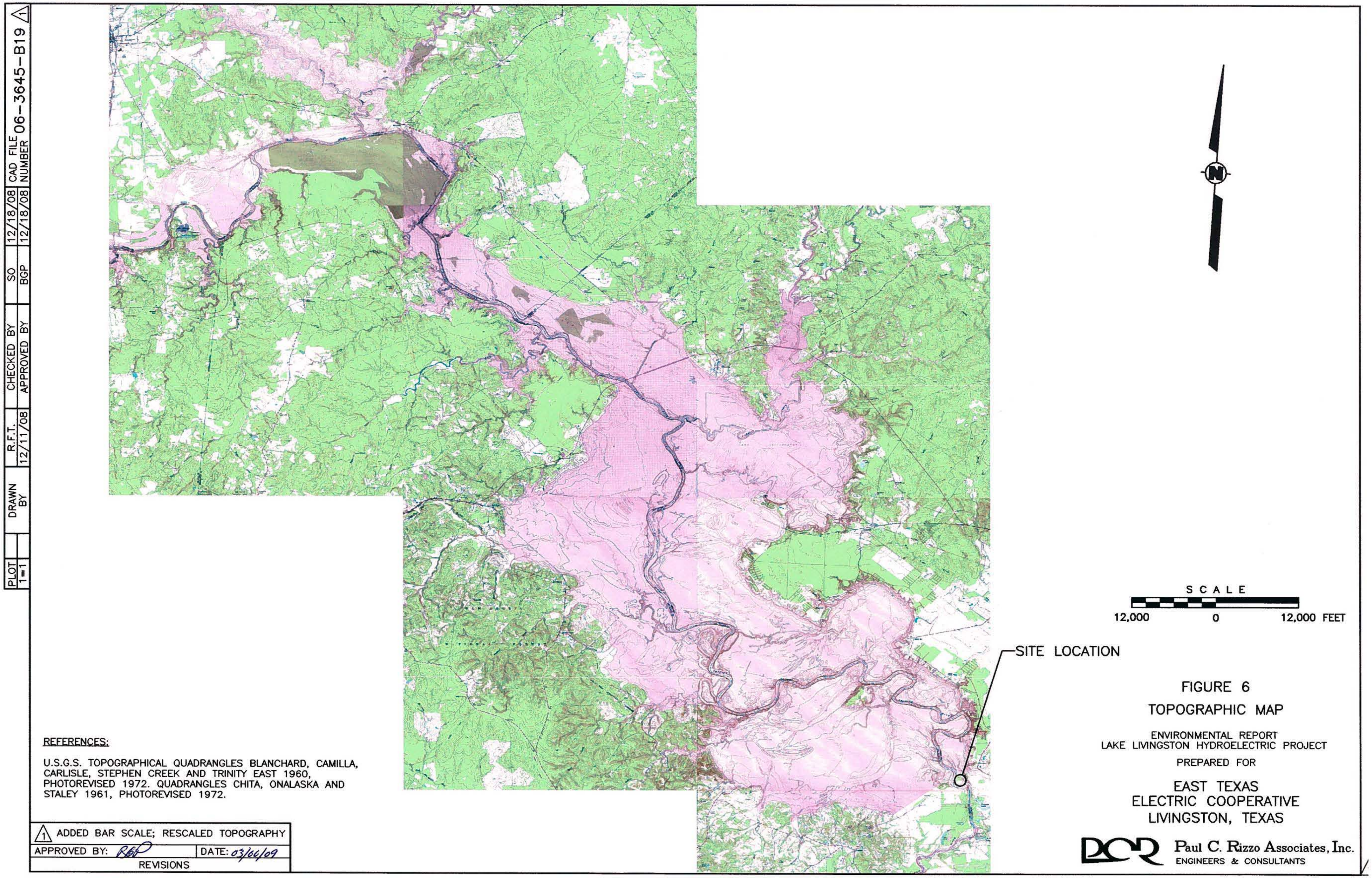


Figure 6. Topographic Map

3.3.1.2 Environmental Effects on Geological and Soil Resources

The potential impacts from the construction and operation of the hydroelectric facilities and transmission line corridor on geological and soil resources are presented in the following Sections.

3.3.1.2.1 Effects of Construction of Hydroelectric Facilities

Construction of the proposed Project will require disturbance of the riverbank sediment and upland vegetation during the excavation for the powerhouse, intake facilities, and tailrace channel. However, the actual construction of the new hydroelectric facility will involve the use of previously disturbed open land that currently consists primarily of maintained lawn and early successional stage scrub vegetation. Land used during the facility's construction will be seeded or stabilized after the completion of the work. Best Management Practices (BMPs), including sedimentation and erosion control plans, will be implemented to control erosion and sediment entering the river.

3.3.1.2.2 Effects of Construction of Transmission Line Corridor

No significant impact on the geological resources of the area would result from construction of any of the preferred route or any of the alternative routes studied for the proposed transmission line. Activities associated with the construction of the line, such as the erection of structures and grading of temporary roads, construction areas, and staging areas, are small in scope and temporary and, therefore, would have no measurable impacts on geological features or mineral resources. Compaction and possible erosion where vegetation is cleared are the primary potential impacts to soils. Clearing of vegetation associated with construction activities would be minimized, and cleared areas would be revegetated with native grasses, where possible. Impacts from soil erosion caused by construction activity should be minimal because of the small degree of slope that generally occurs within the transmission line study area and the implementation of BMPs designed in the SWPPP (***Attachment A***).

3.3.1.2.3 Effects of Operation of Hydroelectric Facilities

During operation of the hydroelectric facilities, tailrace water velocities would not exceed 5.0 feet per second although average velocities would be substantially lower. Consequently, there would be no danger of riverbed scouring within the channel nor any increased turbidity in the river.

3.3.1.2.4 Effects of Operation of Transmission Line Corridor

Following the completion of construction of the transmission line, disturbed areas, with the exception of previously forested areas, would quickly recover, either by assisted revegetation or natural succession. In either case, construction areas would be reclaimed naturally with species of grasses, forbs, and shrubs that occur in adjacent habitats or are native to the region (***Attachment A***). Therefore, no significant impact on the geological and soil resources of the area is expected during proposed Project operations.

3.3.2 Aquatic Resources

3.3.2.1 Affected Environment

3.3.2.1.1 Water Resources

The Texas CEQ has classified all state surface waters for "uses deemed desirable" by applying water quality criteria and standards identified in accordance with the federal Clean Water Act and U.S. Environmental Protection Agency (EPA) guidelines.

As noted above, the Trinity River Basin (Basin 08) is divided into 41 sub-basins. Within each sub-basin are additional divisions by area, section, stream branch, creek, and monitoring station. Of particular significance to the environmental evaluation of this Project are three segments within the Trinity River Drainage Basin:

- **Segment 0802**: Trinity River Below Lake Livingston (from a point 3.1 kilometers (1.9 miles) downstream of US 90 in Liberty County to Livingston Dam in Polk/San Jacinto County);
- **Segment 0803**: Lake Livingston (from Livingston Dam in Polk/San Jacinto County to a point 1.8 kilometers (1.1 miles) upstream of Boggy Creek in Houston/Leon County, up to the normal pool elevation of 131 feet (impounds Trinity River)); and
- **Segment 0804**: Trinity River Above Lake Livingston (from a point 1.8 kilometers (1.1 miles) upstream of Boggy Creek in Houston/Leon County to a point immediately upstream of the confluence of the Cedar Creek Reservoir discharge canal in Henderson/Navarro County).

On at least a biannual basis, the State of Texas surveys all surface water resources to identify water quality concerns. Point and nonpoint source pollution impacts Lake Livingston and the greater region. Excess nutrients from urban runoff, development, agriculture, and wastewater treatment plant effluents result in depressed oxygen levels, algal blooms, high bacteria levels, and eutrophic conditions. Analysis of available information on nutrients revealed that, in the Trinity River Basin, the lowest nutrient concentrations occur immediately downstream from reservoirs, which act as sinks for nutrients. Furthermore, nutrient loads increase substantially in the Dallas-Fort Worth area with the addition of nutrients from point sources, while loads decrease substantially as flow passes through Lake Livingston Reservoir (USGS, 1995).

Throughout the Trinity Basin, wastewater discharges, urban runoff, and agricultural runoff have also been identified as potential contributors of constituent loadings. The following chemical constituents have been documented to exceed water quality criteria levels in recent years: cadmium, chlordane, chromium, copper, dieldrin, endrin, heptachlor, lead, lindane, and polychlorinated biphenyls (PCBs). Other constituents which have caused concern because of elevated levels in water and sediments include aldrin, arsenic, dichlorodiphenyltrichloroethane (DDT), hexachlorocyclopentadiene, mercury, selenium, silver, and zinc. However, it should be noted that the water quality criteria are used only as a point of comparison. If a parameter exceeds a water quality criterion, it does not always mean that the value is in violation of a water quality standard. Oftentimes, the value is measured at a location where the water quality standard does not strictly apply, such as in the hypolimnion of a reservoir, an intermittent tributary, etc. (TRA, 2007a).

The Trinity Basin Water Quality study conducted by U.S. Geological Survey (USGS) between 1992 and 1995 indicated decreased lead, DDT and PCB concentrations, and increased chlordane, polycyclic aromatic hydrocarbon (PAH), and zinc concentrations in sediments from urban streams since the mid-1960s. The reason for elevated chlordane levels was explained as urban growth, while increased PAH and zinc concentrations were reported as largely due to automobile use in the watershed. This study also revealed that total nitrogen concentrations were larger in urban and agricultural streams than in streams in rangeland and forest areas, while total phosphorus levels were similar in all tributaries, regardless of land use (USGS, 1998).

Regional water quality has improved significantly over the years since the dam was constructed, particularly downstream of the dam. Reduced DO in the lake has been an ongoing concern and is largely due to excess nutrient loading (EPA, 1977; Hydroscience, 1976; TRA, 1983, 2005a, 2007b, 2008a). Sulfate has recently been identified as a concern in Lake Livingston, as 12 monitoring stations during the biannual water quality survey in 2006 reported elevated sulfate concentrations for the first time (Texas CEQ, 2007). The levels reported exceed levels considered non-supporting for "General Use." These levels do not impact contact recreation or potable water usage. However, they are of concern because they could potentially affect aquatic life in the lake.

Existing and Proposed Water Use

Lake Livingston Reservoir, the largest reservoir in the Trinity River Basin, was constructed by TRA to provide a dependable raw water supply for domestic, municipal, industrial, and irrigational needs to the Houston metropolitan area, the lower Trinity River Basin, and communities near the lake.

The original water rights permit (Permit No. 1970) was issued jointly to TRA and the City of Houston in October 1960, authorizing construction of Lake Livingston Dam and impoundment for 1,750,000 AF of storm, flood, and unappropriated waters of the Trinity River. The joint permittees were originally authorized to utilize 1,254,400 AF of water per year for municipal, industrial, and irrigation purposes.

Also in March 1960, Permit No. 1974 was issued jointly to TRA and Houston providing for the construction of the Wallisville Salt Water Barrier (by the U.S. Army Corps of Engineers [Corps]) on the lower Trinity River. TRA and Houston jointly were authorized to divert and use 89,600 AF of water per year from Wallisville.

In the mid-1980s the state adjudicated the water rights in the Trinity River Basin. TRA's portions of Permits 1970 and 1974 were combined in Certificate of Adjudication No. 08-4248. This Certificate was issued by the state on June 9, 1986, but TRA retained its priority dates for the Livingston and Wallisville water rights of September 23, 1959, the date its original applications were filed. Houston's water rights were adjudicated separately. The state has amended TRA's Certificate of Adjudication on three occasions between 1988 and 2006 to: (1) add six counties to the service area of Lake Livingston; (2) grant TRA a permit to reuse treated wastewater discharged into the Trinity River upstream of Lake Livingston; and (3) remove specific allocations of use noted above, so that TRA may use its entire water right for any permitted use (domestic, municipal, agricultural, and/or industrial).

TRA sells water and water rights to smaller consumers on a contract basis. As of 2007, there were 1,341 small water sales contracts in place with TRA (TRA, 2007c). TRA utilizes its share of Lake Livingston water by entering into short-term (1 to 5 years) or long-term (22 to 44 years) water sales agreements with industries, municipalities, governmental bodies, and corporations. All water used by Houston is discharged through the dam and transported via the Trinity River to the Coastal Industrial Water Authority's pump station in Liberty County. A summary of current major water rights and historic water use from Lake Livingston down to Wallisville (TRA, 2007d) is provided in ***Table 2***.

Table 2. Lake Livingston/Wallisville Water Rights (Source: TRA, 2007d)

LAKE LIVINGSTON WATER RIGHTS:	
Houston	902,800 AF/yr = 806.0 MGD
TRA	351,600 AF/yr = 314.0 MGD
TOTAL	1,254,400 AF/yr = 1,120.0 MGD
WALLISVILLE WATER RIGHTS:	
Houston	38,000 AF/yr = 33.9 MGD
TRA	51,600 AF/yr = 46.1 MGD
TOTAL	89,600 AF/yr = 80.0 MGD
LIVINGSTON/WALLISVILLE TOTAL:	
Houston	940,800 AF/yr = 839.9 MGD
TRA	403,200 AF/yr = 360.1 MGD
TOTAL	1,344,000 AF/yr = 1,200.0 MGD
OTHER WATER RIGHTS BELOW LAKE LIVINGSTON:	
Dayton Canal System: · 33,000 AF/yr in Fixed Rights Agreement. · The City of Houston purchased the system and all water rights including the Fixed Rights.	
Devers Canal System: · 58,500 AF/yr permitted rights plus 27,500 AF/yr from TRA totaling 86,000 AF/yr in Fixed Rights. · San Jacinto River Authority purchased 56,000 AF/yr, Devers Canal retained 2,500 AF/yr + 27,500 AF/yr from TRA (total of 30,000 AF/yr) all as Fixed Rights. SJRA has no Fixed Rights on their 56,000 AF/yr.	
Chambers-Liberty Counties Navigation District: · 88,820 AF/yr in Fixed Rights Agreement. · 54,127 AF/yr if available, the diversion point is downstream of Wallisville Saltwater Barrier so the water is usually too salty. · SJRA purchased 30,000 AF/yr with no Fixed Rights. · CLCND retained 58,820 AF/yr with Fixed Rights.	
Houston: · In addition to 940,800 AF/yr from Livingston/Wallisville, Houston has 45,000 AF/yr that can be diverted from the Trinity River or Old River with no Fixed Rights.	

Historically, TRA was required to release from Lake Livingston during the irrigation season (May 15 to September 15) such quantities of water, not to exceed 1,000 cfs (approximately 2,000 AF/day), as was necessary to prevent the intrusion of salt water to existing pumping plant intakes. This quantity was in excess of the quantities diverted for irrigation and municipal water supply. It was found that during a dry summer approximately 500 cfs was adequate to prevent salt water intrusion. However, the completion of the Wallisville Salt Water Intrusion Project in mid-1999 has helped to meet this water quality requirement and specific minimum releases from Lake Livingston are no longer necessary or required[7] (TRA, 2004).

Additional discussion on current water rights and water rights issues, including a trend of water rights transfers from irrigation to municipal and industrial uses, is provided in the latest (2007) Trinity River Basin Master Plan (TRA, 2007a).

Other current, non-consumptive usages of Lake Livingston waters at this time include various forms of recreation such as fishing, hunting, water-skiing, swimming, sailing and motor boating, camping, and hiking. Recreational use and opportunity in the region are discussed in ***Section 3.3.5***.

Existing Water Quality

Section 303(d) of the 1972 Federal Clean Water Act, as amended in 1985 and 1992, requires that states develop a list of water bodies that do not meet water quality standards, establish priority rankings for waters on the list, and develop action plans, called Total Maximum Daily Loads (TMDLs), to improve water quality. The list of impaired water bodies is revised periodically (typically every two years).

Under this federal requirement, the Texas CEQ is required to monitor the water resources of the state and report to the EPA biannually regarding the progress of achieving water quality goals. The state has established criteria to determine if a water body meets the state's goal of maintaining its beneficial uses, such as drinking, fishing, and contact recreation. If it is determined that the designated uses of a water body are threatened or impaired, the affected water body is then placed on a list of impaired waters (commonly referred to as the 303(d) list) and the state develops action plans to achieve compliance. If the impact is severe enough, the state may recommend developing specific numerical water body-based TMDLs. A numerical TMDL is a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards. A fraction of that amount is then allotted to each permitted discharger, so that the compliance goal for the affected receiving waterbody is not exceeded.

There have been a number of water quality assessments performed over the years for Lake Livingston. The original licensing application in 1983 contained an extensive summary of water quality data and studies conducted for biochemical oxygen demand (BOD), DO, and temperature profiles with reservoir depth; phytoplankton; macrophytes; and other parameters (TRA, 1983). These data, collected between 1973 and 1983, confirmed that a trend toward low DO was present only ten years after the reservoir was filled. Although Lake Livingston is considered eutrophic due to excess nutrient loading,

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[7] The Wallisville Saltwater Barrier controls intrusion of salt water from Trinity Bay into the Trinity River by mechanically blocking the upstream movement of saltwater from Trinity Bay during low flow conditions.

DO levels below the spillway have always been high and overall regional water quality is improving (TRA, 2000a, 2005a, 2007a).

Other studies of the reservoir include a Sedimentation Survey performed by the U.S. Department of the Interior, Bureau of Reclamation (DOI, 1993) and a comprehensive water quality assessment conducted for TRA in 1998 (Espey, 1998). The Sedimentation Survey was conducted primarily to gather data needed to compute the capacity of Lake Livingston for reservoir operation. The data were also used to calculate the volume of sediment accumulated in the lake since impoundment began in 1969. The survey revealed a 3.56 percent loss in total capacity with an average annual loss of 2,854 AF for the operation period of 1969 through 1991. The storage capacity of the reservoir was determined as 1,741,867 AF at normal pool elevation of 131 feet msl based on the 1991 survey (DOI, 1993). The latter study included a review of previous water quality studies conducted on Lake Livingston; an evaluation of the water quality database for Lake Livingston and proximate reaches of the Trinity River downstream of the reservoir for the sampling period 1988-1997; an assessment of historic and current water quality and trends; and an evaluation of TRA's water quality monitoring, data management, and Quality Assurance/Quality Control Programs. This report also included an extensive analytical and field survey that included 50 physical and chemical parameters and fish tissue sampling results. Within those analyses, hundreds of chemical compounds such as pesticides, organics and metals, and water quality constituents were evaluated.

In the 1998 report, it was noted that the reservoir exhibited depressed DO and increased presence of fecal coliform bacteria at the upper north end of the reservoir. Nutrient loading was also identified as a concern, but it was also noted that improvement occurred from the upper to lower end of the reservoir. Established Maximum Contaminant Levels (MCLs) for primary metals were not exceeded. Secondary MCLs for aluminum, iron, and manganese were exceeded but were not at levels for human health concern (Espey, 1998).

The most recent 303(d) list indicated a great improvement over prior years in the reservoir water quality since Lake Livingston (Segment 0803) was no longer listed in 2008 as impaired due to low DO levels. High sulfate levels at all 12 monitoring stations and elevated pH values at the lowermost and middle portion of the reservoir were noted as water quality concerns in this segment. Segment 0804G was recorded as having impairments related to DO levels and macrobenthos community in 2008 (Texas CEQ, 2008c).

In summary, Lake Livingston may be characterized as a eutrophic reservoir as evidenced by a high rate of primary production. Nutrient levels have been historically high throughout the lake and are still a concern. Concentrations tend to be higher near the head waters; the likely contributing source is non-point source pollution in the upper Trinity. These abundant nutrients contribute to excessive growths of aquatic macrophytes and algae, the metabolism of which cause substantial diurnal ranges in DO levels. DO levels in the reservoir surface waters are generally high, with few samples falling below the 5.0 mg/l criterion. Potential concerns are noted with respect to trace metals and inorganics, particularly sulfate, and also pesticides. The lake water has been recently reported to not be supporting general uses due to high sulfate levels recently observed in Lake Livingston.

The quality of water in Lake Livingston and the downstream Trinity River segment (as well as upstream) continues to be extensively monitored by TRA, Texas CEQ, and USGS. The Texas Water Development Board (Texas WDB) coordinates with these agencies and monitors regional groundwater. ***Figure 7*** provides a location map for Trinity River Basin monitoring stations within the study area. Both Segments 0802 and 0803, which are used for water diversions, are designated suitable for recreation and domestic raw water supply.

Lake Livingston Reservoir

Lake Livingston Reservoir was developed primarily to provide a raw water supply for the east Texas region including the Houston metropolitan area. Since 1969, when filling the reservoir began, the water quality and fisheries of the reservoir have been extensively and regularly studied.

The water quality is generally good despite tributary inflow containing municipal, industrial, and agricultural pollutants (TRA, 1983). ***Table 3*** (***Attachment C***) lists 37 water quality parameters that were monitored at various depths of Lake Livingston (in main pool near the dam) during the period of 1987-1998 (Espey, 1998).

<u>Nutrients</u>

Eutrophication is the term given to the situation in which surface waters receive an excess of nutrients, primarily phosphorus and nitrogen. Eutrophication is both beneficial and detrimental to fisheries. Increasing the primary production (algae and macrophytes) of a waterbody will generally increase overall fish yield. However, the resulting decline in DO favors those species that are generally more tolerant, but less desirable, for sport fishing. There is also evidence of reduced grazing ability of carnivorous fish brought about by increased turbidity from increased amounts of phytoplankton (SWCSMH, 2006).

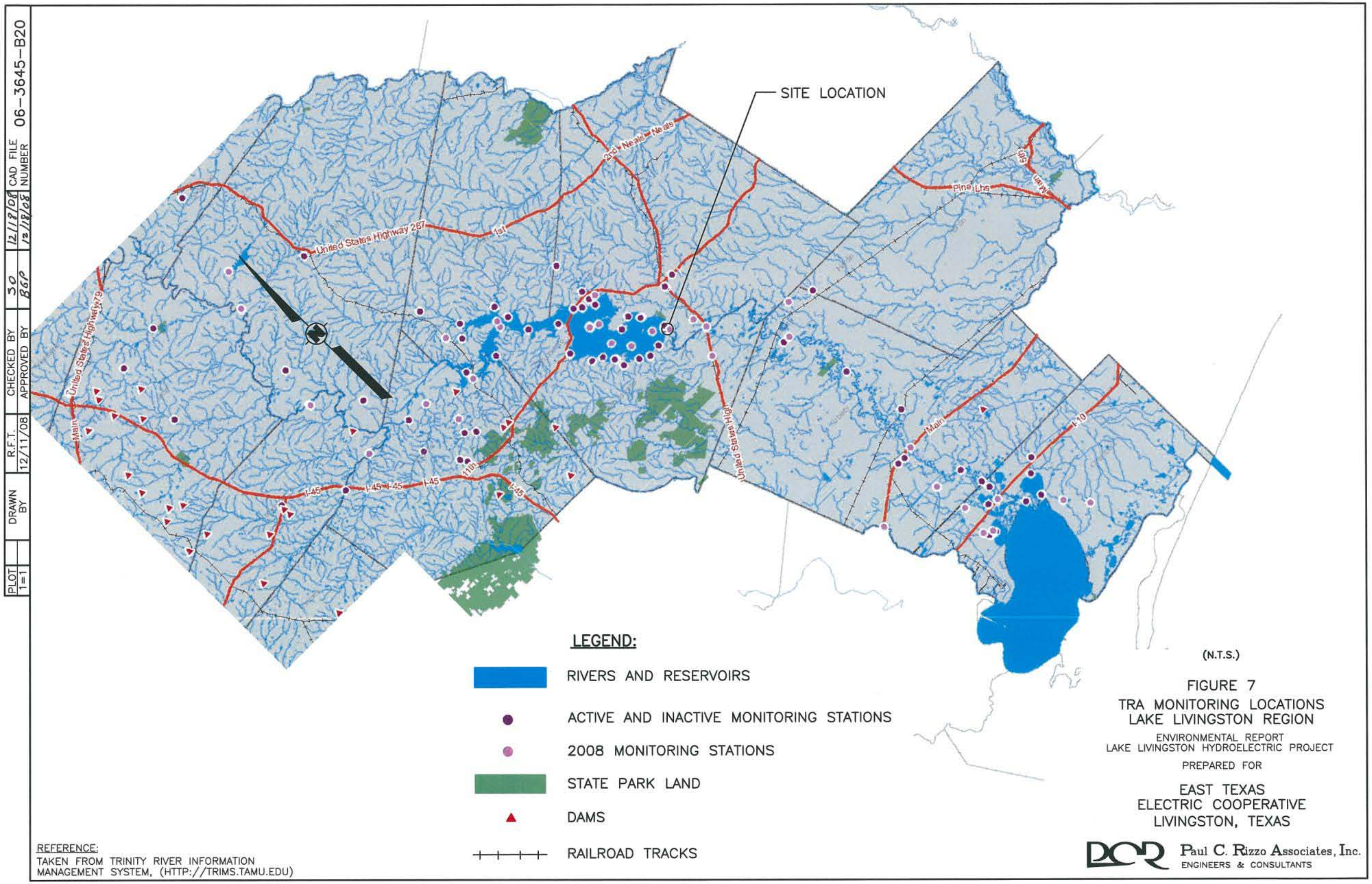

Figure 7. TRA Monitoring Locations Lake Livingston Region

Excessive nutrient inflow has produced a eutrophic state. Texas CEQ (2008d) identified Lake Livingston as eutrophic and ranked it 73rd of 102 reservoirs with regard to its trophic state. Available data show high levels of nutrients in all portions of Lake Livingston with generally higher concentrations near the headwaters. Nitrogen has been determined to be the most probable limiting nutrient in Lake Livingston (Hydroscience, 1976; EPA, 1977), though the EPA has cautioned that the apparent nitrogen limitation may be the result of excessive phosphorus inputs rather than from a scarce nitrogen supply. Although water quality has improved since the 1970s when the lake water was first impounded, nutrients in runoff and DO levels remain a concern. The comprehensive water quality assessment conducted for TRA from 1988 to 1997 for Lake Livingston revealed similar concerns for nutrient loading (mainly nitrates and phosphorus) and DO levels (Espey, 1998). The most recent Basin Highlights Reports prepared for the Trinity River Basin (TRA, 2007b, 2008a) also indicated nutrient concerns throughout the Main Stem Trinity River subwatershed, in which Lake Livingston is located.

Increased nutrient concentrations can cause increased algal activity, which leads to diurnal DO swings. When these swings are severe enough, DO during night and early morning hours can drop to levels below which aquatic organisms can survive, which can result in fish kills. However, as explained in 2000 Basin Summary Report (TRA, 2000a) and a special TRA study conducted in 2005 (TRA, 2005b), there is ample evidence that light, and not nutrients, is limiting to algal growth in most of the Trinity River Basin. Therefore, in most cases, neither the elevated nutrient nor chlorophyll a concentrations identified by the Texas CEQ screening as a water quality concern are believed to be problematic (TRA, 2000a).

Also, as noted above, sulfate has recently been listed for the first time as a water quality impairment at all 12 Lake Livingston monitoring station locations. The source of the sulfate is currently not identified.

Phytoplankton and Chlorophyll

An analysis of phytoplankton in Lake Livingston was conducted in 1977 (McCullough, 1977). Phytoplankton groups showed both seasonal and spatial variations in Lake Livingston. The annual mean standing crop reported was 8,511,000 cells/liter (cells/l) with values ranging up to 22,806,000 cells/l. Values up to 32,600,000 cells/l in 1974 have been recorded by the EPA (1977). These levels are indicative of the high rate of primary production in the lake.

Total chlorophyll levels can also be used to represent the total phytoplankton (algae) production in the lake and is monitored regularly as an indication of the trophic condition of the reservoir, along with total phosphorus and Secchi disk analysis for water clarity. The Texas CEQ reports these data as part of the 303(d) monitoring program. The trophic classification is determined by calculating the "Carlson Trophic State Index

(TSI)," which determines a standardized rating based on established formulas using inputs for Secchi disk (0 to 64 meters), total phosphorus (0 to 768 micrograms per liter (ug/l)), and chlorophyll a (Chla) (0 to 1,183 ug/l). In the trophic classification list prepared by Texas CEQ, chlorophyll a was given priority as the primary trophic state indicator because it is best for estimating algal biomass in most reservoirs. The score (Chla TSI) for Lake Livingston in 2008 was 57.34, ranking it 73rd out of 102 lakes in Texas (e.g., lowest ranking and lowest score means lowest Chla trophic index and lowest productivity) (Texas CEQ, 2008d).

<u>Fecal Coliform Bacteria</u>

Maximum and mean concentrations of fecal coliform bacteria in Lake Livingston have shown marked declines since the reservoir's creation. The Texas surface water criterion for fecal coliforms is 200 organisms/100 milliliters (ml). All monitoring agencies, including TRA, reported fecal coliform concentrations in excess of 1,000 organisms/100 ml during the early 1970s (TRA, 1983). However, TRA's monitoring results from 1975 to 1977 showed a maximum value of only 400 organisms/100 ml at an Upper reservoir location, which was attributed to improved sewage treatment upstream (TRA, 1978). Results from locations near the dam showed a mean value of only 9.7 organisms/100 ml from 1975 to 1982 (TRA, 1983). During the period of 1988 to 1997, average fecal coliform concentrations in the main pool near the dam were reported as 23 organisms/100 ml (Espey, 1998). No stretches in segments 0802, 0803, or 0804 are currently impaired by bacteria according to the 2008 303(d) reporting (Texas CEQ, 2008c).

<u>Macrophytes</u>

Hydrilla verticillata, which is an exotic, invasive species, historically posed problems for reservoir users, and the TRA used herbicides to control the plants (see ***Section 3.3.2.1.2***, Fishery Resources). Due to shoreline erosion and excessive turbidity, there are presently few submerged and emergent aquatic plants in Lake Livingston (Texas PWD, 2008a), which has contributed to the decline of littoral habitats. However, exotic floating plants, including water hyacinth (*Eichhornia crassipes*) have grown to nuisance densities. These plants are a nuisance to boaters and fishermen as they form thick mats over the water surface. Furthermore they significantly affect the quality of the reservoir by shading submerged plants, preventing oxygen production in the water column and, upon dying, they increase the demand on DO and carry cellular nitrogen and phosphorus to the bottom of the reservoir. TRA continues to use herbicides to control these species.

Temperature and Dissolved Oxygen

Thermal stratification in deep reservoirs is common. Temperature induced density differences result in the formation of three quite distinct water layers: an epilimnion (warm surface water readily affected by atmospheric conditions); a thermocline (a middle layer showing a rapid temperature differential with elevation); and a hypolimnion (a relatively cold and stagnant bottom layer not directly influenced by atmospheric conditions). DO is impacted by depth and temperature as well as associated seasonal variability.

During the November 2007 through October 2008 period, TRA performed monthly sampling for temperature and DO in Lake Livingston (TRA, 2008b). Temperature variations measured in the reservoir in front of the spillway gates and near the headrace location are shown in ***Figures 8*** and ***9***, respectively. As demonstrated in ***Figure 8***, the reservoir temperature is the same at all depths (1 to 50 ft) throughout the year except for the period of April through August, when the reservoir temperature decreased at depths greater than 10 ft. This phenomenon is the result of thermal stratification (i.e. changes in the temperature profile with depth within a lake system) and observed during summer months at deep portions of the reservoir. The reservoir water near the proposed headrace location (***Figure 9***), however, has a stable temperature profile since the water near the surface does not experience stratification.

As a part of a water quality study conducted for the proposed Project, temperature and DO were monitored by PBS&J at three locations from spring through summer 2008. The monitoring locations were in the reservoir near the existing spillway gates (at a depth of 4 ft, 29 ft, and 50 ft), the proposed headrace (at a depth of 5 ft), and in the stilling basin between the dam and the weir (near the surface). The study showed the water temperature at the proposed headrace had an average temperature 0.6 degrees Celsius (º C) higher and a maximum temperature that was 2.1º C higher than the temperature downstream of the dam. This difference is due to the change in the location of the discharge from the dam (at a depth of 29 ft) to the proposed headrace (at a depth of 5 ft). This study shows the change in the downstream river temperature when water is released from the surface of the reservoir.

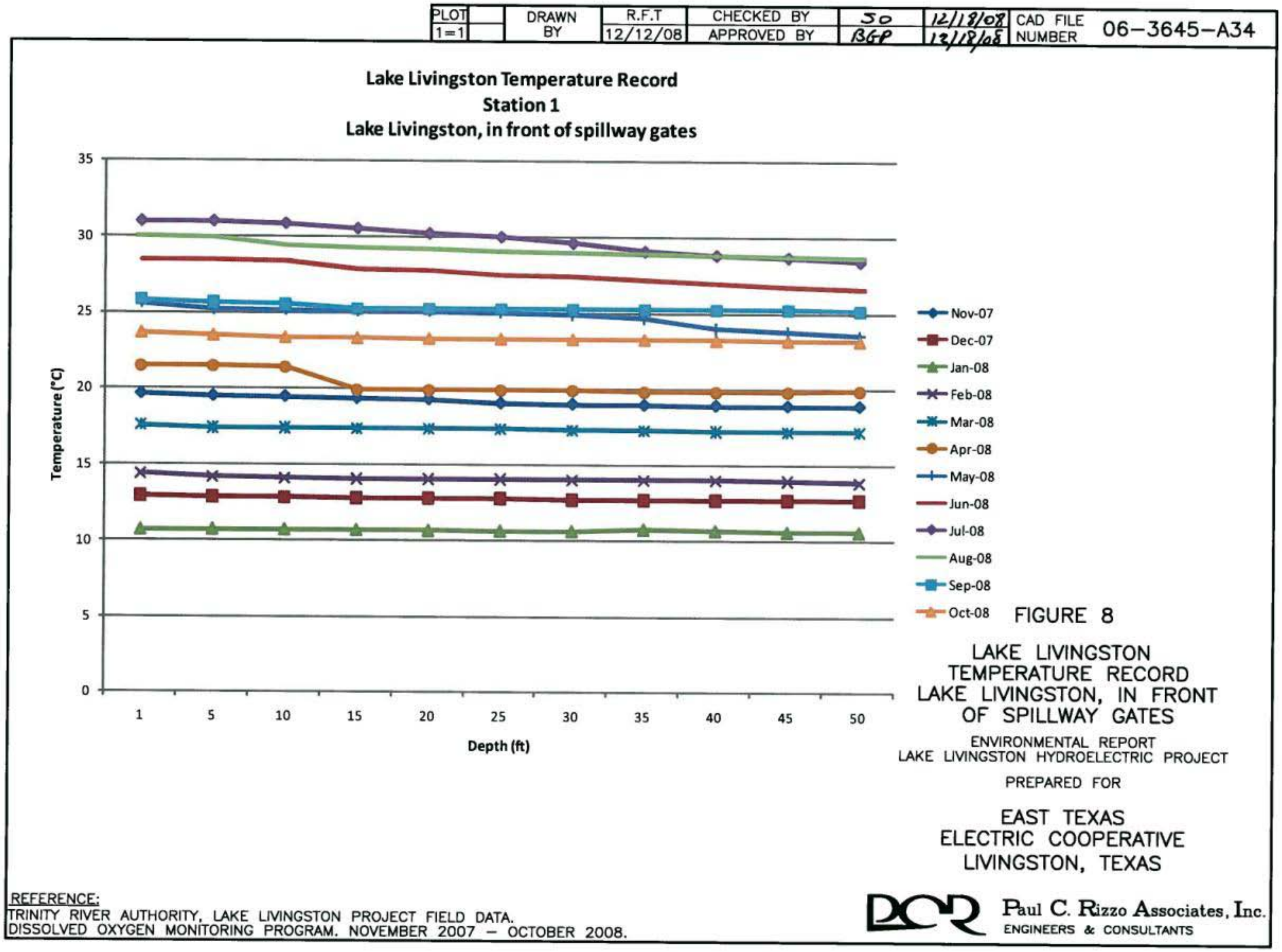

Figure 8. Lake Livingston Temperature Record; Lake Livingston, in Front of Spillway Gates

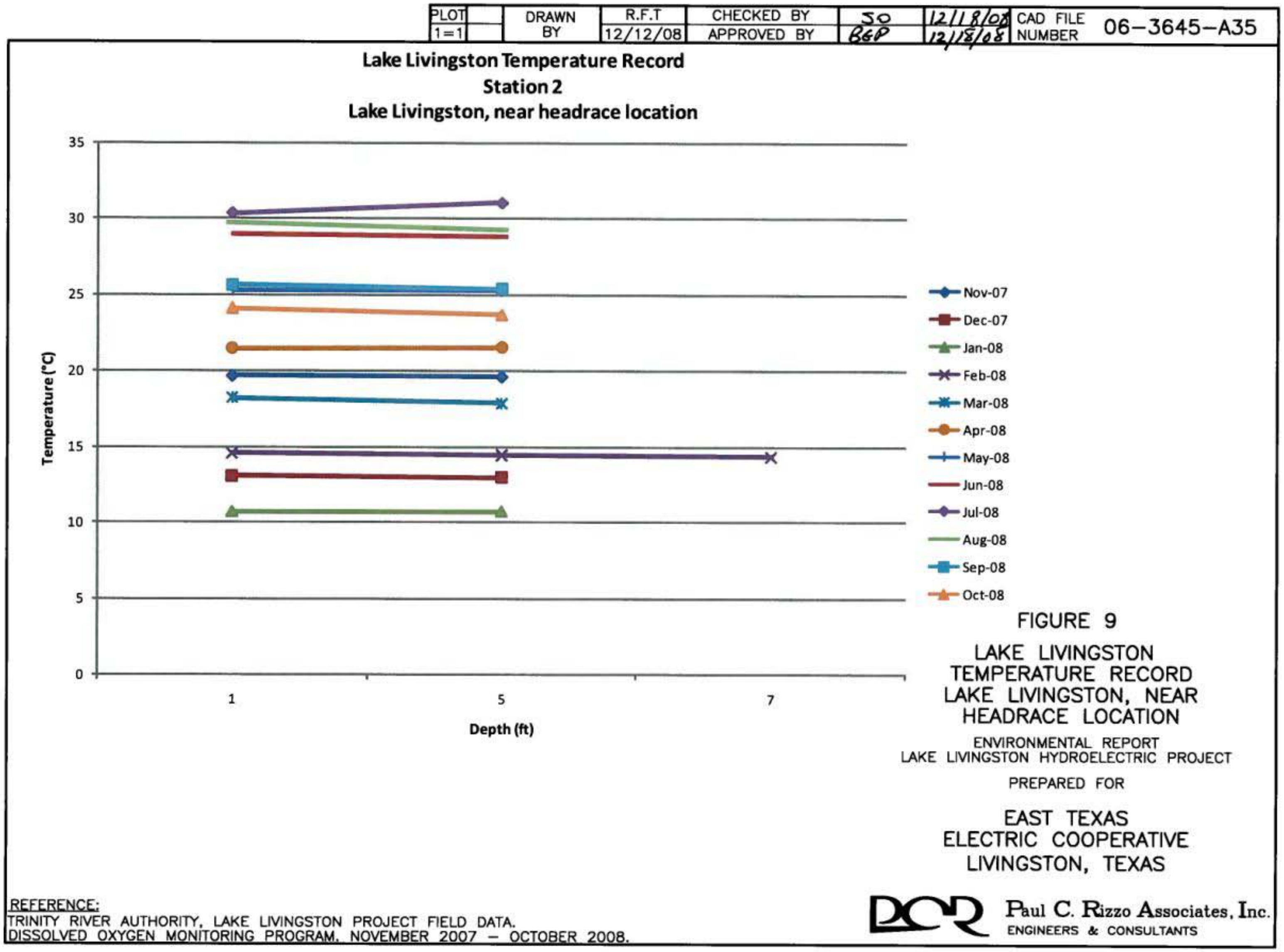

Figure 9. Lake Livingston Temperature Record; Lake Livingston, Near Headrace Location

Historical data collected by the TRA reveal that thermal stratification in Lake Livingston produces a vertical profile only in the deep portions of the lake. ***Figure 10*** shows a time history of water temperature based on ten years of monitoring data collected between 1973 and 1983. The fall overturn generally occurs in September or October and the reservoir is isothermal (i.e., having the same temperature throughout its depth) from November through April. During the months of July through August, a thermocline is present from approximately 30 ft to 60 ft of depth. Since the depth throughout more than 90 percent of the reservoir is less than 40 ft, with an average depth of approximately 22 ft, it was concluded that a large percentage of the stored water is not stratified and has the characteristics of epilimnetic water during the critical summer months (TRA, 1983).

DO monitoring performed by TRA in Lake Livingston during the November 2007 through October 2008 period provided the DO distribution in the reservoir (TRA, 2008b). DO concentrations in the reservoir in front of the spillway gates (***Figure 11***) were mostly stable and above 5 milligrams per liter (mg/l) at all depths during the sampling period, except May through September when thermal stratification is observed at deep portions of the reservoir, as discussed above. The DO levels started to decrease substantially with depth (generally at depths greater than 10 to 15 ft) during these months and concentrations measured during June through August (summer months) dropped below 1 mg/l at 50 ft. However, DO levels measured in the reservoir near the headrace location (***Figure 12)*** were higher than 5 mg/l (except August sampling, in which DO concentration at 5 ft was measured as 4.79 mg/l) throughout the year since the water is near the surface, where photosynthesis, aeration, and mixing occurs.

The DO concentrations monitored by PBS&J from May through September 2008, averaged 7.3 mg/l at the proposed headrace while average DO in the stilling basin was measured as 7.6 mg/l. The minimum DO at the proposed headrace was 0.4 mg/l compared to 5.7 mg/l in the stilling basin. Low DO in reservoir surface waters has not been commonly reported other than during periods of fall overturn. Lowest DO was reported usually during the early morning and was observed on multiple dates at each of the surface stations. DO was generally stable downstream of the dam due to high physical reaeration as the water is discharged from the reservoir and cascades in a relatively thin, turbulent, sheet flow into the stilling basin. Although the reservoir release is periodically hypoxic (minimum DO at 29 ft was 0.1 mg/l), passage of water through the dam appears to aerate the water to near saturation.

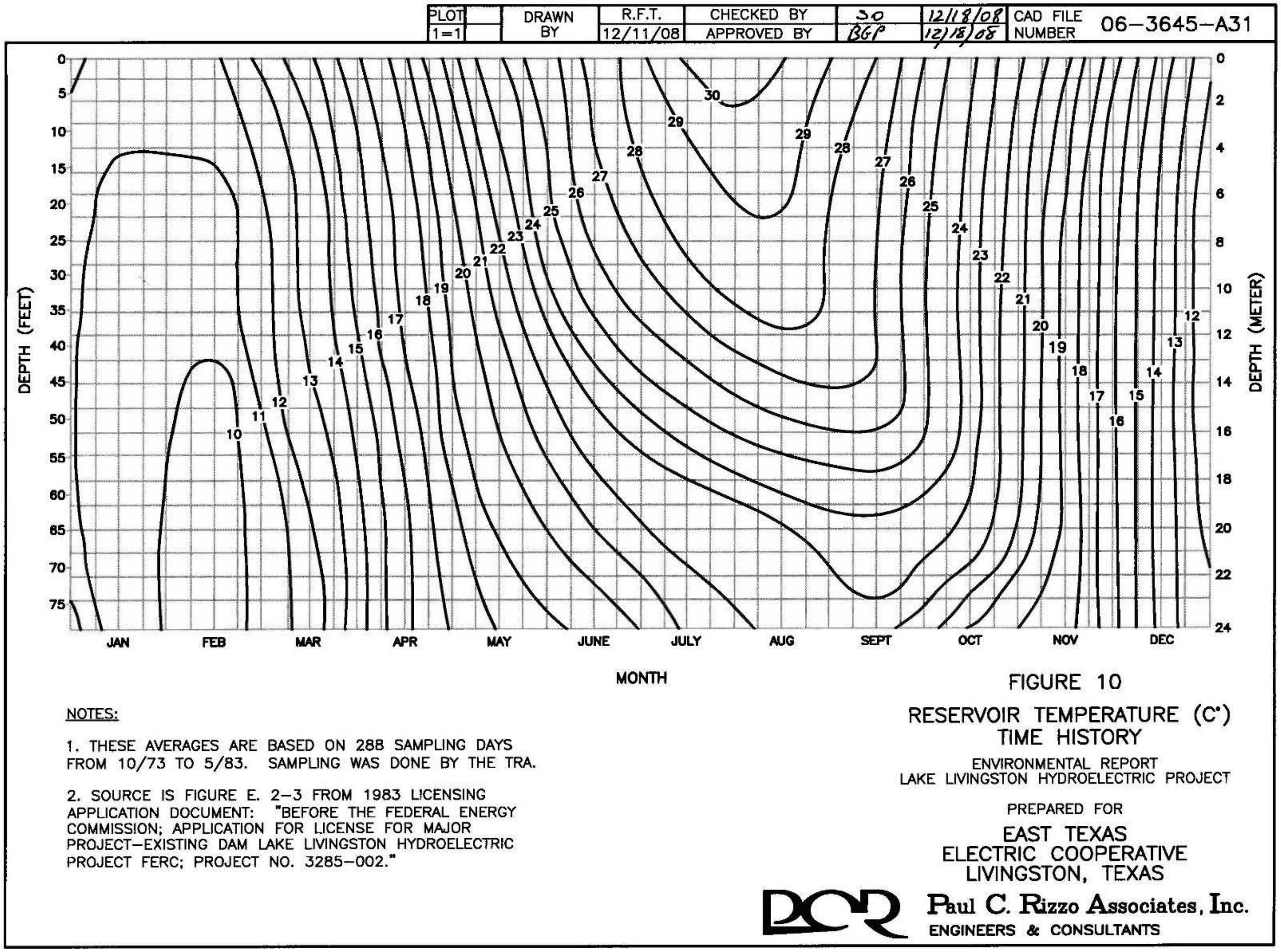

Figure 10. Reservoir Temperature Time History

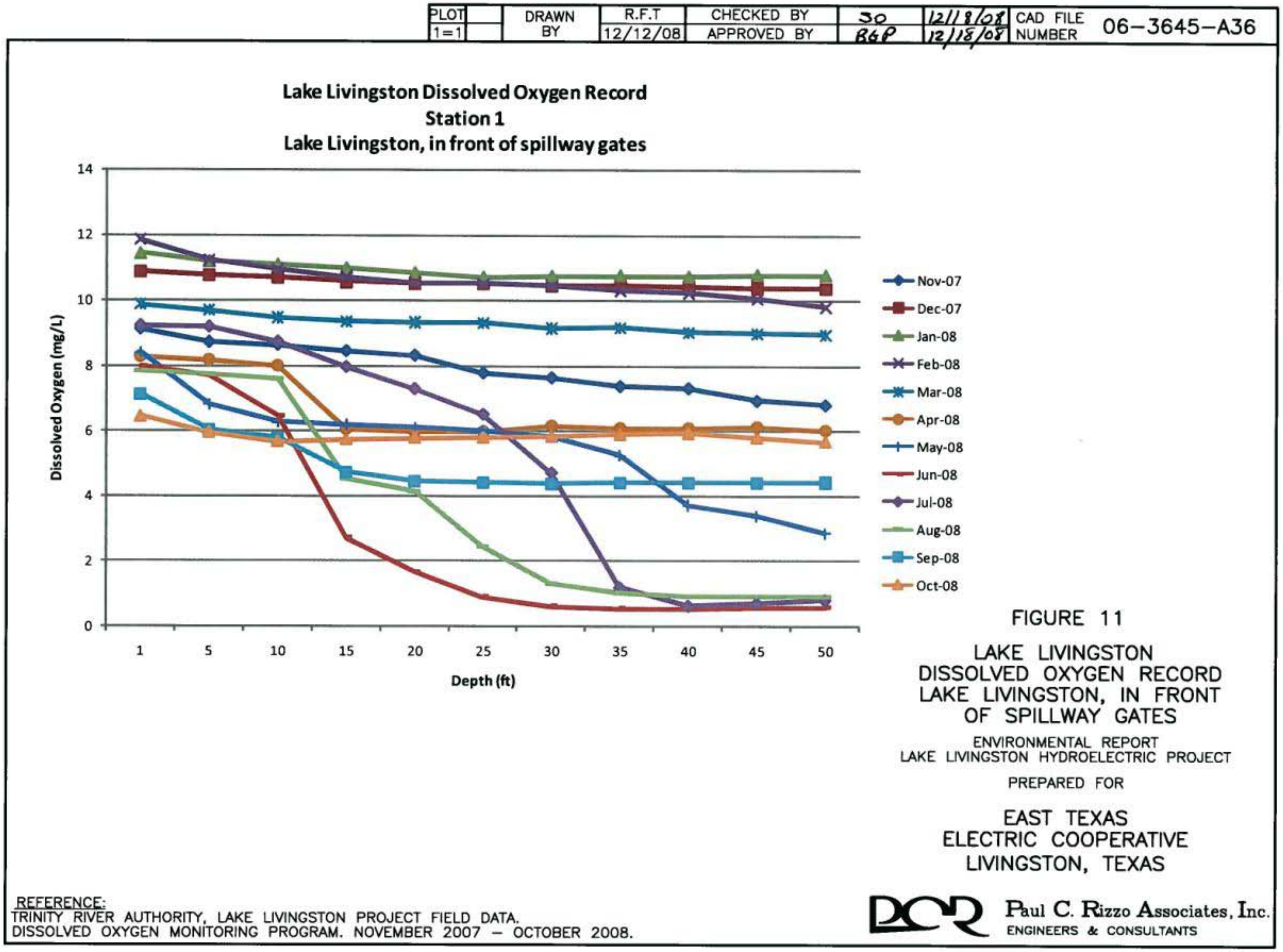

Figure 11. Lake Livingston Dissolved Oxygen Record; Lake Livingston, in Front of Spillway Gates

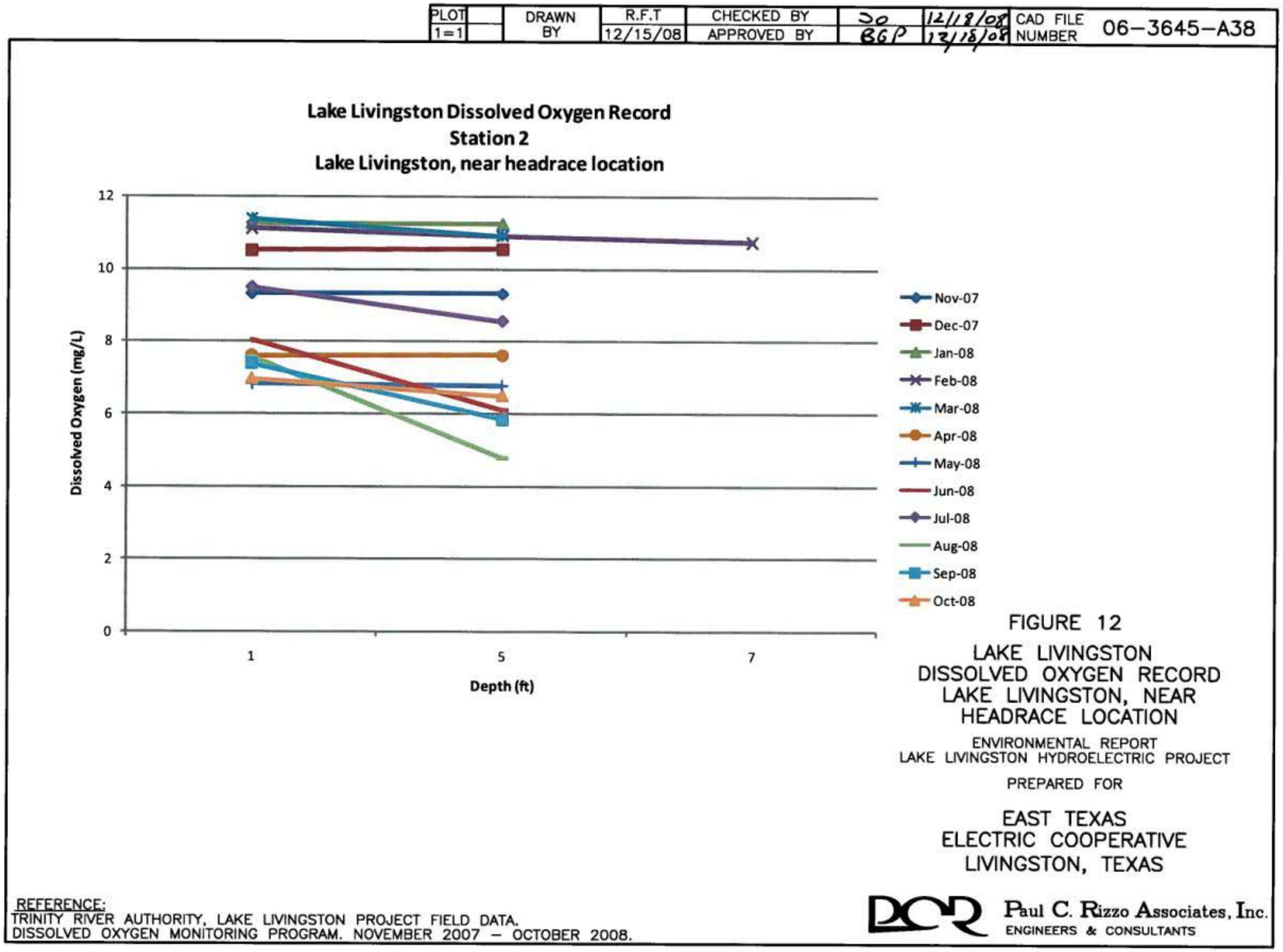

Figure 12. Lake Livingston Dissolved Oxygen Record; Lake Livingston, Near Headrace Location

As a part of water quality assessment for the proposed Project, water quality modeling was also conducted by PBS&J to help predict how temperature and DO in Lake Livingston, the stilling basin, and the proposed tailrace area would be affected by different hydroelectric and reservoir release scenarios. The model calibration, data development, and model results along with various figures comparing the observed and modeled parameters are presented in Trinity River and Lake Livingston Biological Characterization for the Proposed Lake Livingston Hydroelectric Project (***Attachment B***).

The historical distribution of DO in the reservoir and impacts of the thermal stratification were assessed by TRA. The maximum concentration of DO is limited by temperature. During cooler months (November through April) the water is circulated from top to bottom and substantial aeration and mixing occurs, permitting replenishment of DO utilized in the decomposition of organic matter. ***Figure 13*** presents a monthly average at each depth of daytime DO measurements recorded by TRA during ten years of monitoring between 1973 and 1983. DO levels below the criterion (5.0 mg/l) generally occur from May through October at depths greater than 20 to 25 ft. Concentrations below 3.0 mg/l, which could adversely affect many fish species, generally occur at depths greater than 30 ft for a shorter period of time. Surface DO concentrations as low as 2.8 mg/l and as high as 17.2 mg/l have been observed by TRA. Some of this variation is attributable to photosynthetic activities of phytoplankton and aquatic macrophytes (TRA, 1983). Continuous, 24-hour monitoring of DO at the dam site by TRA has revealed daily fluctuations of up to 5.9 mg/l (personal communication between M. Tumerldy and M. Knight, TRA Water Quality Monitoring Laboratory, July 1983).

At monitoring stations on tributaries above the dam, DO concentrations below 1 mg/l have been observed (TRA, 1983). These low concentrations are primarily caused by oxygen demanding wastewaters discharged into the tributaries. Lake Livingston appears to have a positive effect on downstream DO levels. As tributary inflows reach Lake Livingston, velocity decreases and residence time increases such that the oxygen demanding materials in the treated wastewaters have become partially stabilized before reaching the lower half of the reservoir. This results in an increase in the surface DO concentrations as water approaches the dam (TRA, 1983). Water Quality Assessments and studies conducted in the Trinity River downsteam of the dam identified no concerns related to DO (Espey, 1998; TRA, 2000a, 2005a, 2008a).

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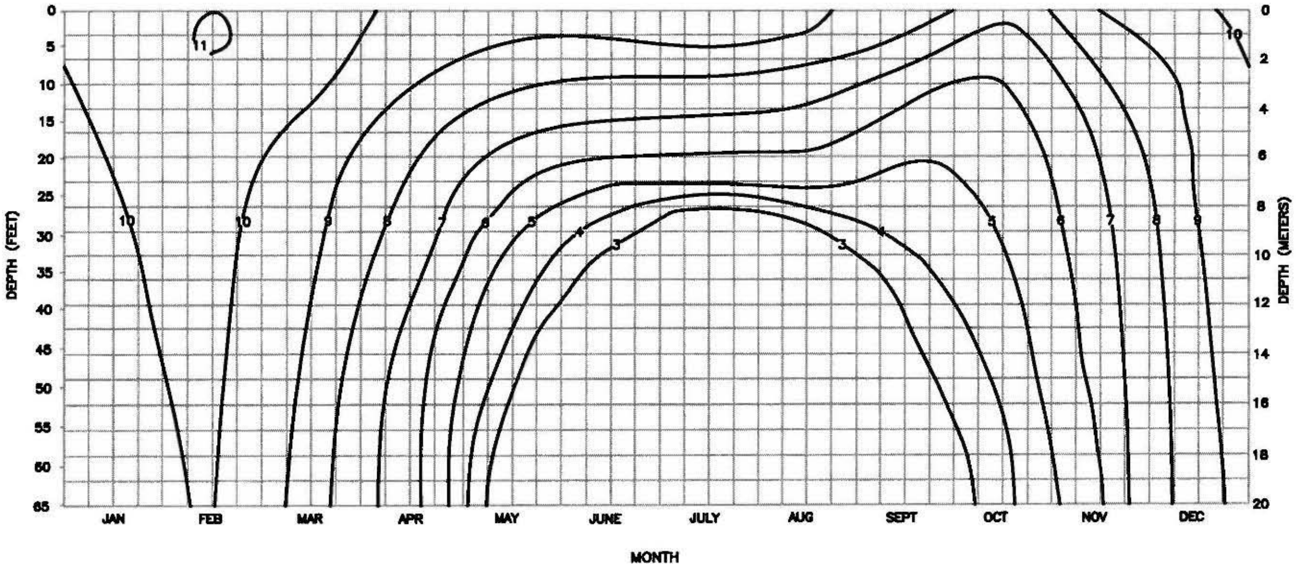

NOTES:

1. THESE AVERAGES ARE BASED ON 288 SAMPLING DAYS FROM 10/73 TO 5/83. SAMPLING WAS DONE BY THE TRA.

2. SOURCE IS FIGURE E. 2-4 FROM 1983 LICENSING APPLICATION DOCUMENT: "BEFORE THE FEDERAL ENERGY COMMISSION; APPLICATION FOR LICENSE FOR MAJOR PROJECT-EXISTING DAM LAKE LIVINGSTON HYDROELECTRIC PROJECT; FERC PROJECT NO. 3285-002."

FIGURE 13

RESERVOIR DISSOLVED OXYGEN
Mg/ℓ HISTORY

ENVIRONMENTAL REPORT
LAKE LIVINGSTON HYDROELECTRIC PROJECT

PREPARED FOR

EAST TEXAS
ELECTRIC COOPERATIVE
LIVINGSTON, TEXAS

Paul C. Rizzo Associates, Inc.
ENGINEERS & CONSULTANTS

Figure 13. Reservoir Dissolved Oxygen History

Inorganic Constituents

Concentrations of dissolved solids, chloride, and sulfate compounds in Lake Livingston vary seasonally and are usually at their maximum during the summer and fall when evaporation is high and inflow is low. The water is usually moderately hard to hard (61 to 180 mg calcium carbonate per liter). Neither the seasonal variation of dissolved constituents in inflow nor that of water temperature has resulted in significant stratification of dissolved solids within the reservoir. Concentrations of dissolved solids, chlorides, and sulfate usually average less than 250 mg/l, 40 mg/l, and 50 mg/l, respectively (TRA, 1983). An evaluation of Lake Livingston water quality data from 1988-1997 reported average dissolved solids, chloride, and sulfate concentrations of 214 mg/l, 25 mg/l, and 38 mg/l, respectively, in the main pool near the dam. The study also indicated that all values reported for every station for these inorganics were less than the drinking water standard secondary MCLs (Espey, 1998).

In 2001, evaluation of the water quality data collected near the dam showed an increasing trend in sulfate concentrations, with the latest 2001 measurements indicating a violation of the stream standard of 50 mg/l. Since there was no apparent anthropogenic cause at that time, it was believed to be due to the drought of the previous several years (TRA, 2001). Although no more concerns pertaining to sulfate levels in the lake water have been noted since 2001, the last two 303(d) lists (Texas CEQ, 2007, 2008c) identified elevated sulfate concentrations as an impairment issue throughout the entire lake. Therefore, Lake Livingston was reported to be not supporting general uses due to sulfate levels. Portions of the river below Lake Livingston Dam (Segment 0802) were also found to have concerns for public water supply use due to sulfate (TRA, 2008a).

Pesticides

Historically, the Texas Department of Water Resources (Texas DWR), predecessor agency of the Texas CEQ, conducted annual pesticide analyses on sediment samples taken at the SH19 Bridge crossing station (0803.02). Analysis in 1982 indicated “elevated” levels of dieldrin and diazinon in the sediments at this location (Texas DWR, 1982). Since 1992, Texas CEQ has not reported Lake Livingston impairments or impaired stream segments in the sections above or below the lake (Trinity River Basin segments 0802, 0803, or 0804) as a result of pesticides (Texas CEQ, 1992, 1994, 1997, 1998, 1999, 2002a, 2002b, 2005, 2007, 2008c). TRA also continues to monitor the reservoir extensively.

Metals

Iron and manganese are the most significant dissolved metals in Lake Livingston. Both are common in most soils and surface waters and both are important trace elements for plants and animals. The main problems associated with high iron and manganese concentrations are their effects on the taste of drinking water and their tendency to discolor laundry.

Surface water throughout the year, as well as bottom water during the cooler half of the year, usually contains less than 0.1 mg/l of iron and manganese. During the summer months, thermal stratification creates anaerobic conditions in the deepest portions of the reservoir. The anaerobic decomposition of organic matter at these depths results in the release from bottom sediments of dissolved iron and manganese such that concentrations as high as 2.3 mg/l of iron and 4.7 mg/l of manganese have been observed. These values exceed the EPA standards for drinking water (0.3 mg/l for iron and 0.05 mg/l for manganese). However, high concentrations are localized to the bottom downstream portion of the reservoir and only occur during summer stratifications. Each year, the fall overturn of water circulates oxygen to the bottom of the reservoir and causes the dissolved iron and manganese to precipitate out and settle to the bottom (TRA, 1983).

Since the filling of the reservoir in 1971, the measured concentrations of dissolved iron and manganese in the bottom waters increased annually until a peak occurred in 1974. Concentrations then leveled off maintaining an average maximum summer concentration of less than 1 mg/l for iron and approximately 3 mg/l for manganese until at least 1983 (TRA, 1983). During the period of 1988 to 1997, average total manganese concentrations in water ranged from 0.065 to 0.158 mg/l at six monitoring stations on the lake. The maximum manganese concentration reported during that period was 1.987 mg/l in the main pool at the dam. During the same sampling period, the range for average total iron concentration was from 0.634 to 6.702 mg/l at six monitoring stations on the lake. In the main pool at the dam, the average total iron concentration was measured as 0.68 mg/l, while minimum and maximum total iron concentrations were 0.037 mg/l and 5.1 mg/l, respectively (Espey, 1998).

Concentrations of heavy metals in water and sediment samples from Lake Livingston are generally not significant (TRA, 1983). However, instances of arsenic, chromium, manganese, mercury, silver, and zinc levels in excess of federal criteria have been reported historically (TRA, 1978). Although dissolved lead and cadmium impairments above or below the lake were noted in the previous 303(d) lists, it has not been identified as a concern since 2002 (Texas CEQ, 2002a, 2002b, 2005, 2007, 2008c).

Summary of Lake Livingston Water Quality

In summary, Lake Livingston may be characterized as a eutrophic reservoir as evidenced by a high rate of primary production. Nutrient levels have been historically high throughout the lake and are still a concern. However, concentrations tend to be higher near the head waters which is reflective of upstream nutrient loading. DO in the surface waters is generally above the 5.0 mg/l criterion. However, periodic excessive algal growth can result in DO falling infrequently below the criterion during the summer.

Potential concerns are noted with respect to trace metals and inorganics, particularly sulfate, and also pesticides. The lake water has been recently reported to be not supporting general uses due to high sulfate levels observed in Lake Livingston.

Trinity River Downstream of Livingston Dam

The river downstream of the dam receives flow from the reservoir either through twelve 40-foot-wide spillway gates or the outlet works, a multiple port outlet tower. Water released through the spillway gates and the top three ports of the outlet tower usually emerges under about two atmospheres of pressure and drops up to 40 ft depending on the tailwater level. This causes an efficient exchange of oxygen to the discharged water and often results in super-saturation of the release. Conversely, flow through the two lowest tower ports does not significantly aerate the released water. Therefore, the upper ports are preferentially utilized (TRA, 1983).

The river section below the dam supports a vital fishery resource with a diversity of gamefish. ***Table 4*** presents the temperature and DO data measured monthly by TRA at five stations in the Trinity River downstream of the dam during the November 2007 through October 2008 period (TRA, 2008b). According to these data, temperatures are less than the standard of 33.9º C (as a maximum) and the DO concentrations are well above the standard of 5 mg/l in the river.

Temperature and DO profiles prepared by PBS&J for downstream of the river for the period of 2000 through 2006 (as a part of water quality modeling study) and from May 2008 through September 2008 (as a part of water quality study) are also presented in ***Attachment B***. These water quality profiles also indicate that there is no concern related to temperature and DO levels in the river downstream of the dam.

The river from the dam to the tidal zone is classified by Texas CEQ as suitable for domestic raw water supply with no significant water quality problems. ***Tables 5 and 6*** (***Attachment C***) present statistical summaries of 37 water quality parameters sampled immediately downstream of the dam and at a monitoring site 30 miles downstream near Romayor, respectively (Espey, 1998). Analysis of these data in light of the occasionally poor water quality upstream of the reservoir indicates that the reservoir is a major recovery zone along the river system.

Table 4. Temperature and dissolved oxygen measurements in Trinity River downstream of Lake Livingston Dam by TRA, November 2007-October 2008 (Source: TRA, 2008b)

	STATION 3(1)			STATION 4(2)			STATION 5(3)			STATION 6(4)			STATION 7(5)		
Time	Depth (ft)	Temp (°C)	DO (mg/l)	Depth (ft)	Temp (°C)	DO (mg/l)	Depth (ft)	Temp (°C)	DO (mg/l)	Depth (ft)	Temp (°C)	DO (mg/l)	Depth (ft)	Temp (°C)	DO (mg/l)
Nov-07	1	19.30	9.96	1	19.36	9.35	1	19.24	9.47	1	19.40	9.36	1	19.48	9.50
										5	19.40	9.36	4	19.36	9.49
										7	19.56	9.39			
Dec-07	1	12.81	11.35	1	12.89	10.86	1	12.30	11.04	1	12.87	11.12	1	12.76	11.05
				2	12.92	10.92				5	12.88	11.12	4	12.75	11.12
Jan-08	1	10.69	11.86	1	10.83	11.69	1	10.72	11.75	1	10.83	11.74	1	10.73	11.93
				5	11	11.71				5	10.94	12.01	5	10.73	11.78
													8	10.73	11.74
Feb-08	1	14.22	10.45	1	14.95	10.51	1	14.26	10.49	1	14.57	11.67	1	14.25	10.92
Mar-08	1	17.53	10.76	1	17.43	10.30	1	17.49	10.35	1	17.39	10.60	1	17.35	10.63
				5	17.34	10.61	5	17.37	10.60	5	17.38	10.62	5	17.35	10.62
							10	17.37	10.62	10	17.38	10.63	10	17.36	10.59
Apr-08	1	20.34	8.74	1	20.94	8.61	1	20.19	9.05	1	20.62	8.7	1	20.23	10.35
				5	20.3	9.03	5	20.16	9.2	5	20.48	8.89	5	20.19	9.82
				10	20.34	9.04	10	20.15	9.21	10	20.47	8.95	10	20.18	9.53
													15	20.2	9.38
May-08	1	24.72	8.38	1	26.34	8.30	1	24.89	8.53	1	25.73	8.34	1	25.02	8.30
							5	24.98	8.62				5	24.92	8.42
Jun-08	1	27.45	7.70	1	26.92	7.53	1	27.43	7.82	1	27.71	7.65	1	27.40	7.59
Jul-08	1	29.90	7.14	1	29.92	6.94	1	29.93	7.37	1	30.05	7.41	1	29.75	6.94
Aug-08	1	29.20	8.01	1	28.94	7.45	1	29.18	7.36	1	29.90	8.20	1	29.35	7.95
Sep-08	1	25.16	7.86	1	25.20	7.85	1	25.21	7.91	1	25.53	8.74	1	25.32	8.03
Oct-08	1	23.56	8.63	1	23.31	8.15	1	23.54	8.53	1	23.67	8.73	1	23.56	8.67

Notes:

(1) Station 3: Stilling Basin below spillway, east side
(2) Station 4: Near west bank of river, 500 ft below spillway
(3) Station 5: Center of river, 500 ft below spillway
(4) Station 6: Near west bank of river, 1000 ft below spillway
(5) Station 7: Center of river, 1000 ft below spillway

Two tributaries to the Trinity River below the dam bring in the only significant waste loadings in this segment. The effluent from the City of Livingston sewage treatment plant (STP) discharges into Long King Creek, and the City of Shepherd STP discharges into Big Creek. Menard Creek, another tributary to the downstream segment of the river, has not been affected by man-made developments and is a source of clean, uncontaminated water for the Trinity River (TRA, 1983). Although the Trinity River below the dam (Segment 0802) was previously listed as impaired mostly due to high bacteria levels, there has been no ongoing concern in this segment since 2002 (Texas CEQ, 2002a, 2002b, 2005, 2007, 2008c).

In summary, the Trinity River below Lake Livingston Dam has no significant water quality concerns. The presence of the lake appears to act as a recovery zone for impacted waters prior to their release. The latest water quality assessments and studies showed that the Lower Trinity River is fully supporting the aquatic life and contact recreation uses (TRA, 2005a, 2008a).

Minimum and Maximum Flow Releases

The proposed Project would operate as a run-of-river facility. There would be no change in the schedule of releases from the reservoir as a result of the proposed hydroelectric development. TRA presently operates the spillway gates to maintain a more or less constant reservoir level of 131’ msl during normal operations.

The Project would use up to 4,500 cfs. When reservoir releases need to exceed 4,500 cfs, the flows exceeding this amount will be released through the existing gates at the dam. When reservoir releases are less than 4,500 cfs, the majority of the reservoir releases will pass through the hydroelectric turbines and a small portion will be released through the existing spillway gates to maintain water quality in the spillway stilling basin. The release of water used for electric generation will come from depths ranging from the surface to approximately 15 ft below the surface and would discharge off of the east shore of the Trinity River immediately downstream of the weir.

Since the construction of the dam, the minimum recorded discharge in the river downstream of the dam occurred in 1972 and was approximately 230 cfs. The highest recorded discharge since construction of the dam occurred in October 1994 and was 110,600 cfs. There have been a number of days that the recorded flow exceeded 100,000 cfs. Occasional controlled high water release is warranted such as the discharges of 79,200 cfs which was sustained for two days on September 24 – 26, 2005 to release water following damage to the upstream face of the dam during Hurricane Rita (TRA, 2005c). Flood releases are strictly based on the amount of inflow into the reservoir.

Historically, TRA had a responsibility to supply irrigation water, free of salinity intrusion, during the rice irrigation season from May 15 through September 15. This obligation required the spillage of up to 1,000 cfs regardless of possible low inflow to the reservoir at that time. Without a barrier, saltwater could travel upstream and cover the diversion points of major water distribution systems along the Trinity River. However, saltwater intrusion mitigation has been greatly assisted by the Corps of Engineers' completion of the Wallisville Salt Water Barrier Project in mid-1999 and, therefore, such releases are no longer required (TRA, 2004).

Ongoing TRA Water Quality Initiatives

TRA has the responsibility for maintaining high water quality within Lake Livingston. The organization currently is involved in four major, long-term programs designed to insure high quality water. These are: (1) a septic system program, (2) sewage treatment plant operation/technical assistance; (3) an intensive water quality monitoring program; and (4) yearly spraying to control nuisance growth of aquatic macrophytes. The programs are described as follows.

<u>Septic System Program</u>

On March 26, 1971, the Texas Water Quality Board (later Texas NRCC and then Texas CEQ) approved Order 69-5, establishing rules and regulations governing the control of private sewage systems around Lake Livingston. This was done at the request of TRA and was the first such order in the state directed specifically to a reservoir. Through the years, this Order has been amended and is currently codified as the Texas CEQ Private Sewage Facility Regulation 157.31.01.001-.016.

This regulation established a Water Quality Area around Lake Livingston from the operating pool elevation of 131.0 ft msl landward for 2,000 ft. An area of 75 ft around the perimeter of the lake and adjacent to the 131.0 ft level has been established as the Restricted Area in which no soil absorption lines may be placed (TRA, 1983).

The Septic System Program currently is responsible for over 6,700 conventional systems and more than 1,840 aerobic systems (TRA, 2007c), with an average of 400 new systems added yearly. Half of all conventional systems are inspected yearly, so renewal licenses are issued for a two year period (TRA, 1983). Aerobic systems are inspected annually.

<u>Sewage Treatment Operations</u>

TRA owns and operates a number of wastewater facilities upstream of Lake Livingston, including Central (162 million gallons per day) and Ten Mile Creek (24 million gallons per day) in the Dallas area. TRA is involved in the issuance of bonds for the financing of small public and private water pollution control facilities upstream of the lake, including the Huntsville STP and the Crockett STP.

In addition, TRA provides a technical assistance program for privately owned STPs. This program was started in 1975 by TRA and provides professional assistance in the operation of privately owned sewage treatment plants. This service is provided on a contract basis with each treatment plant owner. A licensed treatment plant operator employed by TRA visits each contracted facility a specified number of times each week to make process adjustments, to make field measurements and control tests, to check on the maintenance of equipment, and to collect samples for laboratory analysis. Since the inception of the program in 1975, none of the treatment plants serviced has received any notice of noncompliance from the Texas CEQ or from any other regulatory agency.

All recently issued permits for treatment plants within 5 miles of Lake Livingston limit BOD and total suspended solids monthly average effluent levels to 10 and 15 mg/l, respectively. Minimum chlorine levels of 1 mg/l and maximum monthly average fecal coliform values of 200 organisms/100 ml are required. In addition, pH levels are required to be maintained between 6 and 9 (TRA, 1983). Some of the permits have a seasonal ammonia nitrogen limit of 3/5 mg/l.

Water Quality Monitoring Program

A water quality monitoring program was initiated by TRA in 1972 for Lake Livingston. Several agencies, including TRA, USGS, and Texas CEQ routinely monitor more than 36 stations in the reservoir, the Trinity River above and below the lake, and in various tributaries entering the lake and river. Other agencies such as Corps, Texas PWD, EPA, and FWS also monitor the hydrology, environmental health, ecology, and development throughout the Lake Region and River Basin. Monitoring along the main pool of the reservoir will reveal changes in water quality as water moves through the lake. Shoreline and tributary stations are designed to show the effects of runoff and of development in areas around the lake. River stations document the changes in water quality as the river flows into the lake and flows downstream to the various water users. Wastewater treatment plants are monitored regularly to help insure that these facilities are operated adequately and meet current standards and best management practices for treatment.

The National Pollutant Discharge Elimination System (NPDES) program regulates point source discharges, as well as requiring permits for non-point source discharge such as stormwater associated with industrial activities and stormwater associated with construction. These non-point source permitting programs require obtaining NPDES permit coverage and implementing best management practices for controlling non-point source pollution in stormwater. This monitoring program provides coverage of water quality parameters, which relate to water supply suitability, eutrophication of the reservoir, pollution control, and the well-being of aquatic life. ***Figure 7*** shows the location of various monitoring stations throughout the region.

Control of Aquatic Macrophytes

In an effort to control the spread of aquatic macrophytes (water hyacinths and hydrilla), TRA laboratory personnel have been chemically treating certain areas of the lake with aquatic herbicides from 1974 to present.

Flood Plain and Flood Events

Due to the extensive area drained within the Trinity River Basin, heavy rainfall events in the watershed have the potential to produce flooding. Rapid surface runoff during intense thunderstorm activity can produce flash floods on the smaller tributaries and upper reaches of the river. Slow-moving floods, sometimes of long duration, are common in the middle and lower basin area where the flood plain is wide. The extreme lower reaches of the river are also subject to hurricane-induced surge tides and strong winds typical of the Gulf Coast region. Annual stream flow averages five million AF but is highly irregular because the rainfall is often concentrated so much that it has caused several destructive floods.

The most disastrous flood on record was that of 1908. Damage caused by that flood prompted construction of a number of reservoirs on the upper branches of the river basin to control flooding and provide municipal water supply. The Corps has completed and operates eight lakes on the upper Trinity River Basin for flood control and allied purposes. These installations include Lewisville, Ray Roberts, and Grapevine Lakes of the Elm Fork Project Office, and the five lakes of the Trinity Project Office: Benbrook, Lavon, Navarro Mills, Bardwell, and Joe Pool. There are 933 Soil Conservation Service floodwater retarding reservoirs constructed in the river basin. There are 27 in-basin water supply reservoirs above Lake Livingston, impounding over 5,000-AF each, and two below the Lake Livingston Dam, which also assist in flood control (TRA, 2007a). ***Figure 14*** indicates the extent of the regional 100-year floodplain for Lake Livingston and the upstream and downstream drainage areas.

At Livingston Dam, TRA maintains the lake elevation at 131 ft msl plus or minus one to two ft depending on the season and weather conditions. However, seasonal weather conditions that produce more evaporation and less rainfall can result in the level of the lake dropping below the 130 ft msl level. Run of the river inflows to Lake Livingston determine release rates at the spillway, except during times of low inflow when downstream water demands may dictate the amount of release.

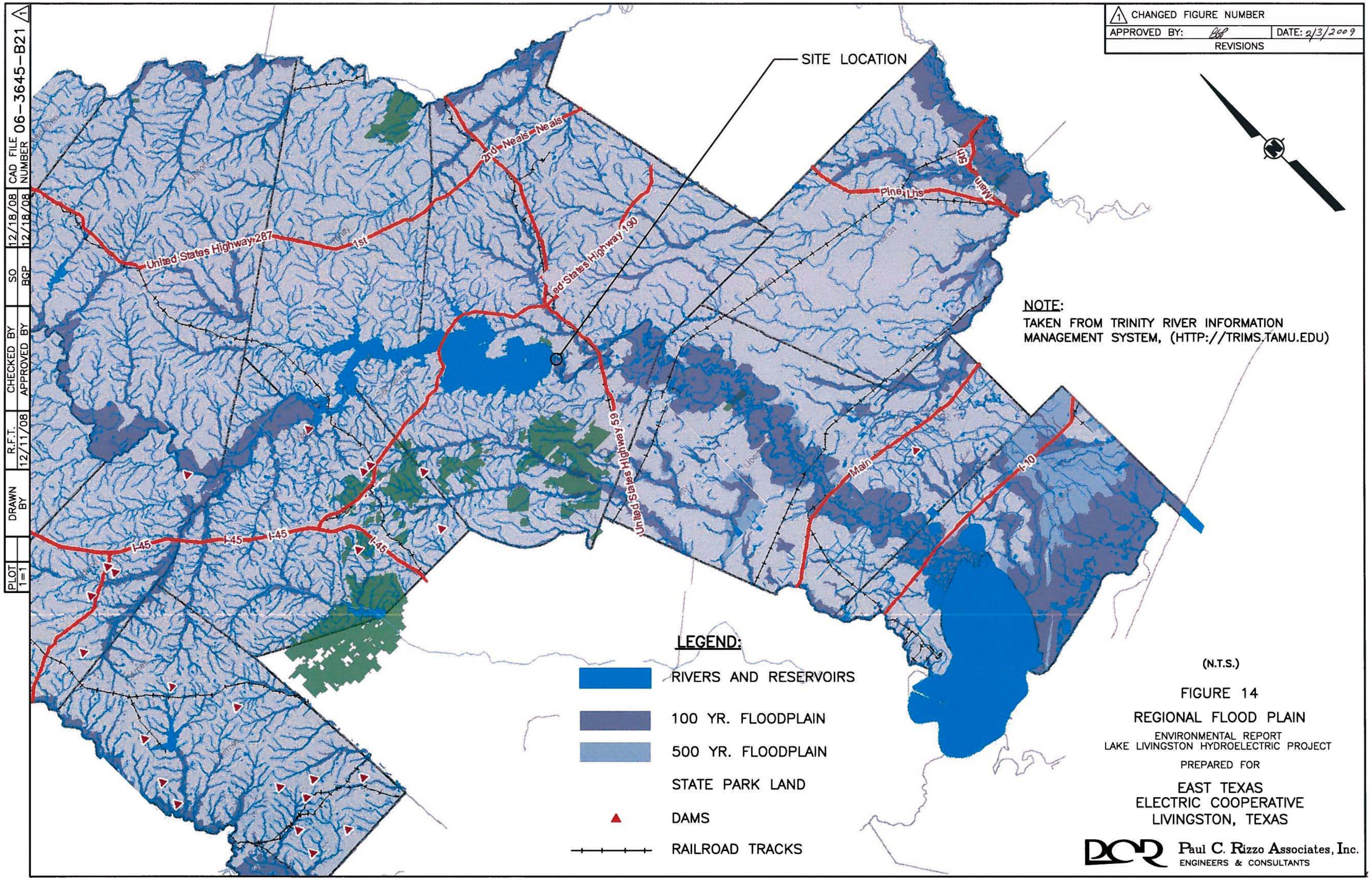

Figure 14. Regional Flood Plain

Ecologically Significant Stream Segments

As a result of the Texas legislature's enactment of Senate Bill 1 in 1997, water planning in Texas became the responsibility of regional planning groups. The state was divided into 16 planning groups designated A through P, generally corresponding to river drainage basins and eco-regions. The Lake Livingston Hydroelectric Project is located in State Water Planning Region H, which consists of all or part of 15 counties, including Austin, Brazoria, Chambers, Fort Bend, Galveston, Harris, Leon, Liberty, Madison, Montgomery, Polk, San Jacinto, Trinity, Walker, and Waller. Each regional planning group may include recommendations for the designation of ecologically unique river and stream segments in their regional water plan. The following criteria are to be used when recommending a river or stream segment as being of unique ecological value:

1. *Biological Function*: Segments which display significant overall habitat value including both quantity and quality considering the degree of biodiversity, age, and uniqueness observed and including terrestrial, wetland, aquatic, or estuarine habitats.

2. *Hydrologic Function*: Segments which are fringed by habitats that perform valuable hydrologic functions relating to water quality, flood attenuation, flow stabilization, or groundwater recharge and discharge.

3. *Riparian Conservation Areas*: Segments which are fringed by significant areas in public ownership including state and federal refuges, wildlife management areas, preserves, parks, mitigation areas, or other areas held by governmental organizations for conservation purposes under a governmentally approved conservation plan.

4. *High Water Quality/Exceptional Aquatic Life/High Aesthetic Value*: Segments and spring resources that are significant due to unique or critical habitats and exceptional aquatic life uses dependent on or associated with high water quality.

5. *Threatened or Endangered Species/Unique Communities*: Sites along segments where water development projects would have significant detrimental effects on state or federally listed threatened and endangered species, and sites along segments that are significant due to the presence of unique, exemplary, or unusually extensive natural communities.

The Texas legislature may designate a river or stream segment of unique ecological value following the recommendations of a regional water planning group. This designation solely means that a state agency or political subdivision of the state may not finance the actual construction of a reservoir in a specific river or stream segment designated by the legislature under this subsection (Texas PWD, 2007a).

Two stream segments relevant to the Project have been designated as Ecologically Significant Stream Segments (Texas PWD, 2007b, 2007c). These are as follows:

<u>Ecologically Significant Stream Segment Trinity River Below Lake Livingston</u>: The ecologically significant segment is from the confluence with Trinity Bay in Chambers County upstream to FM 787 in Liberty County. This is within Texas CEQ stream segments 0801 and 0802. This section of the Trinity River meanders between gently sloping banks lined with interspersed bottomland hardwood forest, cultivated land, residential housing developments, and commercial development. This section of the river provides valuable recreational opportunities such as boating, fishing, and swimming and supports abundant wildlife habitat. Adjacent oxbow lakes and marshes associated with the bottomland forest also provide habitat for wildlife such as migrant waterfowl. The portion of the river downstream of IH 10 has many interconnecting sloughs and bayous that provide habitat for alligators, beavers, waterfowl, and other wildlife. Bald eagles have nested in this area for years and are commonly found during winter. Other commonly seen birds include anhingas, white ibis, herons, cormorants, egrets, roseate spoonbills, red-shouldered hawks, and numerous migratory songbirds.

<u>Ecologically Significant Stream Segment Trinity River Above Lake Livingston</u>: The ecologically significant segment is from Lake Livingston in Walker/Trinity County upstream to State Highway 7 in Leon/Houston County. This is within Texas CEQ segments 0803 and 0804. The Trinity River upstream of Lake Livingston has steep muddy banks lined with elm, sycamore, and willow trees. The river meanders through isolated areas and is fed by numerous scenic creeks that provide habitat to abundant fish and wildlife. The channel is wide and contains many sandbars that can be utilized for camping and day use. A variety of game fishes can be caught in this reach including freshwater drum, striped bass, white bass, yellow bass, flathead catfish, channel catfish, blue catfish, as well as a number of sunfish species. Also present are gar, shad, minnows, suckers, western mosquitofish, silversides, and dusky darters.

3.3.2.1.2 Fishery Resources

The study area includes two distinct aquatic ecosystems – Lake Livingston (Texas CEQ Segment 0803) and the Trinity River above and below Lake Livingston (Texas CEQ Segments 0804 and 0802). The impoundment of the Trinity River to form Lake Livingston significantly modified the hydrology and water quality of the river and created a largely artificial ecosystem, which is dominated by relatively few fish species that are adapted to lentic environments. The Trinity River downstream of Lake Livingston is relatively undeveloped and consists of natural stream features. As with other similar reservoirs and dams, the diversity of the aquatic community is generally reduced by the modified flow and temperature regimes associated with reservoir operations (Yeager, 1993). However, the reservoir and dam operations also provide significant benefits, including development of important sport fisheries in the reservoir and immediately downstream of the dam.

The discharge from Lake Livingston is through the spillway gates, from a depth of approximately 30 ft. Due to the depth of discharge, the river immediately downstream of the dam maintains slightly cooler water then would normally occur in this region. In addition, the energy and turbulence associated with the discharge from the spillway gates to the stilling basin aerates the water, even when the reservoir DO is low. Therefore, the river immediately downstream of the dam is usually saturated with DO. Due to these conditions, the Texas PWD developed a striped bass fishery in this reach of river that is important to anglers and to the Texas PWD striped bass stocking program. Striped bass broodfish are collected there by the Texas PWD in the spring and transported to the hatchery system for spawning. Offspring from these fish are stocked in water bodies around the state.

The striped bass population is maintained by stocking juvenile fish in the reservoir. A portion of the reservoir-stocked fish migrate through the spillway gates into the Trinity River downstream of Livingston Dam. While some natural reproduction has been documented, the fishery is maintained through reservoir stocking. In addition to striped bass, several warm-water sport fish are common in this reach of the Trinity River, including blue catfish, white bass, crappie, and spotted bass.

Due to the large volume of water that passes through the dam, fish movement through the dam gates is believed to be important, although historically not well understood. Many predatory species reside in the tailrace because of the movement of prey fish (primarily threadfin and gizzard shad) from the reservoir to this area. In addition, paddlefish, a state-listed threatened species, were stocked in the reservoir in the 1990s in an attempt to reestablish the species (Texas PWD, 1999). As with striped bass, paddlefish migrated to the downstream reach of the Trinity River. Another important aspect of the dam is that it blocks the upstream movement of fish. This includes American eel, which are common downstream of the dam and much less common upstream of Lake Livingston. The following Sections provide an overview of the reservoir and river communities in the vicinity of the Project and include discussions on potentially relevant issues.

Lake Livingston

The aquatic flora and fauna are reflective of species adapted to lentic (standing water) environments. The change in the ecosystem that occurred with the impoundment of the Trinity River resulted in the development of an important warm-water sport fishery. After construction, Lake Livingston became a popular fishing destination. The newly inundated bottomland forests, abundant aquatic vegetation, and vast size of the reservoir provided excellent habitat for a variety of sport fish. As the reservoir aged, the habitat quality decreased due to deterioration of the flooded timber, shoreline erosion, and heavy sediment load associated with Trinity River inflows. In addition, floating, exotic plants (e.g. water hyacinth and water lettuce) also threaten reservoir uses (Texas PWD, 2008a). While Lake Livingston remains important to local anglers, angling use of the reservoir has declined since it was first impounded.

Issues impacting the fishery are described by the Texas PWD (2008a) and include heavy silt loading, nuisance growth of exotic, floating plants, and poor habitat quality. Current management strategies for Lake Livingston include establishing native aquatic plants to improve largemouth bass habitat, evaluating striped bass stocking success, and assisting with nuisance vegetation control (Texas PWD, 2008a).

<u>Fisheries</u>

At the time of the construction of Lake Livingston, the Trinity River Basin Water Quality Management Plan (1974) listed approximately 80 species of fish as possible inhabitants of the Lake and its major tributaries (***Table 7***). Subsequent reports (Menn, 1976; Bounds et al., 1982) confirmed the highly productive nature of the lake. As a result of the ongoing improvement of water quality in the Trinity River Basin (see ***Section 3.3.2.1.1***, Water Resources) the fish community has improved markedly (USGS, 1998). The Texas PWD reports that in 2007 the most abundant species in the lake included largemouth bass; bluegill; blue, channel, and flathead catfish; white bass; striped bass; and crappie (Texas PWD, 2008a).

Although physical habitats in Lake Livingston are inadequate for cover-dependent species, the reservoir is highly productive with respect to phytoplankton communities which serve as an important basis for the food web in the reservoir (Menn, 1976; Bounds et al., 1982). Forage species, such as shad and sunfish, benefit from the plankton communities. Shortly after impoundment, threadfin shad, gizzard shad, inland silverside, and red shiner were reported as the main forage species (TRA, 1983). More recently, the Texas PWD (2008a) reports the primary forage species as threadfin shad, gizzard shad, bluegill, longear sunfish, and inland silverside.

Table 7. Fish Species of Lake Livingston and Major Tributaries (Sources: TRA, 1974; Bounds et al. 1982; Texas PWD, 2000, 2004, 2008a; PBS&J, Attachment B)

SPECIES	TRA (1974)[1]	BOUNDS ET AL. (1982)[1]	TEXAS PWD (2000, 2004, 2008A)[2]	PBS&J (ATTACHMENT B)[3]
Icthyomyzon gagei (southern brook lamprey)				
Scaphirhynchus platorynchus (shovelnose sturgeon)				
Polyodon spathula (paddlefish)	X	X		X
Lepisosteus oculatus (spotted gar)	X	X	X	X
L. osseus (longnose gar)	X	X		X
L. platostomus (shortnose gar)	X			
L. spatula (alligator gar)	X	X		X
Amia calva (bowfin)	X	X		X
Anguilla rostrata (American eel)	X			X
Dorosoma cepedianum (gizzard shad)	X	X	X	X
D. petenense (threadfin shad)	X	X	X	X
D. petenense x D. cepedianum (threadfin x gizzard shad)				X
Alosa chrysochloris (skipjack herring)				X
Esox americanus vermiculatus (grass pickerel)	X	X		
Campostoma anomalum (central stoneroller)	X			
Carassius auratus (goldfish)		X		X
Cyprinus carpio (common carp)	X	X	X	X
Ctenopharyngodon idella (grass carp)				X
Hybognathus nuchalis (Mississippi silvery minnow)	X			
H. placitus (plains minnow)	X			
Notemigonus crysoleucas (golden shiner)	X	X		X
Notropis amnis (pallid shiner)	X			
N. atherinoides (emmerald shiner)	X			
N. atrocaudalis (blackspot shiner)	X			
N. buchanani (ghost shiner)	X			
Opsopoeodus emiliae (pugnose minnow)	X			
Lythrurus fumeus (ribbon shiner)	X			X
Cyprinella lutrensis (red shiner)	X	X		X
N. sabinae (sabine shiner)				X
N. shumardi (silverband shiner)	X	X		X
N. stramineus (sand shiner)				X
N. texanus (weed shiner)	X	X		
N. umbratilis (redfin shiner)	X			

Table 7. Fish Species of Lake Livingston and Major Tributaries (Sources: TRA, 1974; Bounds et al. 1982; Texas PWD, 2000, 2004, 2008a; PBS&J, Attachment B) (Continued)

SPECIES	TRA (1974)[1]	BOUNDS ET AL. (1982)[1]	TEXAS PWD (2000, 2004, 2008A)[2]	PBS&J (ATTACH-MENT B)[3]
Cyprinella venusta (blacktail shiner)	X			X
N. volucellus (mimic shiner)	X	X		X
Opsopoeodus emiliae (pugnose minnow)		X		
Phenacobius mirabilis (suckermouth minnow)	X			
Pimephales promelas (fathead minnow)				
P. vigilax (bullhead minnow)	X	X	X	X
Semotilus atromaculatus (creek chub)	X			
Carpiodes carpio (river carpsucker)	X	X	X	X
Erimyzon oblongus (creek chubsucker)	X	X		
E. sucetta (lake chubsucker)	X	X		
Ictiobus bubalus (smallmouth buffalo)	X	X	X	X
I. niger (black buffalo)	X			X
Moxostoma poecilurum (blacktail redhorse)				X
Minytrema melanops (spotted sucker)	X	X		
Cycleptus elongatus (blue sucker)	X			
Ictalurus furcatus (blue catfish)	X	X	X	X
Ameiurus melas (black bullhead)	X	X		X
A. natalis (yellow bullhead)	X	X		
I. punctatus (channel catfish)	X	X	X	X
Noturus gyrinus (tadpole madtom)	X	X		X
N. nocturnus (freckled madtom)	X			
Pylodictis olivaris (flathead catfish)	X	X	X	X
Aphredoderus sayanus (pirate perch)	X	X		
Cyprinodon variegatus (sheepshead minnow)		X		X
Fundulus chrysotus (golden topminnow)	X	X		
F. notti (starhead topminnow)	X	X		
F. notatus (blackstripe topminnow)		X		X
F. olivaceus (blackspotted topminnow)	X			
Gambusia affinis (western mosquitofish)	X	X		X
Labidesthes sicculus (brook silverside)	X	X	X	
Menidia audens (Mississippi silverside)	X	X		
Menidia beryllina (inland silverside)	X		X	X
Morone chrysops (white bass)	X	X	X	X
M. mississippiensis (yellow bass)	X	X	X	X
M. saxatilis (striped bass)		X	X	X
M. chrysops x M. saxatilis (white bass x striped bass)			X	X

Table 7. Fish Species of Lake Livingston and Major Tributaries (Sources: TRA, 1974; Bounds et al. 1982; Texas PWD, 2000, 2004, 2008a; PBS&J, Attachment B) (Continued)

SPECIES	TRA (1974)[1]	BOUNDS ET AL. (1982)[1]	TEXAS PWD (2000, 2004, 2008A)[2]	PBS&J (ATTACHMENT B)[3]
Centrarchus macropterus (flier)	X			
Lepomis gulosus (warmouth)	X	X	X	X
L. auritus (redbreast sunfish)	X			
L. cyanellus (green sunfish)	X	X		
L. humilis (orangespotted sunfish)	X		X	X
L. macrochirus (bluegill)	X	X	X	X
L. marginatus (dollar sunfish)	X			
L. megalotis (longear sunfish)	X	X	X	X
L. microlophus (redear sunfish)	X	X	X	X
L. miniatus (redspotted sunfish)	X	X		X
L. symmetricus (bantam sunfish)	X			
Micropterus punctulatus (spotted bass)	X			X
M. salmoides (largemouth bass)	X	X	X	X
Pomoxis annularis (white crappie)	X	X	X	X
Pomoxis nigromaculatus (black crappie)	X	X	X	X
Elassoma zonatum (banded pygmy sunfish)	X			
Ammocrypta vivax (scaly sand darter)	X			
Etheostoma chlorosomum (bluntnose darter)	X			
E. gracile (slough darter)	X			
E. parvipinne (goldstripe darter)	X			
Percina caprodes (logperch)	X	X		X
P. sciera (dusky darter)	X			X
Aplodinotus grunniens (freshwater drum)	X	X	X	X
Oreochromis mossambica (Mosambique tilapia)	X			
Agonostomus monticola (mountain mullet)	X			
Mugil cephalus (striped mullet)	X			X
Trinectes maculates (hogchoker)				X

Notes:

(1) TRA (1974) and Bounds et al. (1982) list the fish species as possible inhabitants of the lake and its major tributaries.

(2) Texas PWD (2000, 2004, 2008a) lists the fish species collected from Lake Livingston during 1990, 1991, 1993, 1996, 1999, 2003, and 2007 fish surveys.

(3) PBS&J (Attachment B) lists the fish species collected from Lake Livingston and Trinity River downstream of the Lake from December 3, 2007 through August 22, 2008.

The Texas PWD Inland Fisheries Division surveys the reservoir approximately every three years using standardized sampling techniques, including boat electrofishing, gill nets, and trap (frame) nets. These sampling techniques are designed to collect qualitative population data for monitoring sport fish and selected forage species (Murphy and Willis, 1996). Although sport and forage fish are the target species, the reports often list all species collected in samples. A list of species collected from 1990 through 2008 (Texas PWD, 2000, 2004, 2008a) is included in ***Table 7***. The Texas PWD data are not believed to be an exhaustive inventory since many smaller species are not targeted by the sampling techniques.

In addition to fisheries surveys, the Texas PWD conducts periodic angler (creel) surveys that are summarized in performance reports as required by the Federal Aid in Fisheries Restoration Act. Recent creel surveys indicate that total angling effort at Lake Livingston has declined by approximately 20 percent. During 2003-2004, anglers spent approximately 101,000 hours fishing, while in 2007-2008, angling time decreased to approximately 83,000 hours. According to the Texas PWD (2000, 2004), largemouth bass were once the most popular sport fish in the reservoir involving approximately 43 percent of the total angling effort. In 2007, angling effort for largemouth bass decreased to 2 percent (Texas PWD, 2008a). Electrofishing catch rates of largemouth bass have been very low. In 1999 and 2003, no largemouth bass longer than 14 inches (the minimum length limit per harvest regulations for Lake Livingston Reservoir) were collected, while only one legal-size largemouth bass was collected in 2001 (Texas PWD, 2004). The survey in 2007 was similar (Texas PWD, 2008a), with only one largemouth bass over 14 inches in length collected. According to the Texas PWD, the low abundance of largemouth bass is the result of poor littoral habitat quality, particularly the absence of aquatic plants and high turbidity/silt loading in the reservoir (Texas PWD, 2000, 2004, 2008a).

White bass, striped bass, crappie, blue catfish, flathead catfish, and channel catfish may also be sought by anglers at Lake Livingston (Texas PWD, 2008a). Gill net catch rates and intended angler effort for white bass have increased in the past several years. As noted earlier, although striped bass are stocked almost annually, their abundance in the reservoir is low and there does not appear to be a significant striped bass or crappie fishery in the reservoir. Catfish are important to recreational anglers at Lake Livingston. Blue catfish are the most common catfish species in the reservoir, whereas channel catfish and flathead catfish are present at much lower densities. There is limited commercial fishing allowed for catfish (Texas PWD, 2008a).

As noted earlier, the Texas PWD frequently stocks fish in Lake Livingston to enhance sport fishing and resource conservation. ***Table 8*** provided in ***Attachment C*** presents the fish stocking history for Lake Livingston (Texas PWD, 2008b). Recent stocking includes largemouth bass in an attempt to improve the reservoir population and striped bass to maintain the population downstream of the dam. Approximately 20 million striped bass were stocked from 1977 through 2008. Florida largemouth bass are periodically stocked, with the latest stocking in 2006 and 2007, which totaled approximately 400,000 fish. Other historically stocked species have included blue and channel catfish and paddle fish (*Polyodon spathula*) (Texas PWD, 2008b).

Although the reservoir fishery has been well studied over the years, specific information was needed with respect to the fish community in the vicinity of the dam so potential Project impacts could be evaluated. Therefore, the lake fisheries and the river fisheries downstream of the dam were surveyed quarterly from 2007-2008. The details of this study are provided in ***Attachment B***. Surveys included boat and back-pack electrofishing, paired-frame trawls, seines, and gill nets. In addition, fish passage was monitored seasonally and during different reservoir discharge conditions using high-definition sonar (DIDSON), which recorded fish moving through a spillway gate from the reservoir into the river.

Results of the study indicated that large numbers of fish are entrained in the reservoir water discharged through the spillway gates. Most of the fish were small (less than 8 inches in length) and were forage species (e.g. threadfin and gizzard shad). Striped bass appeared to migrate downstream during the spring, under high-flow conditions. While the high velocity (25 ft/s) at the spillway gate is an important reason for entrainment, there also appeared to be a behavioral component to fish passage (e.g. desire to migrate downstream).

The study also suggested that fish density and diversity is higher in the vicinity of the proposed headrace than in open water at the depth at which water is released through the spillway gates. There were no juvenile striped bass collected in the reservoir. All of the striped bass collected were larger than juveniles (e.g. longer than 16 inches) and appeared to be present in the vicinity of the dam only during the winter and spring. Other sport fish common in the vicinity of the dam were white crappie, blue catfish, white bass, and channel catfish. With the exception of paddlefish, there are no species of regulatory interest known to occur in the reservoir. No paddlefish were collected in the lake in this study. The fish collected in the PBS&J reservoir survey are listed in ***Table 7***. ***Table 7*** contains both historical and current information of fish species that were possible inhabitants of the lake and its major tributaries as well as actual collections from the lake itself.

<u>Macroinvertebrates</u>

Limited study has been conducted for the benthic macroinvertebrates inhabiting Lake Livingston and the Trinity River downstream of the reservoir (McCullough, 1977; TRA, 1983). Benthic macroinvertebrates in Lake Livingston were studied for the 1974 Trinity River Basin Water Quality Management Plan (TRA, 1983). McCullough (1977) surveyed the diversity of benthic macroinvertebrates in Lake Livingston. Results of these studies revealed low benthic diversity, dominated by chironomid fly larvae and oligochaetes, in the upstream end of the reservoir. Amphipods and damselfly and dragonfly nymphs were relatively abundant among the roots of water hyacinths floating in the lake. Other invertebrate taxa inhabiting water hyacinth roots included adult and larval water beetles (families Dytiscidae and Hydrophilidae), spiders, water bugs (Order

Hemiptera), and flies (Order Diptera). Standing trees and submerged aquatic vegetation provided substrate for crustaceans and caddisfly nymphs (Family Psychomyiidae). At depth within the reservoir, taxa diversity and abundance declined with the exception of the mayfly nymph, *Hexagenia limbata*.

Phytoplankton and Zooplankton

McCullough (1977) performed intensive phytoplankton and zooplankton identification studies on the reservoir. However, TRA's frequent analyses of chlorophyll levels provide an appropriate indicator of phytoplankton numbers and primary production. Diatoms generally dominate the phytoplankton population on both upper and lower portions of the lake. Blue-green algae often become an important part of the phytoplankton in the lower reaches of the reservoir. Green algae and euglenophytes are also common in the lake. The lake is subject to periodic phytoplankton blooms, although improvements in river basin water quality have helped to control algal proliferation. Zooplankton populations were highest in the spring. Dominant zooplanktons include *Brachionus*, *Keratella*, *Polyarthra*, and *Synchaeta*. Copepods and rotifers were the most abundant groups.

Macrophytes

Bounds (Bounds et al., 1982) identified 23 species of aquatic vegetation in Lake Livingston. Hydrilla and water hyacinths were the most common (Bounds et al., 1982; McCullough, 1977). Coontail, pondweed, and duckweed are also commonly found. *Rhizoclonium* (a filamentous green algae) was identified in many areas of the lake, especially where hydrilla was present. In a study conducted by Menn (1976), 6.9 percent of the total lake area was infested with some form of aquatic vegetation with approximately 400 acres of water hyacinth and 150 acres of hydrilla. Bounds et al.(1982) found increased acreage of hydrilla and water hyacinth over Menn's 1976 values, but a decrease in the amount of coontail. The total area infested by aquatic vegetation in 1981 (Bounds et al., 1982) was approximately 7 percent (not including the filamentous green algae). Since these early studies, hyacinth continues to populate the lake, although TRA has an abatement and control program to manage proliferation. Texas PWD reported approximately 1,000 acres or about 1 percent of the lake was covered with invasive macrophytes (mainly hyacinth and water lettuce) in 2003 (Texas PWD, 2004). TRA reported treatment of approximately 989 acres of hyacinth and water lettuce in 2007 (TRA, 2007e). Relatively few macrophytes are found in the reservoir near the proposed Project site.

Trinity River Downstream of Livingston Dam

The Trinity River downstream of Livingston Dam is easily accessed by anglers and is very popular because of the abundance of striped bass and blue catfish. White bass and crappie also offer good seasonal angling opportunities. In addition to recreational angling, this reach of river is also fished, on a limited basis, by commercial fishermen who harvest catfish and buffalo.

The tailrace of the dam is particularly important to the Texas PWD for the collection of striped bass for brood stock for the state's hatchery system. Approximately one-third of the striped bass fingerlings produced in the state's hatchery system are stocked in Lake Livingston for the primary purpose of maintaining the tailrace fishery. Although this fishery is vitally important to the agency, there is little known about the population dynamics or the efficiency of this stocking approach. As a result of this knowledge gap, the Texas PWD is considering a study, to be completed in 2012, to evaluate the stocking program (Texas PWD, 2008c).

In addition to the paucity of striped bass information, there is little known about the diversity of fish downstream of the dam. Bonner (2007) provides a list of species for the Trinity River Basin, but the information is not location specific. In addition, the TRA recently compiled information on the species in the basin, which confirmed that few data are available for this reach of river (TRA, 2007f). Therefore, a study of the aquatic community was conducted for this Project. The study details are provided in ***Attachment B***. Seasonal surveys of the abundance and diversity of fish in the Trinity River downstream of the dam were conducted. In addition, studies were also conducted to collect information to aid in addressing specific aspects of the Project. These studies included an assessment of striped bass diet and surveys of American eel abundance downstream and upstream of the dam.

A list of the fish species collected in the Trinity River downstream of the dam is presented in ***Table 7***. Fifty-four taxa were collected from the river over the course of the study. The most common species was threadfin shad, most individuals of which were believed to come from the reservoir. Threadfin shad densities (number per unit volume) in the reservoir and discharged through the dam were the lowest during the spring and highest during the summer. The higher densities during the summer are likely the result of newly recruited individuals into the population following spring spawning. The availability of threadfin shad to predators downstream of the dam is directly related to reservoir discharge. Although the densities were highest during the summer, the low flows precluded the downstream passage of large numbers of threadfin shad. Conversely, although threadfin shad densities were lower during the other seasons, flows were much higher, allowing the downstream passage of more threadfin shad than during the summer.

Striped bass were abundant during all seasons immediately downstream of the weir, but were also common at other downstream locations where velocities were relatively high. Blue catfish and smallmouth buffalo were also very common throughout the study reach. Marine species also use this reach of river, including striped mullet (*Mugil cephalus*), blue crab (*Callinectes sapidus*), and skipjack herring (*Alosa chrysochloris*). Paddlefish, which were believed to be from the stocking program in the 1990s, were collected and observed in low numbers.

Striped bass and blue catfish were collected for stomach-content analysis. Results indicated threadfin shad is the primary forage species, but minnows, yellow bass, and American eels were also found in the stomachs. The abundance of prey in the stomachs was related to flow, which transported forage fish from the reservoir. In particular, threadfin shad were abundant in the river during all seasons except summer, when discharge from the reservoir was lowest. As a consequence, most striped bass and blue catfish had empty stomachs during the summer. In addition, striped bass body condition decreased considerably during the summer as a result of the limited food supply.

American Eel

There is very little information on the American eel in the Trinity River Basin. Due to this lack of information, the U.S. Fish and Wildlife Service, Clear Lake office, requested that the Cooperative study the American eel to better understand the distribution and abundance in the Trinity River. This study involved a comprehensive literature search and interview of fisheries professionals, along with field sampling. The only recent accounts (2001 and 2005) of this species are from Lake Lavon near Dallas, which involved two separate collections of large adults. The field studies were conducted in the Project area downstream of Livingston Dam and in the upper Trinity River Basin. Details of this American eel study are presented in ***Attachment D***.

Results indicate that the American eel are common in limited areas downstream of the dam. All individuals collected were found among gravel/cobble/boulder substrates with flowing water. All of the individuals collected or observed were small (shorter than 12 inches) and were believed to be sub-adults. The largest number of American eel was found in the riprap armoring of the weir.

American eel sampling in the upper Trinity River Basin involved sampling immediately downstream of all of the major impoundments in the Dallas-Ft. Worth area as well as a number of other locations in the river. No American eels were collected or observed. From these studies, it was concluded that very few American eel inhabit the river upstream of Livingston Dam.

Paddlefish

Paddlefish are state-listed threatened species in Texas. Their native range in Texas is limited to rivers in east Texas and prior to the 1990s, the species was believed extirpated from most of its range in Texas due to construction of dams (Betsill, Texas PWD et al., 1999). A program to reintroduce paddle fish to selected river segments through stocking was conducted in the 1990s by the Texas PWD. Results of the restoration efforts are provided in Texas PWD (Texas PWD, 1999). The Trinity River upstream of Lake Livingston was one of the river reaches that was identified as possible paddlefish spawning habitat. Paddlefish were stocked in Lake Livingston from 1990 through 1992, when approximately 110,000 juvenile paddlefish were released. A tracking study using radio telemetry was performed on the Neches River to identify habitat use and movement of young paddlefish (Pitman and Parks, 1994). Results of the study indicated that young paddlefish migrated great distances within a short period after stocking, and paddlefish moved downstream through a reservoir floodgate on the Neches River. However, there has been no indication that reproduction occurred and the paddlefish remaining in the Trinity River are believed to be from the stocking in the 1990's (Texas PWD, 1999). The sampling conducted by PBS&J for this Project collected three paddlefish downstream of the dam, and at least two additional paddlefish were observed, but not collected in the same reach.

While paddlefish are found in the Trinity River, spawning of the fish has not been documented (personal communication with T. Engling, Texas PWD, 2007). The most recent fish survey conducted in the vicinity of the dam reported that no paddlefish were collected or observed in Lake Livingston.

3.3.2.2 Environmental Effects on Aquatic Resources

The potential impacts from the construction and operation of the hydroelectric facilities and transmission line corridor on aquatic resources are presented in the following Sections.

3.3.2.2.1 Effects of Construction of Hydroelectric Facilities

Water Resources

The proposed powerhouse, intake facilities, and tailrace canal will not be placed in the dam spillway or river. The powerhouse and tailrace will be located within the floodplain, just downstream of the dam but will have no significant impact on the water surface elevations under flood flow conditions.

Construction activities associated with the hydroelectric facilities near the dam site may have short-term effects on the aquatic environment, primarily increases in turbidity and suspended sediments. Since much of the construction will be conducted “in the dry,” sediment generating activities will be largely confined to the dredging removal of earth separating the river channel from the completed tailrace, and the dredging of the most distant portion of the headrace within the lake. Neither activity will have long-term effects on the lake or the river downstream. It is anticipated that sediment containment measures will be applied at the headrace/ lake and the tailrace/river junctions in the form of silt curtains, silt socks, or similar devices.

Development and implementation of BMPs including sedimentation and erosion control plans, and a spill control plan and/or a Federal Spill Prevention Control and Countermeasures Plan (if the quantity of petroleum products stored at the Project site exceeds threshold requirements) would minimize the potential construction impacts on water quality. Precautions would be taken to avoid accidental spillage or leakage of any construction related contaminants (such as oils) into the surface waters or the groundwater draining into the river. All refueling and lubrication of construction equipment would be performed away from the lake and river to prevent contamination. Temporary sanitary facilities would be supplied on site until permanent facilities meeting current treatment practice are operating.

Spoil material from excavation would be used for construction of the earth embankment, the switchyard and access roads. Excess spoil would be disposed of on the downstream slope of the existing dam or at approved disposal areas in accordance with applicable Texas environmental requirements. The amount of disturbance exposed to rainfall would be minimized. Areas that are disturbed and exposed would to the extent possible be kept stabilized and/or seeded when not active. Sedimentation containment measures would also be implemented. Any disturbance work in the river would likewise be conducted in a manner to minimize and control sedimentation.

Fishery Resources

Typical aquatic impacts related to the construction of projects such as this one are often the result of changes in water quality or available habitat. Sedimentation and turbidity may be caused by construction activities in or adjacent to water bodies. Construction-related controls including erosion and sediment control devices will help to alleviate this potential impact. Limiting the open area of excavation and using in-the-dry excavation techniques would also help to minimize the sediment release to the river and its potential impacts on aquatic communities.

During the construction of the powerhouse and its associated facilities, normal river flow will be maintained. A limited amount of dredging in the shallow water area of the headrace will result in a temporary loss of some benthic habitat. This modest area should be quickly recolonized after construction ceases.

3.3.2.2.2 Effects of Construction of Transmission Line Corridor

The following information has been summarized from PBS&J's environmental assessment and alternative route analysis performed for the transmission line project (***Attachment A***). Construction of the proposed transmission line may result in locating some structures within 100-year floodplains and wetlands. These structures would be designed and constructed so as not to impede the flow of any waterway or create any hazard during flooding. Construction activities in floodplains would be limited to the transmission line project ROW, and structures would not be located in obvious flood channels. Some scouring could occur around structures if flood-flow depths and velocities become great enough. The transmission line project is not expected to impact the function of the floodplain. No adverse effects from flooding to adjacent downstream property owners are anticipated as a result of constructing the proposed transmission line.

Construction of the proposed transmission line is expected to have little adverse impact on the surface water resources within the transmission line study area. Short-term disturbances from construction activities may result in the form of increased erosion and possible accidental spills of petroleum and other chemical products. Additionally, activities such as clearing of vegetation may temporarily increase local stormwater runoff volumes and sediment loading. Potential impacts would be avoided whenever possible by spanning surface waters, diverting construction traffic around flowing streams via existing roads, and eliminating unnecessary clearing of vegetation. The use of erosion-control measures, such as silt fences and selective clearing, and the implementation of BMPs regarding the use of chemicals would also minimize potential impacts. Impacts occurring from construction of the proposed transmission line would, however, be short term and minor because of the relatively small area that would be disturbed at any particular time and the short duration of the construction activities. No long-term adverse effects are anticipated.

Direct disruption of aquatic habitats is not likely to occur as a result of the proposed transmission line project because all waterbodies should be spanned, and erosion-control measures will be employed to reduce potential impacts. The severity of impacts at water crossings would be reduced when the proposed route is located adjacent to existing ROW, especially where that ROW is already cleared.

Potential detrimental impacts to aquatic communities would be avoided whenever possible. Where impacts are unavoidable, they would be minimized using BMPs. Placement of rock berms, siltation fences, or brush barriers downslope of disturbed areas would help dissipate the flow of runoff at stream and drainage crossings. Placement of silt fences or hay-bale dikes between streams and disturbed areas would also help prevent siltation into the waterway. Alternative routes were analyzed and their impacts have been detailed in the PBS&J report submitted as ***Attachment A***.

3.3.2.2.3 Effects of Operation of Hydroelectric Facilities

Water Resources

Operation of the hydroelectric facility would be in the run-of-river mode, hence there would be no fluctuations of either reservoir levels or downstream water levels or flows relative to those which would otherwise occur. Operation of the facility is not expected to alter the properties of the water released from the reservoir. The water quality will be the same coming out of the turbines as it is entering the headrace. However, changing the location in which the water is released may marginally change water quality in the river compared to existing conditions. Due to the importance of the downstream fishery, extensive monitoring and modeling of temperature and dissolved oxygen, and other analysis were conducted to assess the potential impacts of facility operations particularly during summer conditions when the reservoir vertically stratifies. The water quality study and analysis are described in detail in ***Attachment B***.

Fisheries and Water Quality

It is important to note that water quality differences might only occur when the majority of water is diverted through the hydroelectric facility. At flows greater than 4,500 cfs, the excess volume will be released through the spillway gates and would moderate possible alterations associated with routing the water through the facility.

Water released through the spillway gates is at or near saturation when it reaches the river, regardless of the DO in the reservoir, as a result of physical aeration. However, DO near the surface of the reservoir shows declines on a seasonal, daily, and hourly basis. Monitoring data showed there were approximately 20 days between July and September 2008 when surface DO concentrations fell below 5 mg/l for 8 hours or longer. Five of these days experienced DO concentrations below 3 mg/l for 8 hours or longer. During the majority of the year, DO would remain well above the stream standard.

DO in the river for a distance of 10 miles downstream of the Project was modeled for a range of flows with and without the Project. Although the TRA has indicated that future reservoir releases will not likely fall below 1,000 cfs due to downstream water demand, a flow of 750 cfs was modeled since it is the minimum flow required for turbine operations. The model description and calibration are provided in ***Attachment B*** and the modeling results are presented graphically in ***Attachment E***. Although the hydraulic capacity of the power plant is 4,500 cfs, to be conservative, 5,500 cfs was used for the high flow conditions. The results show that under low-flow conditions DO gradually returns to existing (without Project) conditions with increasing distance from the Project. Under higher flows, travel time and opportunity for physical reaeration are reduced; therefore, DO does not return to existing conditions as quickly as under low flow. There is no downstream reduction in DO under any flow scenarios.

For periods in which DO might fall below the surface water quality standard, the Cooperative proposes to use automated water quality monitoring stations which will be established at the headrace and tailrace of the hydroelectric facility. These stations will continuously monitor DO and water temperature. They will document the frequency, extent, and duration of any events in which DO levels fall below 5 mg/l. Turbines will be designed with deflector plates to allow for air injection in the draft tube ports below the turbine runner, which will enable the Cooperative to mitigate DO level problems detected during operations by the monitoring system. At times when the DO level is confirmed to drop near 5.0 mg/l, water would be passed preferentially through the turbines fitted with the air injection system. In addition to these measures, it is noted that during periods of extreme low flows (below 750 cfs) when efficient turbine operation cannot be maintained and the units shut down, all releases will be made through the spillway gates. Maintaining the DO standard should protect striped bass and other species in the river.

The temperature standard for Lake Livingston and the Trinity River downstream of the dam is 34° C (93° F) (Texas CEQ, 2008e). Discharge through the power facility is expected to be below this standard, even during summer "worst case" conditions. The striped bass might presently be near their upper thermal tolerance during these worst case conditions. There have been no studies that would suggest an upper thermal limit for the striped bass in the Trinity River. Nevertheless, the Cooperative proposes to continue working with the Texas PWD to monitor and address any temperature issues. The Cooperative also proposes to incorporate into its final tailrace design features that would maximize opportunities to provide thermal refugia (colder areas within a water body that provide cold water refuge from unsuitably warm water) downstream of the existing weir.

As discussed in the next Section, some flow will be maintained through the spillway gates for maintenance of the fish population upstream of the weir. Due to the short residence time in the stilling basin, the temperature of the water discharged through the spillway gates is not expected to change. Therefore, the temperature in the stilling basin of the dam and immediately downstream of the notch in the weir will not substantially change from the reservoir temperature at a depth of 30 ft (the depth of release). The location of the centerline of the Project tailrace will be 300 ft downstream of the weir. This will result in a reach of approximately 200 ft from the weir downstream to the Project tailrace that could serve as an area of thermal refugia formed by cooler waters released from the spillway gates. In addition, there is an artesian well located in the river channel near the east bank and approximately 75 ft downstream of the weir (see ***Figure 2-2*** in ***Attachment B***). The discharge from the artesian well is continuous, but less than 1 cfs. While the flow from the well is low, the temperature is approximately 5° C cooler than the river water during the heat of the summer. The area of influence by the groundwater is small under existing conditions due to the dilution of water flowing over the weir. With the Project, there will be no flow over the top of the weir under flows through the spillway gates less than 600 cfs; therefore, the area influenced by the groundwater around the artesian well may enlarge, expanding the existing refugium for striped bass beyond the existing conditions. Presently, large numbers of striped bass occupy the isolated area immediately around the base of the well during the summer, presumably due to the cooler temperatures.

Entrainment

Entrainment-reduction features to reduce fish passage and turbine mortality are often desirable at hydroelectric facilities. However, reducing entrainment also reduces downstream fish migration. In this Project, allowing fish to migrate downstream is critical to maintaining the tailrace fishery. As illustrated by the DIDSON monitoring (***Attachment B***), most fish migrating through the spillway gates are less than 8 inches in length, whereas many of the threadfin shad are less than 5 inches in length. Installing fine-mesh screens would limit the size and biomass of forage, ultimately stressing the predator population. Therefore, the vertical bar screen spacing will be designed to allow entry of smaller fish, but will prevent larger debris from entering the facility.

Fish condition and survival after passage through turbines is an important consideration. The Cooperative will use Kaplan turbines which are considered "fish friendly." This type of turbine has fewer blades and more space for fish passage. Survival of fish through Kaplan and similar turbines has been well studied. Cada (2001) and GeoSyntec Consultants (2005) provide reviews of studies of fish survival with different turbine technologies. In general, survival through Kaplan turbines is generally above 70 percent for most species and comparably high for larger, warm water species including shad, sunfish, catfish, and temperate bass. Operation of the facility will result in some mortality of fish; however, many of the fish passing through the bar screens are expected to be shad and will likely be consumed by the striped bass, blue catfish, and other predators upon reaching the river even if injured or dying.

The same studies indicate small sport fish would have a high probability of surviving turbine entrainment. However, it is also important to note that the movement of larger striped bass from the reservoir to the river downstream of the dam is critical for maintaining the fishery. As discussed in ***Attachment B***, it appears that striped bass tend to migrate downstream with high flows during the spring. The spring flood flows exceeding 4,500 cfs will be released through the spillway gates and most striped bass are expected to move over the dam under those conditions. Therefore, it is unlikely that the facility operations would affect the downstream movement of striped bass.

Water Quality Maintenance Upstream of the Weir

Discharge ranging from approximately 50 to 200 cfs will be maintained through the spillway gates when the total reservoir discharge drops below 4,500 cfs. This will prevent the stilling basin from dewatering which might result in occasional fish die-offs in the stilling basin. To facilitate water level management and water quality in the stilling basin, the Cooperative proposes to reduce the width of the existing weir notch. This would create higher water elevations in the stilling basin with lower flows. Therefore, the stilling basin will be managed to maintain sufficient water levels, which would allow fish to migrate to the river downstream. However, any such modifications must be approved by TRA. Since water entering the stilling basin will come from the current release depth of 30 ft, stilling basin water quality is expected to remain unchanged.

American Eel

As explained previously, upstream eel migration is possibly impacted by the Lake Livingston Dam; however, the proposed Project would not have an additional impact on their upstream movement. Eels migrating downstream through hydropower turbines might be injured or killed; however, as explained above, the turbines will be designed to enhance the probability of safe passage of turbine-entrained fish and promote their survival. Eels begin to migrate downstream as they become sexually mature, and the density of adult eels in the Trinity River watershed upstream of Lake Livingston was found to be very low. Therefore, the impact from the proposed Project on downstream migrating eels is not expected to be significant.

Paddlefish

In the PBS&J study, paddlefish were not collected or observed in Lake Livingston; therefore, it appears the proposed hydropower intake in Lake Livingston would not affect paddlefish in Lake Livingston. Paddlefish are planktivorous and probably feed on the zooplankton passing from Lake Livingston through the dam. The proposed hydroelectric facility is not expected to affect passage of zooplankton from the reservoir to the river since zooplankton would not be destroyed by passage through the turbines. Therefore, paddlefish inhabiting the river downstream of the dam are not expected to be affected.

Reservoir and River Habitat

As a result of the Project, little change is expected in physical habitat compared to existing conditions. Creation of the proposed headrace structure will create a relatively small amount of additional hard structure in part of the reservoir east of the dam. Except for the presence of the riprap on the dam, most of the shore and bottom is mud. The stilling basin and weir will remain in place. An additional point at which flow enters the river from the hydroelectric facility will be added to the east shore of the river about 300 ft downstream of the weir, which might result in some relatively localized modification of the existing shore and bottom habitat. Therefore, minimal impact on fish habitat is expected from the proposed Project.

The effect of the proposed hydropower Project on sediment and nutrient removal by Lake Livingston Dam was questioned by FWS Trinity River National Wildlife Refuge, since reservoirs along the Trinity River are speculated to reduce sediment and nutrient loading to the Galveston Bay estuary. Reduced sediment and nutrient loading may contribute to marsh subsidence and reduced estuarine productivity. The proposed Project would not change impoundment areas and as such would not have an adverse effect in Galveston Bay estuary. Considering that the location of the proposed hydropower intake is relatively close to the shore and strong winds may increase sediment suspension in the relatively shallow water column there compared to sediment concentrations in deeper water, the proposed hydropower Project may result in small increases in sediment and nutrient transport over current amounts from Lake Livingston to the Trinity River downstream. However, periods with increased sediment and nutrient transport are expected to be episodic with difficult-to-measure effects on the Galveston Bay system.

3.3.2.2.4 Effects of Operation of Transmission Line Corridor

The operation of the proposed transmission line is not expected to have significant adverse impacts on the aquatic resources within the transmission line study area.

3.3.2.3 Cumulative Effects

The quantity of water in the reservoir or in the Trinity River downstream of the dam will not be impacted by the operation of the proposed Project since the Project will be operated run-of-river, and there will not be any increase in consumptive uses.

The temperature in the stilling basin of the dam and immediately downstream of the weir will not significantly change from the reservoir temperature at a depth of 30 ft since some flow will be maintained through the spillway gates to maintain the water quality and fish population upstream of the weir. Although water temperatures within the Trinity River downstream of the weir, where the Project tailrace will be located, might slightly increase over current conditions during summer months (due to stratification), it is not expected to adversely impact the downstream fishery. The Cooperative also proposes to continue working with the Texas PWD to address the issue regarding possible thermal impacts on the striped bass.

Currently, high physical reaeration occurs as water is discharged from the reservoir and cascades in a relatively thin, turbulent, sheet flow into the stilling basin. Therefore, DO levels are generally at or very near 100 percent saturation downstream of the dam even though the reservoir release is periodically hypoxic. With the proposed Project, when reservoir releases are less than 4,500 cfs, the majority of the reservoir releases will pass through the powerhouse instead of the spillway gates. Absent mechanical modifications to inject air or oxygen, there is not expected to be any physical reaeration of water passing through the turbines. However, surface waters that will be used by the hydroelectric facility generally have higher DO than bottom waters currently released. Implementing a DO monitoring plan and DO enhancement measures, such as installing turbines with deflector plates to allow for air injection or releasing all water through the existing spillway gates or the outlet works during periods of extreme low flows (below 750 cfs), would prevent adverse impacts on water quality and aquatic communities. The Project might cause a reduction in DO downstream of the dam during episodic low DO conditions near the surface; however, monitoring and artificial aeration will ensure DO always exceeds the water quality standards.

3.3.3 Terrestrial Resources

3.3.3.1 Affected Environment

3.3.3.1.1 Wildlife Resources

The middle section of the Trinity River Basin (including Lake Livingston) hosts an enormous diversity of amphibians, reptiles, birds, and mammals (see ***Table 9*** in ***Attachment C***). All of these are potential inhabitants of the Lake Livingston regional area, but their presence at the powerhouse site, which is located to the edge of the dam, or along the transmission corridor, is limited by the residential and agricultural development of the areas to be traversed (TRA, 1983).

Of the bird and mammal species listed in ***Table 9*** (***Attachment C),*** the most likely inhabitants of the brushland, pine stand, and pasture lands involved include opossum, skunk, woodchuck, meadow mouse, armadillos, cottontail rabbit, fox squirrel, white-tailed deer, ruffed grouse, ring-necked pheasant, killdeer, mourning dove, robin, blue jay, common crow, and Carolina chickadee (TRA, 1983).

3.3.3.1.2 Botanical Resources

Plant distribution and vegetation composition are a function of climate, geology, topography, and soils in addition to biotic (wildlife, insects, disease, etc.) factors. The vegetation in the study area is largely a result of anthropogenic influences. Lumbering, burning for cultivation and grazing, agriculture, and residential development have all contributed to the distribution and diversity (or lack of diversity) of vegetation. Most of the native vegetation has been logged, with clear-cutting the most common logging practice. Timber production in Texas has grown substantially throughout the 1990s. Major commercial timber species are loblolly, shortleaf, longleaf, and splash pines. Hardwoods (oaks, hickory, and maple) are also present in the overstory, but much of the area has been cleared and typically replanted with pine.

Vegetation along the Trinity River Basin has been sampled by Gould (1969), Mahler (1972), Nixon (1972, 1973), and Nixon and Willett (1974). An ecological study of the vegetation was undertaken in the Big Thicket, an area approximately 20 miles east of Lake Livingston, by Marks and Harcombe (1981). Sweetgum and oak are the dominant overstory species and are abundant in areas surrounding Lake Livingston. Willow, laurel, and southern red are the dominant oaks. Black willow, hawthorn, and water locust make up the other principal hardwood overstory. Loblolly pine is the predominant conifer of the area. ***Table 10*** (***Attachment C***) lists the trees found in the Trinity River Basin (Corps, 1975).

There are a number of aquatic plant species that live in the shallow and marginal zones of the lake. Hydrilla, rhizoclonium, water hyacinth, duckweed, pondweed, smartweed, senna bean, and coontail are the most prevalent. Water hyacinth and hydrilla in particular are invasives and an active program is ongoing to control their extent on the lake. Despite being a nuisance plant, hyacinth was found to provide extensive habitat for macroinvertebrates as noted previously.

3.3.3.1.3 Wetlands, Riparian, and Littoral Habitat

The FWS defines wetlands as "lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water." For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports hydrophytes, (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is non-soil and is saturated with water or covered by shallow water at some time during the growing season of each year (Cowardin et al., 1979) [8]. The FWS definition includes swamps; freshwater, brackish water, and saltwater marshes; bogs; vernal pools, periodically inundated salt flats, intertidal mudflats, wet meadows, wet pastures; springs and seeps; portions of lakes, ponds, rivers and streams; and all other areas which are periodically or permanently covered by shallow water, or dominated by hydrophytic vegetation, or in which the soils are predominantly hydric in nature. In some instances wetlands may also be defined as riparian or littoral zones.

The site is located within the Pineywoods Vegetation Region in an area also known as the Big Thicket. The majority of historically wetland and riparian areas above the dam are currently under the waters of the lake. As is evident from National Wetland Inventory (NWI) maps, there are numerous forested and unforested wetlands in the area near and downstream of the dam. Most are located within the 100-year floodplain of the Trinity River (which serves as the Polk / San Jacinto County line) and its tributaries.

[8] Similarly, the Environmental Protection Agency (EPA) defines wetlands as follows: "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas." 40 CFR § 230.3(t).

Laurent Lake and Baker Lake are two water features that occur in this area. Riparian areas may be wetland or not and may include forested and nonforested areas.

In 1983, field surveys of the proposed Project area downstream of the dam uncovered no areas which fall within the general definition of wetlands where saturation with water is a dominant factor and biota are adapted for life in water or in saturated soil (TRA, 1983). Within the transmission line study area, the NWI indicates emergent and forested wetlands occurring primarily in areas associated with the Trinity River, Long King Creek, Baker Lake, Laurent Lake, and other minor surface waters.

From June 2003 through May 2004, the Texas PWD conducted an extensive fisheries survey of Lake Livingston which included an extensive littoral zone and physical habitat survey (Henson and Webb, 2004). The survey identified the miles of shoreline of each environment and relative percent of each. The littoral habitats in the Project area consist of the shallow shoreline zone along the southern end of Lake Livingston and the Trinity River below Livingston Dam. Texas PWD (Henson and Web, 2004) reported that approximately 35 percent of the shoreline consists of bulkhead. Due to the large fetch associated with the broad, open water on this end of the reservoir, shoreline erosion has deteriorated much of the shoreline, which is one reason for the extensive bulkhead development. Shortly after impoundment, flooded timber and brush was common throughout Lake Livingston. However, most of the flooded terrestrial vegetation that once was common is presently absent or scarce.

Substrates along the shoreline are primarily sand and clay, but in coves and tributaries, the substrates often consist of soft sediments. With the exception of water hyacinth, there are few, if any, aquatic plants in the Project vicinity. Water hyacinth is common in the protected areas of the reservoir and can sometimes drift into areas near the dam. Riprap armoring is the primary littoral habitat features immediately adjacent to the Project. Large rock and boulders were used to armor Livingston Dam and extend nearly the entire reach of the dam.

The habitats in the Trinity River downstream of Livingston Dam are reflective of other large-order southeast Texas rivers. The riverbed immediately below the dam is scoured due to the hydraulic alterations that resulted from reservoir operations. Substrates consist of gravel, course sand, and clay. Man-made alterations, including riprap armoring, provide substantial fish habitat in the tailrace of the dam; however, the river channel is generally incised and uniform downstream of the tailrace. The scoured reach below the tailrace gives way to clay and sand substrates farther down the river. From distances of approximately 2 miles to 5 miles downstream of the dam, large sand bars are common and logs and brush piles are common in the river. Immediately downstream of this reach, the river channel is constricted by a series of rock outcrops that form a complex of riffles and runs that extend several hundred yards. Beyond this reach, the river channel is deeply incised with slow velocities, homogeneous, and the substrates consist primarily of clay, sand, and soft sediments. Major tributaries are absent from Livingston Dam to U.S. Highway 59, although some small, ephemeral streams intersect the river channel.

3.3.3.2 Environmental Effects on Terrestrial Resources

The potential impacts from the construction and operation of the hydroelectric facilities and transmission line corridor on terrestrial resources are presented in the following Sections.

3.3.3.2.1 Effects of Construction of Hydroelectric Facilities

Terrestrial resource impacts will be limited to the immediate area of the dam during the construction of the powerhouse and tailrace areas. The area involved consists primarily of early successional stage scrub vegetation and maintained lawn, which is not a unique or valuable habitat. Construction of the new hydroelectric facility would remove about 12 acres of this vegetative cover. This reduction is not deemed significant because large areas of more productive habitat exist in the immediate vicinity. Mobile wildlife species would likely temporarily avoid the areas near the construction site due to noise and construction activities, however, these species are likely to use similar habitats nearby. Any permanent loss of productive wildlife habitat would be minimal.

3.3.3.2.2 Effects of Construction of Transmission Line Corridor

The impacts of transmission lines on terrestrial ecosystems were evaluated by PBS&J (***Attachment A***). The following paragraphs present PBS&J's evaluation of the impacts of transmission line construction on vegetation and wildlife.

The primary impact to vegetation resulting from site preparation and construction of the proposed transmission line would be the removal of existing woody vegetation along the proposed ROW. The amount of vegetation cleared from the transmission line ROW will be dependent upon the type of vegetation present and whether the ROW will be completely new or involve widening existing ROW. For example, the greatest amount of vegetation clearing would occur in wooded areas, whereas pastureland or cropland would require little to no removal of vegetation. Widening an existing ROW would have less of an impact on vegetation than clearing completely new ROW. Areas currently used as rangeland or cropland may be temporarily unavailable for grazing or commercial crop production for the duration of the transmission line construction, but can usually be returned to previous land uses upon completion of the construction.

During the vegetation clearing process, efforts will be made to retain native ground cover where possible, and impacts to local vegetation will be minimized. Much of the undeveloped land and pastureland crossed by the alternative routes is covered with low to medium grasses and/or forbs that may or may not require clearing. Clearing of woody vegetation will only occur where necessary to provide access and working space and to protect conductors. Soil conservation practices will be undertaken to benefit native vegetation and to assist in successful restoration of disturbed areas. As soon as possible after the construction of the transmission line, the ROW will be reseeded with native grasses or a cover or forage crop, if necessary, to facilitate erosion control.

The impacts of transmission lines on wildlife can be divided into short-term effects resulting from physical disturbance during construction and long-term effects resulting from habitat modification. The net effect on local wildlife of these two impact types is typically minor.

During the clearing of the transmission line ROW, animals of lesser mobility and size may be impacted and suffer some loss of habitat by the actions of mechanical clearing by machinery. The noise and physical activity of work crews and machinery might temporarily disturb the normal behavior of certain species. Impacts to mobile, earthbound species such as small mammals, amphibians, and reptiles are typically minor and temporary, although the nests of small mammals and others may be lost during clearing or construction. Some animals, being temporarily deprived of cover, may be subject to increased natural predation. Ground-dwelling animals may be negatively impacted by soil compaction caused by heavy machinery. Wildlife in the immediate area may experience a slight loss of browse or forage material resulting from the clearing or shredding of woodland/brushland within the ROW; however, the prevalence of similar habitats in adjacent areas will minimize the effects of this loss. In addition, the regrowth of herbaceous and brushy/shrubby vegetation in the ROW following construction will also help to offset the effects of this loss.

The increased noise and activity levels during construction could potentially disturb breeding or other activities of species inhabiting the areas adjacent to the ROW. Dust and gaseous emissions should minimally affect wildlife. Although the normal behavior of many wildlife species will be disturbed during construction; no permanent damage to the populations of such organisms should result.

In general, the greatest potential impact to wildlife would result primarily from the loss of habitat, particularly woodland habitat, and fragmentation of habitat. Woodland habitats are relatively static environments that require a greater regenerative time compared to pastureland, cropland, grassland, or emergent wetlands. Other considerations include having the ROW parallel to and within 100 ft of streams; crossing wetlands and waterbodies; the length of the line along existing ROW and the total length of the line. Impacts to aquatic ecosystems will be negligible because most streams in the transmission line study area are intermittent and usually dry, and they would be spanned. Erosion-control measures would be employed at all crossings. Stock tanks and small ponds should receive no impact from the proposed transmission line because the line would span these waters. Alternative routes were analyzed and their impacts have been detailed in the PBS&J report submitted as ***Attachment A***.

3.3.3.2.3 Effects of Operation of Hydroelectric Facilities

The operation phase of the Project would result in minimal impacts on wildlife. Since the hydroelectric Project will operate in a run-of-river mode, there will be no changes in lake water levels impacting upstream or downstream wetlands, littoral, or riparian zones.

3.3.3.2.4 Effects of Operation of Transmission Line Corridor

During the operation of the proposed transmission line, periodic maintenance clearing of the transmission line ROW, while producing temporary negative impacts to wildlife, improves the habitat for ecotonal or edge species as a result of the increased production of small shrubs, perennial forbs, and grasses (***Attachment A***).

The operation of transmission lines may result in impacts on avian species. These impacts were evaluated by PBS&J (***Attachment A***) and are presented in the following paragraphs.

Impacts of transmission lines on birds are considered to be both positive and negative. Positive impacts of transmission lines and structures on avian species, particularly raptors, include additional nesting and roosting sites and resting and hunting perches, particularly in open, treeless habitats. Additionally, edge-adapted species may flourish along changed vegetation areas adjacent to the transmission ROW. Adverse impacts to avian species from electric transmission lines range from conductor, ground wire, and structure interactions (electrocution and/or collision) to habitat loss and fragmentation from ROW construction and maintenance.

Although electrocution from electric powerlines (distribution and transmission lines) may claim thousands of birds per year, electrocution impacts are highly unlikely for this Project. Typically, electrocution is not a threat from electric transmission lines greater than 69 kV, as the distance between conductors or conductor and structure or ground wire are greater than the wingspan of most birds (i.e., greater than 6 ft).

Habitat loss and fragmentation are other potential adverse impacts to avian species from transmission lines. Several studies indicate forest and grassland fragmentation have detrimental effects on some avian species that show a marked preference for large undisturbed and/or native habitat patches. Species are not randomly distributed with regard to habitat patch size, and fragmentation favors edge- and small-patch-adapted species. For those species dependent on larger patches and less adapted to edge, increases in woodland or forest edge effect can increase predation, brood parasitism, invasive species introduction, and reduce mating and nesting success. Changes in contiguous prairie habitats can do the same.

The transmission line (both structures and wires) could present a hazard to flying birds, particularly migrants. Collision may result in disorientation, crippling, or mortality. Collision hazards are greatest near habitat “magnets” (e.g., wetlands, open water, edges, and riparian zones) and during the fall when flight altitudes of dense migrating flocks are lower in association with cold air masses, fog, and inclement weather. The greatest danger of mortality exists during periods of low ceiling, poor visibility, and drizzle when birds are flying low, perhaps commencing or terminating a flight, when they may have difficulty seeing obstructions. Most migrant species known to occur in the transmission line study area, including passerines, should be minimally affected during migration, since their normal flying altitudes are much greater than the heights of the proposed transmission structures. For resident birds or for birds during periods of nonmigration, those most prone to collision are often the largest and most common in a given area; however, over time, these birds learn the location of transmission lines and become less susceptible to wire strikes. Raptors, typically, are uncommon victims of transmission line collisions, because of their great visual acuity. While waterfowl (ducks, geese, swans, cranes, shorebirds, etc.) are among the birds most susceptible to wire strikes, it has been estimated that wire strikes (including distribution lines) account for less than 0.1 percent of waterfowl nonhunting mortality. Suitable habitat for waterfowl does not occur within the transmission line study area, and the normal flying altitudes of any waterfowl migrating through the area are considerably greater than the heights of the proposed transmission towers. Therefore, no impacts to waterfowl are anticipated.

Collision potential and negative edge effects can be significantly reduced for some species through avian-safe routing and design. Routing and individual structure placement to avoid intense bird use areas (e.g., communal foraging or roosting areas, rookeries, wetlands, etc.) and increasing line visibility are important considerations. The position of the individual structures can also help reduce collisions. Where the transmission line would pass between roosting and foraging areas, the structures can be placed in the center of the flyway (i.e., where the birds are more likely to fly) to increase their visibility, in addition to marking the wires. Increasing wire visibility using markers, such as orange aviation balls, black-and-white ribbons, spiral vibration dampers, or avian flight diverters, particularly at mid-span, can reduce the number of collisions. Negative edge effects can be reduced through native revegetation of disturbed construction areas where necessary and appropriate for safe and reliable operation. Additionally, where lighting is required due to aviation concerns, use of white strobe lighting is preferred over other options in order to reduce avian collision potential with taller facilities. Lastly, nest management through platform design, equipment protection, and other physical disincentives to bird use and nesting can avoid negative impacts to birds and power reliability.

3.3.4 Threatened and Endangered Species

3.3.4.1 Affected Environment

3.3.4.1.1 List of Rare, Threatened, and Endangered (RTE) Species in Project Vicinity

Table 11 (***Attachment C***) contains a consolidated list and brief description of fauna and flora currently designated under federal or Texas law (or both) as rare, threatened, or endangered (RTE), which are believed to exist in one or more of the four-Lake counties in the vicinity of the proposed Project (Texas PWD, 2008d). A Biological Assessment of the federally-listed RTE species is presented in ***Attachment A, Section 3.7***.

The FWS (pursuant to Section 7(c)(1) of the Endangered Species Act) furnished TRA in 1983 at the time of original licensing application with a list of those listed and proposed endangered and threatened species which may be affected by the Project. At that time, the list was fairly limited and included the bald eagle (*Haliaeetus leucocephalus*) which over-winters on east Texas Reservoirs, the red-cockaded woodpecker (*Picoides borealis*) which lives in forests with stands of mature pine trees, and the American alligator (*Alligator mississipiensis*) which permanently inhabits many water bodies in East Texas (TRA, 1983).

Bald eagles recently were removed from the endangered species list. The bald eagle will continue to be monitored and protected as a recovering species. Both bald and golden eagles are protected under the Eagle Protection Act of 1940 as amended (16 U.S.C. §§ 668-668d, June 8, 1940, amended 1959, 1962, 1972, and 1978).

The red-cockaded woodpecker is federally/state-listed as endangered. The species historically ranged across the southeastern U.S., from southeast Virginia south to Florida, and west to southeastern Oklahoma and east Texas. Current populations are highly fragmented and are concentrated primarily in extensive old-growth pine forests of federal and state lands within the woodpecker's historic range (Jackson, 1994; Connor et al., 2001; as summarized by PBS&J).

Alligators are no longer listed as threatened or endangered. In Texas, they are protected and managed through hunting and wildlife regulation. They can be hunted under a general hunting license during a limited annual period (Texas PWD, 2007d).

The endangered and threatened species that may exist in Polk and San Jacinto Counties, where the proposed hydroelectric facilities and proposed transmission line will be located, are described in detail in PBS&J's environmental assessment and alternative route analysis performed for the transmission line project (***Attachment A***).

3.3.4.1.2 Critical Habitat

As defined in Section 3(5)(A) of the ESA, critical habitat is (i) the specific areas within the geographical area occupied by the species, at the time that it is listed in accordance with the ESA, on which are found those physical or biological features that are (I) essential to the conservation of the species and (II) that may require special management considerations or protection; and (ii) specific areas outside the geographical area occupied by a species at the time it is listed, upon a determination that such areas are essential for the conservation of the species. No critical habitat for any listed species occurs within the proposed Project boundary or in the area of potential effects downstream of the Project.

3.3.4.2 Environmental Effects on Threatened and Endangered Species

The potential impacts from the construction and operation of the hydroelectric facilities and transmission line corridor on threatened and endangered species are presented in the following Sections.

3.3.4.2.1 Effects of Construction of Hydroelectric Facilities

The proposed Project is not anticipated to have any adverse impacts on the identified RTE species. Among federally/state-listed plant species, Texas trailing phlox does not likely occur in the Project area and vicinity due to the absence of suitable habitat. The other federally/state-listed species, Texas prairie dawn, and the candidate species for federal listing, Neches River rose-mallow, are recorded only from Trinity County and their presence is unlikely in the construction area. Therefore, no impact on endangered/threatened plant species would occur as a result of the Project construction.

In Texas, most populations of the red-cockaded woodpecker, which is listed as Endangered under the ESA and state law, are found on state and federal lands in mature pine stands. The proposed hydroelectric facility will not disturb any such areas. White-faced Ibis is recorded only from Trinity County and is not expected to be adversely impacted by the proposed Project. Other listed bird species, such as piping plover, peregrine falcon, swallow-tailed kite, and wood stork, are mostly postbreeding wanderers or migratory visitors to the area. None of these has habitat requirements that would be interfered by the proposed hydroelectric facility.

With regard to bald eagles and other raptors known to inhabit the lake shore and regional areas, construction activities will neither remove favored perching trees nor impact the species hunting activities at the dam, over the lake, or throughout the region both above and below the dam.

The bat species listed prefer caves, mine tunnels, old buildings, culverts, beneath bridges, etc., as roosting sites. The proposed hydroelectric facilities are not anticipated to have any impact on such habitats.

The federally-listed terrestrial animals, such as the black bear (Louisiana subspecies and others) and red wolf, would not be affected by the construction since they are not expected to occur in the Project area due to lack of suitable habitat. The area proposed for construction of the hydroelectric facilities is currently open, previously disturbed, and is now grass and parkland. These animals, even if present, would likely avoid these existing areas already due to a lack of cover and tendency to avoid human activity. Thus, no impact on these species would occur as a result of from the construction of the hydroelectric facility.

The Texas horned lizard, state-listed as threatened, prefers a dry, open, sandy habitat and will not be affected by the Project.

There are no federally listed threatened or endangered fish species in the four-county Lake Region. Of the three prominent local fish species listed, the paddle fish is the subject of active conservation measures. The paddle fish is a state-listed threatened species. Formerly a state game fish, protection and conservation measures have been ongoing since the late 1980s. No taking of the paddle fish is allowed in the state. Lake Livingston was stocked with paddlefish in the late 1980s and early 1990s. The conservation effort has seen paddlefish recover in areas that previously had no record of the presence of the species for upwards of 50 years (Betsill, Texas PWD et al., 1999). After stocking in the Lake Livingston Reservoir, some paddlefish were believed to migrate downstream through the floodgates on the dam and a limited number now reside downstream in the river. While the survival of stocked paddlefish was believed to be good, there has been no indication that reproduction has or is occurring. In the absence of natural reproduction and recruitment, the population is expected to dwindle over time. The Project would likely have little impact to the restoration effort since stocking ceased in the 1990s and there are not believed to be any young paddlefish in the reservoir which would potentially be impacted by the Project. Conservation efforts continue and the species remains under state protection.

The creek chubsucker is the other state-listed threatened fish species. However, this species was not encountered during the studies conducted by PBS&J in Lake Livingston and Trinity River downstream of the dam, and therefore, would not be affected by the proposed Project.

3.3.4.2.2 Effects of Construction of Transmission Line Corridor

The following information has been summarized from the PBS&J's environmental assessment and alternative route analysis performed for the transmission line project (***Attachment A***).

No long-term impacts from the proposed transmission line to any federal or state-listed species that could potentially occur in the transmission line study area are anticipated. In general, the majority of these species are highly mobile and either do not normally use local environments, or pass through the area only during migration. Suitable habitat for many of the species does not exist in the transmission line study area. It is unlikely that the red-cockaded woodpecker occurs in the study area due to lack of suitable habitat. An active bald eagle nest is located approximately 1,900 feet southwest of Segment J (Routes 1 and 2). The eagles forage in the Trinity River west of the nest, even farther away from the primary routes. The piping plover, peregrine falcon, swallow-tailed kite, and wood stork, if they occur in the study area, are likely to do so only as transitory migrants or postbreeding wanderers.

The Louisiana pinesnake, timber/canebrake rattlesnake, and Bachman's sparrow, if they occur in the ROW, may be impacted to some extent during the initial clearing and construction phases of the Project. These impacts would be short term, however, and not expected to be significant. The black bear (Louisiana subspecies and others) is not expected to occur in the study area due to lack of suitable habitat and is highly unlikely to be impacted by the Project. Rafinesque's big-eared bat, should it reside in the transmission line ROW, may be impacted by the proposed facility if its roosts are affected. As with small birds, bats are likely to leave the area during construction and avoid the transmission line once construction is completed. Texas trailing phlox, if it occurs in the transmission line ROW, may be impacted during initial vegetation clearing during construction.

Aquatic species such as the creek chubsucker, paddlefish, and alligator snapping turtle, if they occur in the ROW, are not expected to be impacted by the proposed Project, since the aquatic habitat will be spanned. Regardless, precautions will be taken to minimize siltation influx into area streams. Siltation controls and placement of structures outside of stream and spring areas would minimize or eliminate impacts.

Critical Habitat

Since there is no critical habitat identified within the proposed Project boundary or transmission line study area, no impact to critical habitat as a result of the proposed Project and transmission line construction would occur.

3.3.4.2.3 Effects of Operation of Hydroelectric Facilities

Since the new hydroelectric facility would be operated as run of the river and there would be no changes to the river flow or lake water levels, the habitats for any listed species living in the littoral or riparian zone would not be affected by the operation.

The impacts of the hydroelectric facilities on paddlefish are explained above and also in ***Section 3.3.2***, Aquatic Resources. During the operation of the Project, the remaining larger paddlefish, if present any, in the reservoir would be excluded from the Project due to the bar screens. Furthermore, downstream migration of paddlefish from the reservoir would likely occur under flood conditions, when the floodgates are open on the dam. Therefore, no significant impact on paddlefish from proposed Project operations would occur.

Any changes resulting from the proposed Project would not affect alligator snapping turtle since no individuals of this species were collected or observed during the recent aquatic studies conducted by PBS&J.

3.3.4.2.4 Effects of Operation of Transmission Line Corridor

The impact of the proposed transmission line on avian species is discussed in details in ***Section 3.3.3***,Terrestrial Resources. While the transmission line structures may pose a hazard for the birds that are transitory migrants or post-breeding wanderers such as piping plover, peregrine falcon, swallow-tailed kite, and wood stork, the normal flying altitudes during migration are greater than the height of the proposed structures. The wires themselves may also provide roosting sites for birds passing through the area (***Attachment A***).

Critical Habitat

Since there is no critical habitat identified within the proposed Project boundary or transmission line study area, no impact to critical habitat as a result of the proposed Project and transmission line operation would occur.

3.3.5 Recreation and Land Use

3.3.5.1 Affected Environment

3.3.5.1.1 Existing Recreational Facilities in the Project Vicinity

Within the Trinity River Basin is a wide range of both public and privately owned recreational areas. Included in the public sector are two major national forests, a national grassland area, a wildlife area, and approximately a dozen state and federal public outdoor recreational areas. Both national forests are within 20 miles of the Lake Livingston site. The Davy Crockett National forest, located in Houston County, is 20 miles north of the lake. This forest measures approximately 64,000 acres and contains the Ratcliff Lake area as its major recreational development. Ratcliff Lake is a 45-acre site with fishing, swimming, approximately 80 campsites, and a concession stand. There are a number of hiking trails, and hunting is permitted throughout the area. Sam Houston National Forest, southwest and adjacent to Lake Livingston, is between 140,000 and 160,000 acres and is divided into three areas including Lake Conroe, Central, and the Winters Bayou/Tracking Creek. There are 11 recreational areas within the forest: Stubblefield, Double Lake, Kelley Pond, Scotts Ridge, Cagle, Lone Star Hiking Trail, the Big Creek Scenic area and Big Woods, Nebletts, Tarkington, and Shell hunting camps. Recreation within these sites includes camping, hiking, fishing, swimming and hunting.

The largest recreational resource in the basin is the Lake Livingston Reservoir, with more than 450 miles of shoreline, a width of 7 miles at its widest point, and a length of 39 miles. Covering 83,000 acres and a capacity of more than 1.75 million acre feet of water, the lake offers the region extensive recreational opportunity. Numerous public parks and privately owned concessions allow the public ample access to the lake's amenities.

The state-owned and operated Lake Livingston Recreational Area is a 653-acre site on Lake Livingston just north of Swartwout in Polk County. This facility contains a marina and concession for boating, fishing, and other amenities.

TRA manages 2,900 acres of shoreline lands and islands at Lake Livingston and administers commercial and marina leases. TRA purchased this land primarily for recreational purposes and has developed (since the completion of the lake) park operations, marina concessions, a concession campground, a golf course, and a developed park leasehold.

Wolf Creek Park, located north of the town of Coldspring in San Jacinto County, includes 137 acres and a mile of lake shoreline and is largest of the TRA-developed facilities. This park is operated by TRA and annually receives more than 100,000 visitors. It is one of the most popular recreational areas on Lake Livingston. TRA provides a full range of recreational activities within this park including camping, wilderness areas, a miniature golf course, a full service marina, fishing pier and boat ramp, picnic area, children's playground, and shelter for group activities.

The second recreational facility operated by TRA is Tigerville Park. This facility consists of almost 14 acres of no-fee day-use facilities located in Polk County. It has approximately 2,100 feet of shoreline and includes a boat ramp and day-use facilities.

TRA has also provided for two marina concessions, one located in Onalaska, and the Wolf Creek Marina, located in Wolf Creek Park. TRA operates and maintains five public non-fee boat ramps and leases land for public recreational access below Lake Livingston Dam.

In addition, there are many recreational facilities around Lake Livingston that are privately owned, but open to the public or available for rental. There are a number of private and public facilities on the lake, including at least 30 licensed marinas that serve the recreational needs of boaters, paddlers, water sports enthusiasts, fishermen, campers, and other lake visitors. Two privately owned, residential summer camps for children – Camp Olympia and YMCA Camp Cullen – are operated on lakefront property near Trinity.

Until recently, Polk County operated Southland Park on the eastern bank of the Trinity River just below the dam. The Park site encompasses 33.35 acres of which TRA owns and leases 13.35 acres to Polk County, which owns the remaining acreage. Until its closure in 2008, the park consisted of lawn and trees on flat, graded land, an observation pavilion, a convenience store and cafe, picnic tables, and several travel trailer sites. This park was developed by Polk County soon after the dam's construction with federally provided funds. In recent years, Southland Park had seen declining usage, and its amenities had not been well maintained by the private concessionaire who operated those facilities under an arrangement with the county. Consequently, the park was officially closed to the public in 2008, although an access road from FM 1988 to the site (known as Recreational Road 5) still exists and a small portion of the former park land remains accessible to the public.

TRA owns San Jacinto County Park, which consists of 8.83 acres of undeveloped land located below the dam on the western bank of the river. The access road is south of and parallel to the parcel and is a continuation of an existing county road. The road terminates at the park site where users may park their vehicles and gain access to fishing on the Trinity River. No facilities are provided, as the site is subject to periodic flooding.

Two boat ramps maintained by a private concessionaire, one on either side of the river, are located approximately 0.4 mile below the dam and are readily accessible from a county road. These ramps provide the primary access to the tailwater fishery below the dam. Because of safety and homeland security concerns, the public is restricted from access to the dam and the tailwater area for a distance of 1,000 feet below the dam.

3.3.5.1.2 Land Use in the Project Vicinity

Land use region designations help to define design conditions, environmental impacts, indigenous plants and animals, water resources, soil and geological conditions and other environment related aspects of a study area. The Trinity River Basin transects eight distinct topographic and ecological regions including North Central Prairie, Grand Prairie, Blackland Prairie, Eastern Timberlands, Western and Eastern Cross Timbers, Bottomlands, Coastal Prairie and Marsh, and Texas Claypan. Lake Livingston is located in Bottomlands, which lie along the Trinity River and the lower reaches of major tributaries (USGS, 1998). The region consists of the floodplain areas adjacent to the tributaries and main stream, and primarily consists of alluvial soil washed from the Blackland Prairies upstream. While this region contains the most potentially productive soil resources of the basin, and possibly the state, farming is a gamble due to frequent flooding; and as a result, generally not attempted. Land on higher river terraces is routinely farmed and is notable for large-scale production of corn, cotton, feed crops, livestock and commercial hardwoods. The primary use of the river bottom area is stock grazing. The largest part of the flood plain is covered in native grasses and hardwoods similar to those found in the East Texas Timberlands (TRA, 2007a). Residential development is common along the lower end of Lake Livingston (Henson and Web, 2004).

Development around the Lake is controlled by local land use ordinances of the four lake counties and is limited by TRA ordinances governing septic discharges and construction activities in close proximity to the reservoir (TRA, 1993a, 1993b). There are several sizable subdivisions on the lake, which provide both permanent and second homes for east Texas residents. There are some more densely developed areas in the lake vicinity, but they are located away from the Lake, typically adjacent to the region's major roadways and intersections.

The transmission line study area, which is located southeast of Lake Livingston and includes portions of Polk and San Jacinto Counties, is mostly rural with agricultural fields and some residential development, while no cities occur within the area. According to Natural Resources Conservation Service (NRCS) land use estimates (NRCS, 2000), the three primary land use categories in Polk County were forestland (72 percent), pastureland (14 percent), and large waterbodies (streams greater than or equal to 660 ft in width or waterbodies greater than 40 acres) (5 percent). For San Jacinto County, the top three land use categories were forestland (58 percent), federal land cover (15 percent), and pastureland (11 percent). Agriculture, both crop cultivation and ranching, constitutes an important segment of the area economy. Approximately 65.7 percent of the mapped soils in the area are considered prime farmland soils (***Attachment A***).

3.3.5.1.3 Wild and Scenic Rivers and Wilderness Areas

There are no Wild and Scenic River designations or Wilderness areas within the proposed Project boundary or in the area impacted by the Project. The Rio Grande is the only river in Texas designated as Wild and Scenic (Wild 95.2 miles, Scenic 96.0 miles) under the Federal Wild and Scenic Rivers Act (16 U.S. Code §§ 1271 – 1287). As discussed in ***Section 3.3.2***, two sections of the Trinity River, one above and one below

Lake Livingston have been designated as "Ecologically Significant River Segments" by Texas PWD (Texas PWD, 2007b, 2007c).

3.3.5.1.4 Shoreline Development Policy and Buffer Zones

Most of the land surrounding Lake Livingston is in private ownership, and TRA does not own a "buffer strip" in fee around the reservoir above El. 131 feet msl. However, TRA owns a flood easement surrounding Lake Livingston established in increments from El. 135.0 feet to 140.0 feet. Guidelines are provided for construction of dwellings within the flood easement area which is subject to specific policies and provisions of TRA. The erection of facilities within the easement area over water owned or controlled by TRA (such as fishing piers, bulkheads, and boat docks) requires permits and is reviewed by TRA on an individual basis (TRA, 1993a, 1993b).

TRA also has a number of policies and ordinances that further regulate the development and sanitary discharges along shorelines of Lake Livingston. There are two principal zones that are subject to varying types of regulation. The first is known as the "Restricted Area," defined as the area lying between the contour line at El. 131 feet msl (the normal maximum reservoir operating level) and a parallel line lying 75 feet from the 131 feet msl line, measured horizontally away from the lake. TRA closely restricts activities in the Restricted Area, including a ban on wastewater discharges from the installation of on-site sewage facilities of any kind other than sealed holding tanks (TRA, 1993a, 1993b, 2000b).

The second regulated zone is called the "Water Quality Area," and is defined as the land area extending from the upper end of the Restricted Area to a parallel line 2,000 feet landward from the 131 feet msl line. By ordinance, TRA regulates the installation of all on-site sewage facilities septic discharges and certain other activities and uses within the Water Quality Area, including the initial inspection, licensing and bi-annual follow-up inspections of these facilities (TRA, 1993a, 1993b, 2000b). Copies of these referenced TRA ordinances are provided in ***Attachment F***.

The Cooperative does not propose to acquire any lands in fee around the reservoir as a buffer zone, as doing so would render the Project economically infeasible and could interfere with TRA's effective regulation of uses surrounding the lake. Instead, the Cooperative intends to acquire from TRA the minimum easement rights necessary to satisfy its obligations as a FERC licensee.

3.3.5.2 Environmental Effects on Recreation and Land Use

The potential impacts from the construction and operation of the hydroelectric facilities and transmission line corridor on recreation and land use are presented in the following Sections.

3.3.5.2.1 Effects of Construction of Hydroelectric Facilities

The construction of the powerhouse and the tailrace may encroach upon the upstream (northern) end of the former Southland Park site; however, since the park has been closed to the public and no longer serves as a park, there will be no impact on the park facilities. Depending upon the final design and location of the tailrace channel, the observation gazebo constructed by TRA on TRA-owned land adjacent to the north end of the former Southland Park may need to be removed to accommodate the channel's construction. If the gazebo is removed, the Cooperative should be required to erect a similar structure nearby.

Although construction of the proposed Project would not otherwise displace or adversely affect existing recreational resources, during the environmental scoping process FWS and the Commission staff suggested that the Cooperative explore the feasibility of providing public recreational access below the Project's tailwater discharge. FWS asked the Cooperative to explore the possibility of installing a public, handicapped-accessible fishing pier or deck at a safe location below the dam (Letter from Stephen D. Parris, FWS, to Kimberly D. Bose, FERC, April 24, 2008). The Commission staff asked the Cooperative to consult with Polk County about providing tailrace access after project construction (Letter from Mark Pawlowski, FERC, to Brian Lawson, GDS Assocs., April 25, 2008). The Cooperative has engaged in consultations with Polk County and with TRA concerning the County's plans for the former Southland Park property and the feasibility of providing accessible public fishing access in the Project tailwater area. Both the County and TRA management expressed concerns over the viability of structural fishing access facilities adjacent to the former park area based on shoreline soil conditions and the propensity of the area to periodic flooding. TRA has also expressed concern about security and safety issues related to potential recreational facilities in close proximity to the dam and proposed Project features.[9] We recommend that after the Project's tailrace channel location and design have been finalized, the Cooperative should conduct a creel survey and angler usage study to determine whether there is a need and demand for enhanced shoreline access below the Project. If the survey results demonstrate a demand for enhanced access, the Cooperative should file a proposed Recreation Plan providing for the installation of shoreline access improvements at a safe distance below the tailrace discharge, consistent with the topography and soil conditions in the area.

Construction of the hydroelectric facility would occupy approximately 12 acres of previously disturbed open land and add new structures, including penstock, powerhouse, and tailrace channel, on the east shore of Lake Livingston. Since the facility's

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[9] TRA, for safety and security reasons, passed an ordinance in October 1992 (TRA Ordinance No. 09AAA) prohibiting public access to the Trinity River and its shoreline for a distance of 1,000 feet downstream of the center line of the dam.

construction will occur mostly in the disturbed land and any undisturbed land, if used, will be revegetated following construction, the effect on land use is expected to be minimal.

3.3.5.2.2 Effects of Construction of Transmission Line Corridor

The following information has been summarized from the PBS&J's environmental assessment and alternative route analysis performed for the transmission line project (***Attachment A***).

Potential impacts to recreational land uses include the disruption or preemption of recreational activities. As noted earlier, the former Southland Park, owned and operated by Polk County, is located in the northwest portion of the transmission line study area, on Recreational Road 5 off of FM 1988. However, this park has been closed to the public and no longer serves as a park. Regardless, while no alternative routes cross the park, because of the proximity of the proposed new substation, all routes cross within 1,000 ft of the prior park.

Land use impacts from transmission line construction are usually determined by the amount of land (of whatever use) taken for the actual ROW and by the compatibility of the ROW with adjacent land uses. Productive land use of the ROW can be achieved with activities compatible with the grasses required for the ROW. During construction, temporary impacts to land uses within the ROW could occur due to the movement of workers and materials through the area. Construction noise and dust, as well as temporary disruption of traffic flow, may also temporarily affect residents and businesses in the area immediately adjacent to the ROW. Coordination among the Cooperative, contractors, and landowners regarding access to the ROW and construction scheduling should minimize these disruptions.

The primary criteria considered by PBS&J to measure potential land use impacts for the transmission line project include proximity to habitable structures (i.e., residences, businesses, schools, churches, hospitals, nursing homes, etc.), length parallel to existing ROW, length parallel to property lines, and overall route length. The routes having fewest habitable structures, paralleling existing transmission ROW or other existing compatible ROW, paralleling property lines, and having shorter lengths are considered as the preferable routes. Alternative routes were analyzed and their impacts have been detailed in the PBS&J report submitted as ***Attachment A***.

Impacts to agricultural lands can generally be ranked by degree of potential impact, with the least potential impact occurring in areas where grazing is the primary use (pastureland), followed by cultivated cropland. Typically, the alternative land uses to grazing in the transmission line area are forestland, surface water, or residential. Potential impacts to agriculture lands by transmission lines are generally considered having the least degree of potential impact of all land uses, with forested lands having the highest degree of potential impact. Because the transmission line study area is dominated by pastureland, and because forests and residential areas were avoided as much as feasible, all routes cross a significant amount of pastureland/grazingland.

Construction-related activities could slightly impact agricultural production, depending upon the timing of construction related to the local planting and harvesting schedule. Therefore, no significant potential impact on agricultural land from the transmission line construction would be expected.

3.3.5.2.3 Effects of Operation of Hydroelectric Facilities

The proposed hydroelectric station will be operated as a run-of-river facility and will not result in changes in the flow pattern of the river or in lake surface elevations. As explained above, Southland Park has been closed to the public and no other active parkland or recreational facilities with which the proposed Project might interfere have been identified. Therefore, no operational impact on recreational facilities in the Project vicinity is expected.

Except the amount of land used for the construction of the hydroelectric and transmission line facilities, there would be no significant long-term impacts on land use of the Project area.

3.3.5.2.4 Effects of Operation of Transmission Line Corridor

Potential impacts from the proposed transmission line to agricultural land uses include the disruption or preemption of farming activities. Disruption may include the time lost going around, or backing up to, structures in order to cultivate as much area as possible, and the general loss of efficiency compared to plowing or planting unimpeded in straight rows. Preemption of agricultural activities refers to the actual amount of land lost to production directly under the structures. The type and location of transmission line structures used in agricultural areas also determine the nature and degree of potential impacts to farming operations. Generally, single-pole structures impact agricultural land less than H-frame or lattice towers because they present a smaller obstacle and take up less actual acreage at the foundation. Structures (and routes) located along field edges (property lines, roads, drainage ditches, etc.) generally present fewer problems for farming operations than a route running across an open field.

The ROW for the transmission line Project will not be fenced or otherwise separated from adjacent lands, therefore, no significant long-term displacement of farming or grazing activities will result. Most existing agricultural land uses may be resumed following construction (***Attachment A***).

3.3.6 Cultural Resources

3.3.6.1 Affected Environment

3.3.6.1.1 Texas Prehistory

Texas prehistory has been divided into four periods (Suhm et al., 1954; as summarized by Corps, 1975).

1. Early Man (Prior to 9500 B.C.)

2. Paleo-Indian (9500 B.C. to 5500 B.C.)
   This culture included mammoth and bison hunting, based on seasonal movement of social groups composed of several families. Few sites have been scientifically excavated in Texas. Flint-pointed darts representing this era have been found generally in the Trinity River Basin.

3. Archaic (5500 B.C. to 800 A.D.)
   This stage includes the hunting of small game and gathering of wild plants. Groups comprised of a few families made more efficient use of the environments. They relied on specialized tools and seasonal movements, and they focused on one species and then another. Artifacts from this era have been found near the Project area.
4. Neo-American (800 A.D. to 1600 A.D.)
   These cultures are characterized by the use of the bow and arrow, hunting and gathering, tribal and confederacy groups. The Caddoan culture is represented by the Alto Focus which existed north of Lake Livingston. The Caddoan culture spanned the Neo-American and Historic periods. Artifacts of this era have been found near Lake Livingston.

3.3.6.1.2 Texas and Regional State History

Early European explorations of the Trinity River Basin were conducted by the Spanish in true late 1600s. The Spanish established several missions, and named the river the “Rio de is Santisima Trinidad.” The river became the site of a number of army posts and fortified settlements to defend Spanish Texas against the French and subsequent Anglo-Americans.

When Europeans entered Texas there were already a number of Indian Tribes living in the general vicinity of Lake Livingston. The Hasinai Confederation of the Caddo (credited with providing the state name Texas meaning "ally" or "friend") was located to the northeast of the dam site. The Akokisa or Bidai tribes located in the area of Lake Livingston spoke Ataapan.

After the Texas Revolution in 1836, the Trinity River became a steamboat route with service between Galveston and Cincinnati, Texas.

The Coushatta and Alabama Indians moved into the region from the Mississippi River sometime after 1800. The two Tribes belonged to the Creek Confederacy. There were Indian settlements up and down the Trinity River. As settlement increased, the way of life of the Indian Tribal was impacted. Eventually, the remaining Indian peoples given 1,280 acres of reservation land in 1854, located between Livingston and Woodville in Polk County. Thereafter, the Reservation was increased by an additional 3,000 acres. These Indian Peoples had significant influence on the development of this region during the 1800s. Texas fought for the Confederacy during the Civil war and 19 members of the Alabama-Coushatta tribe were sworn into service. The region was prized for its thick woods. Today, there are hundreds of historic sawmill sties that utilized these woodland resources.

3.3.6.1.3 State Historical Markers and State Listed Historic Places

The State Historical Survey Committee has placed two historical markers near the Project site. One marks the location of the once important river town of Swartwout and the second commemorates the steamboat tradition.

A review of historical sites listed on the Texas Historic Commission’s Website (http://atlas.thc.state.tx.us/shell-county.htm) indicates there are 2,066 listed historical sites located in Polk, San Jacinto, Trinity and Walker Counties. These site listings include historical buildings, residences, museum sites, cemeteries, historical markers, national historical registered sites, military sites, and historical neighborhoods. In addition, there are 381 historical saw mill sites listed for the four-county Lake Region.

3.3.6.1.4 National Register of Historic Places

The Texas Historical Commission lists the following sites on the National Register within the four-county Lake Region:

- Polk County
  - McCardell, William Keenan and Nancy Elizabeth McCardell House
  - Polk County Courthouse and 1905 Courthouse Annex

- San Jacinto County
  - San Jacinto County Courthouse
  - San Jacinto County Jail & Old records Vault Building

- Trinity County
  - Old Red Schoolhouse
  - Riverside Swinging Bridge
  - State Highway 19 Bridge at Trinity River
  - Trinity County Courthouse Square

- Walker County
  - Sam Houston House
  - Riverside Swinging Bridge
  - State Highway 19 Bridge at Trinity River
  - John W. Thomason House

3.3.6.1.5 Native American Tribes

In particular, within the Project vicinity is found the Reservation of the Alabama-Coushatta Indian Tribe, one of three recognized and remaining Indian Tribes in Texas. The Alabama-Coushatta Tribe is Texas' oldest Indian Tribe and is still active and vital with a membership of about 1,000. The Tribe historically has ranged within the four-county Lake Region, and currently owns and manages their historic 4,593.7-acre reservation on U.S. Highway 190, 17 miles east of Livingston in Polk County.

3.3.6.1.6 Previous Investigations

The information presented in this subsection was obtained and summarized by PBS&J as a part of the environmental assessment and alternative route analysis for the Lake Livingston-Rich 138-kV transmission line project (***Attachment A***).

The earliest archeological investigations in the county were reconnaissance surveys conducted by the University of Texas at Austin (UT) in 1919. Additional reconnaissance efforts, test excavations, and more substantial investigations were conducted in the 1920s and 1930s by UT archeologists in Chambers, Galveston, Harris, and Polk Counties (Kenmotsu and Perttula, 1993). One of the sites excavated in Polk County (41PK2) appears to be an 1820s to 1830s Alabama-Coushatta Indian settlement on a tributary of the Trinity River (Story et al., 1990; Kenmotsu and Perttula, 1993).

During 1940 to 1941, UT, with funding from the Works Progress Administration, carried out archeological surveys in Polk and other southeast Texas counties. These surveys, under the direction of G.E. Arnold, identified many archeological sites in these counties (Guy, 1990). However, no excavations were conducted at any of these sites.

During the 1960s, archeological investigations were conducted for the Lake Livingston Reservoir that encompassed portions of Polk, San Jacinto, Trinity, and Walker Counties (Nunley, 1963). During this survey, archeological sites were recorded within and adjacent to the proposed lake. Seven of the sites recorded were subsequently tested during 1965 and 1966 (McClurkan, 1968). The artifacts assembled showed evidence of late Archaic and Neo-American stages of development. The evidence from the sites confirmed that the inhabitants in the Lake Livingston Area were Ataapan speakers. It suggests that the Ataapan culture spanned the Archaic and Neo-American periods, and that the Ataapan culture was strongly influenced by Caddoan culture from the north during the Neo-American period (TRA, 1983).

During 1984 and 1985, 441988/080109 3-55 excavations were conducted at the Crawford Site (41PK69) by the Archeological Research Laboratory, Texas A&M University (Ensor and Carlson, 1988).

Other archeological investigations near this Project area include the Lake Conroe investigations in Montgomery County (McNatt, 1978; Shafer 1968; Shafer and Stearns, 1975) and the survey at B.A. Steinhagen Lake in Tyler County (Horizon Environmental Services). Small-scale investigations have also been conducted for water and sewer improvements in San Jacinto County (Corbin, 1993) and for oil and gas interests (Moore, 1993).

More recently, Turpin and Sons, Inc. (Turpin, 2006) conducted a pipeline survey for Enbridge. Two archeological sites were recorded during this survey. Between September and October 2007, PBS&J conducted an archeological survey for the proposed Goodrich Pipeline Project in Houston, Trinity, and Polk Counties (Cordova and Martin, 2007). The survey identified one previously unrecorded prehistoric site (41PK256).

3.3.6.1.7 Results of the Literature and Records Review

A site file and records review was conducted by PBS&J (***Attachment A***) for Polk and San Jacinto Counties, where the proposed Project and transmission line will be located. The files at Texas Archeological Research Laboratory (Texas ARL) and at the Texas HC were both examined for the location of recorded archeological sites; the location of listed or determined eligible for listing National Register properties; State Archeological Landmark (SAL) sites; and Texas Historic Markers (Texas HM). Also reviewed were Texas Department of Transportation (Texas DOT)'s Master List of National Register Eligible Bridges, and Texas HC's Texas Historic Cemeteries database.

The file review was conducted utilizing the maps at Texas ARL and the Texas HC's Historic Sites Atlas and the Restricted Archeological Sites Atlas. This review identified 257 recorded archeological sites in Polk County. It also identified four SAL-designated sites, two National Register-listed properties, and 59 Texas HMs in the county. The records at Texas ARL and the Texas HC revealed no evidence of any previous cultural resource investigations and only two previously recorded cultural resource sites in the transmission line study area. The Texas HC Historic Sites Atlas did not identify any National Register-listed properties or SAL-designated sites in the transmission line study area.

The results of the file review for San Jacinto County revealed 206 recorded archeological sites in the county, four SAL-designated sites, two National Register-listed properties, and 28 Texas HMs. None of the recorded cultural resources in San Jacinto County occur in the transmission line study area.

During the original license application in 1983, review of sources on archaeology in the area provided no evidence concerning existence of archaeological resources at the dam site (TRA, 1983). In 2008, a site investigation performed by PBS&J also revealed no evidence of any cultural resources in the Project area.

3.3.6.2 Environmental Effects on Cultural Resources

The potential impacts from the construction and operation of the hydroelectric facilities and transmission line corridor on cultural resources are presented in the following Sections.

3.3.6.2.1 Effects of Construction of Hydroelectric Facilities

Since the construction of the proposed hydroelectric facility will occur entirely on land previously excavated and disturbed during the construction of Lake Livingston Dam, the facility's construction is not expected to impact any of the above identified historic and cultural resources.

The construction of the proposed hydroelectric facility at the Lake Livingston Dam is expected to have no negative impact on historic Native American Indian lands, reservation land, or other tribal resources of the four-county Lake Region, including those lands and resources of the local Alabama-Coushatta Tribe specifically.

3.3.6.2.2 Effects of Construction of Transmission Line Corridor

The following information has been summarized from the PBS&J's environmental assessment and alternative route analysis performed for the transmission line project (***Attachment A***).

Direct impacts to known or unknown cultural resources sites may occur during the construction phase of the proposed transmission line. Direct impacts are caused by the actual construction of the line or through increased vehicular and pedestrian traffic during the construction phase. The increase in vehicular traffic may damage surficial or shallowly buried sites, while the increase in pedestrian traffic may result in vandalism of some sites. The Cooperative, however, does not allow public access to its easements, most of which are on private property, further limiting access. Additionally, the integrity of the character of any unrecorded, significant historic structures could also be visually impacted by the construction of the proposed transmission line.

The preferred form of mitigation for cultural resources is avoidance. An alternative form of mitigation of direct impacts can be developed for archeological and historical sites with the implementation of a program of detailed data retrieval. Additionally, relocation may be possible for some historic structures.

3.3.6.2.3 Effects of Operation of Hydroelectric Facilities

Because the proposed mode of Project operation will not affect reservoir levels or rates of river flow below the Project, its operations will not impact any cultural or historic resources.

3.3.6.2.4 Effects of Operation of Transmission Line Corridor

Indirect impacts to cultural resources include those caused by a Project that occur later in time or are farther removed in distance, but are reasonably foreseeable. These indirect impacts may include alteration in the pattern of land use, changes in population density, accelerated growth rates, or increased pedestrian or vehicular traffic, all of which may have an adverse impact on properties of historical, architectural, archeological, or cultural significance. Historical sites and landscapes could potentially be adversely impacted by the visibility of the transmission line. Indirect impacts on historical properties and landscapes can be lessened through careful design and landscaping considerations.

The methodology utilized to assess each segment's and each route's potential for cultural resources, and the detailed evaluation of impacts of primary routes to cultural resources is presented in the PBS&J report submitted as ***Attachment A***.

3.3.7 Aesthetic Resources

3.3.7.1 Affected Environment

Lake Livingston and the surrounding region afford significant opportunity for recreation and enjoyment of the natural and created environments. The lake itself is a significant aesthetic resource enjoyed by the region. The reservoir is surrounded by a combination of forest, pasture and range, cropland, residential, and urban lands. The lake region's aesthetic values are described more fully in ***Section 3.1*** above.

The transmission line study area was analyzed by PBS&J with respect to aesthetics (***Attachment A***). Topographical variation, prominence of water in the landscape, vegetation variety, color, diversity of scenic elements, degree of human development or alteration, and overall uniqueness of the scenic environment compared to the larger region were among the factors taken into consideration to define the potential impact to a scenic resource from the construction of the proposed transmission line. Based on these criteria, the area was found to exhibit a generally medium to high level of aesthetic quality. Water is quite prominent in the landscape, from the Trinity River in the western portion of the transmission line study area, to the several lakes and smaller waterbodies. The area has not been extensively developed, most development being agricultural. Woodland also occurs within the transmission line study area.

3.3.7.2 Environmental Effects on Aesthetic Resources

The potential impacts from the construction and operation of the hydroelectric facilities and transmission line corridor on aesthetic resources are presented in the following Sections.

3.3.7.2.1 Effects of Construction of Hydroelectric Facilities

Although construction phase of the powerhouse, intake facilities and tailrace channel would impact the visual qualities of the Project site, construction activities would occur on the previously disturbed open land and their impacts would be short-term. In addition, these disturbances would impact only the individuals using the immediate Project area for recreation. Therefore, minimal impact on aesthetics from the facilities' construction is expected.

3.3.7.2.2 Effects of Construction of Transmission Line Corridor

Construction of the proposed 138-kV transmission line could have both temporary and permanent aesthetic effects. Temporary impacts would include views of the actual assembly and erection of the structures, and clearing of the ROW. Where wooded areas are cleared, the brush and wood debris could have a temporary negative effect on the local visual environment. Permanent impacts from the Project would involve the views of the structures and lines as well as views of cleared ROW (***Attachment A***). These permanent visual impacts are discussed in ***Section 3.3.7.2.4***.

3.3.7.2.3 Effects of Operation of Hydroelectric Facilities

TRA has always maintained high visual standards for its developments, and the Cooperative has indicated its commitment to designing the hydropower facilities using the same high standards. Efforts will be made in the final design to blend in the Project with the surroundings and provide a pleasant aesthetic appearance. Redevelopment of parkland and the location of structures would be completed in such a way as to enhance the area downstream and in the vicinity of the dam. Homeland Security considerations would be accommodated in the design. Therefore, no significant impact on aesthetics from the proposed hydroelectric facilities is expected.

3.3.7.2.4 Effects of Operation of Transmission Line Corridor

The following information has been summarized from the PBS&J's environmental assessment and alternative route analysis performed for the transmission line project (***Attachment A***).

Aesthetic impacts, or impacts on visual resources, exist when the ROW, lines, and/or structures of a transmission line system create an intrusion into, or substantially alter the character of, the existing view. The significance of the impact is directly related to the quality of the view, in the case of natural scenic areas, or to the importance of the existing setting in the use and/or enjoyment of an area, in the case of valued community resources and recreational areas.

In order to evaluate aesthetic impacts, PBS&J conducted field surveys to determine the length of the proposed transmission line that would be visible from selected publicly accessible areas. According to these surveys, a portion of each alternative route would be visible from either or both of FM roads, FM 988 and FM 3278, which occur within the transmission line study area. The proposed line would not be visible from two RV parks located in the transmission line study area, one on either side of the Trinity River; thus, no recreational areas will be visually impacted by the proposed transmission line. Portions of all alternative routes studied (except for one route) would be visible from either or both of two cemeteries, Victory Place Cemetery located off of FM 1988 and the second cemetery located near the Trinity River just off FM 3278. No schools or churches are found within the foreground visual zone of any of the alternative routes, therefore, no visual impacts from the transmission line on these places are expected to occur. A complete analysis of transmission line impacts is detailed in the PBS&J report submitted as ***Attachment A***.

3.3.8 Socioeconomics

3.3.8.1 Affected Environment

3.3.8.1.1 Population and Regional Residential Development

The U.S. Census Bureau 2000 Census reports that the largest counties in the Trinity River Basin, hosting approximately 70 percent of the population, are Dallas and Tarrant Counties. The largest cities include Dallas, with a year 2000 Census reported population of 1,118,580, and Fort Worth, with a population of 534, 694. Other cities in the basin with a population of 50,000 or more include (in order of lower population): Arlington, Plano, Garland, Irving, Grand, Prairie, Mesquite, Carrollton, Richardson, Denton, Lewisville, North Richland Hills, McKinney, and Flower Mound. The reported population for the 395 cities and designated census places within the 38 county areas comprising the Trinity River Basin was 5,235,950 in 2000 (U.S. Census Bureau, 2000a).

The four counties adjacent to Lake Livingston were relatively sparsely populated at the time the dam was built in late 1960. As of 2000, the largest cities in the immediate area were Huntsville in Walker County, population 35,078, and Livingston in Polk County, population 5,433.

A number of smaller cities and towns are located within five miles of the lake (U.S. Census Bureau, 2000a). Of these, Trinity and Onalaska have reported populations of over 1,000. Other cities and towns within 5 miles are listed below along with year 2000 Census population.

CITY/TOWN	YEAR 2000 POPULATION
Coldspring	691
Camilla	*
Blanchard	*
Onalaska	1,174
Carlisle	*
Sebastopol	*
Trinity	2,721
Riverside	425
Point Blank	559
Stephen's Creek	*
Goodrich	243

* Unincorporated with population under 1,000

Beginning in the 1960s and continuing with the construction of the dam and reservoir, a number of residential subdivisions were opened along the lake. As a result, population growth in the four-county Lake Region was significant, but leveled off within about 10 years. The total population grew from 49,028 to 56,467 between 1960 and 1970, reflecting an annualized growth rate of 1.42 percent. From 1970 to 1980, the population increased from 56,467 to 87,080, reflecting an annualized growth rate of 4.43 percent. From 1980 to 2000, the population increased from 87,080 to 138,916, reflecting a lower annualized growth rate of 2.37 percent. The regional sustained annualized growth rate was nearly 1 percent higher than before construction of the dam, which is equivalent to an actual increase in the rate of change of growth of approximately 67 percent above pre-dam construction levels.

Table 12 (***Attachment C***) provides additional population statistics for the years between 1960 and 2000 for the four-county Lake Region of the study area (U.S. Census Bureau, 1995, 2000a, 2000b). Overall, the four-county Lake Region experienced an annualized growth rate between 1.5 percent and 3.3 percent with an overall average of 2.6 percent during this forty year time period. By contrast, over the same time period Dallas and Ft. Worth experienced an annualized growth rate of 1.2 percent and 1.0 percent, respectively (U.S. Census Bureau, 1960, 2000a).

However, the area remains rural in character with a relatively low population density. There are 185 platted subdivisions on the lake as of October 2007 (TRA, 2007c). Until the lake created suburban growth in the 1970s, Walker County, the only lake county that is more than half urban, had a population density of 27.3 persons per square mile in 1960, which just about tripled by the year 2000 to 78.4 persons per square mile. Trinity County, which is more typical of the area until the dam was built, had a density of 10.9 percent per square mile, experiencing more moderate growth through year 2000, achieving a population density of 19.9 persons per square mile.

San Jacinto and Polk Counties experienced explosive growth during the decade following the construction of the dam. Since 1980 growth has moderated although it has not returned even close to pre-dam levels.

Table 13 (***Attachment C***) presents projected population growth trends based on extrapolation using the calculated average annual growth rate over the 40 year period between the year 1960 and the year 2000 (U.S. Census Bureau, 1995, 2000a, 2000b). Based on projection, total population for four-county Lake Region is estimated to be around 240,000 for the year 2020.

3.3.8.1.2 Regional Employment

The region offers perhaps some of the best recreational opportunity found in the state with an expansive lake, clean rivers and streams, wooded areas, and a rich cultural heritage. The region remains largely rural despite relative proximity to such large population centers as Dallas, Fort Worth and Houston. The four-county Lake Region relies primarily on recreation and tourism, agriculture, timber, mining, and oil and gas for its economy.

Among the four counties, Walker County had the largest number of both businesses and employment-aged individuals, with 45.2 percent of the business establishments in Census Year 2005 (U.S. Census Bureau, 2005) and approximately 46 percent of the employment-aged individuals in Census Year 2000 (U.S. Census Bureau, 2000c). A total of 4,212 (about 3.7 percent) employment-aged individuals were reported being unemployed in four-county Lake Region in Year 2000, which is a relatively low unemployment number.

Employment in the construction industry ranges from 6.3 percent in Walker County to 12.5 percent in San Jacinto County, which indicates sufficient local resources should be available for performing much of the necessary work, excluding any highly specialized trades.

Median household income was reported the lowest among the four counties in Trinity County at $27,070 and the highest in San Jacinto County at $32,220 (U.S. Census Bureau, 2000c).

3.3.8.2 Environmental Effects on Socioeconomics

The potential impacts from the construction and operation of the hydroelectric facilities and transmission line corridor on socioeconomics are presented in the following Sections.

3.3.8.2.1 Effects of Construction of Hydroelectric Facilities

Construction phase of the proposed Project would have a positive direct impact on the local economy. A portion of the Project wages will find its way into the local economy through purchases such as fuel, food, lodging, and, possibly, building materials. Resources, such as timber, and services might be also provided by the Tribe or Tribal members that own or work for local business.

3.3.8.2.2 Effects of Construction of Transmission Line Corridor

As explained above, the Project would have a positive impact on the regional economy. Transmission line ROW easement payments (or some other method) will be made to individuals whose lands are crossed by the transmission line based on the appraised land value, and this will result in increased income to those landowners. Since the Cooperative will only require easements for the proposed transmission line, none of this land will be taken off the tax rolls. The cost of permitting, designing, and constructing the line will be paid for through revenue generated by the sale of electrical service (***Attachment A***).

3.3.8.2.3 Effects of Operation of Hydroelectric Facilities

The long-term economic benefits from the proposed Project are explained in the following Section.

3.3.8.2.4 Effects of Operation of Transmission Line Corridor

Potential long-term economic benefits to the community resulting from this Project are based on the requirement of electric utilities to provide an adequate and reliable level of electrical transmission and distribution service throughout their service areas. Economic growth and development rely heavily on adequate public utilities, including a reliable electrical power supply system. Without this basic infrastructure, a community's potential for economic growth is limited (***Attachment A***).

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the Lake Livingston Hydroelectric Project would not be constructed. There would be no changes to the environmental and cultural resources of the area, and no electrical generation from the Project would occur. The power that would have been developed from a renewable resource would have to be replaced with the power developed from another location within the grid and possibly from nonrenewable (fossil) fuels. The environmental impacts, particularly air quality impacts, from fossil fuels would continue at increasing rates as the electrical demand increased. Increased power generation (electrical) would not be readily available to support economic growth for the area through industrial manufacturing opportunities and subsequent population increases provided by the increased ability to obtain sustainable steady employment. The economic benefits to the community during the construction and operation phase of the Project, such as service, equipment and resource purchase, and reliable electrical power supply, would not occur.

4.0 DEVELOPMENTAL ANALYSIS

In this Section, we investigate the Lake Livingston Project's use of the Trinity River for hydropower purposes to see what effect various environmental measures would have on the Project's costs and power benefits. Consistent with the Commission's approach to economic analysis, we calculate the power benefits of the Project by comparing the cost for each Project alternative to the cost of obtaining the same amount of energy and capacity from other alternative generating resources available in the region. 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. [10]

To determine the net power benefit for each of the licensing alternatives, we compare Project costs to the value of the power output as represented by the cost of a likely alternative source of power in the region. 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.

In the following Sections, we analyze the Project's power benefits for two alternatives: (1) applicant's proposed Project; and (2) the proposed Project with staff-recommended environmental measures.

4.1 POWER AND ECONOMIC BENEFITS OF THE PROPOSED PROJECT

Table 14 summarizes the economic assumptions and sources of the assumptions that were used in our analysis. Much of this information was provided by the Cooperative in the license application and the assumptions have been found reasonable for the purposes of this analysis as well. All dollars in ***Table 14*** are in 2009 dollars, as given in the license application.

[10] See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (July 13, 1995).

Table 14. Parameters for the Economic Analysis of the Lake Livingston Project (Source: Cooperative)

PARAMETER	VALUE	SOURCE
Power rate (energy, no capacity)	$61.10/MWh	Cooperative[a]
Annual net output	124,000 MWh	Cooperative[b]
Period of analysis	30 years	Staff
Term of financing	30 years	Cooperative
Construction cost	$67,400,000	Cooperative
Licensing cost	$3,500,000	Cooperative
Annual O&M, A&G, commission fees, etc.	$2,800,000	Cooperative
Short-term interest rate	6.0%	Cooperative
Long-term interest rate	5.0%	Cooperative
Discount rate	5.0%	Cooperative
Federal income tax rate	Exempt	Cooperative
Local income tax rate	Exempt	Cooperative
Property tax rate	2.0%	Cooperative
Insurance rate	0.25%	Cooperative
Escalation rate	3.0%	Cooperative

[a] Average market prices for the Entergy area in 2008 was approximately $59.35/MWh (Source: Megawatt Daily (2008)).
[b] Assumes minimum flow of 200 cfs into the stilling basin.

The Cooperative proposes to install a 24-MW powerhouse at the Lake Livingston Dam at an estimated cost of $73,500,000, including interest during construction, in 2009 dollars. The Cooperative estimates annual operation and maintenance costs of approximately $2,800,000.

4.2 COMPARISON OF ALTERNATIVES

4.2.1 Cooperative Proposed Project

As proposed by the Cooperative, the annualized cost of operating the Lake Livingston Project would be approximately $9,545,000, or $76.98/MWh. Based upon an estimated average annual generation of 124,000 MWh, the Project would produce power valued at $7,756,000 when multiplied by the $61.10/MWh value of the Project's power. Therefore, on an annualized cost basis, the power from the Project would cost $1,969,000, or $15.88/MWh more than the likely cost of alternative power.

4.2.2 Staff Proposed Project

[*To be completed by FERC staff*]

4.3 COST OF ENVIRONMENTAL MEASURES

Table 15 shows the costs for each of the environmental enhancement measures considered in the analysis. All costs are converted to annualized costs, over a 30-year period of analysis, to give a consistent basis for comparing the benefits and costs of the measures. Costs proposed by the Cooperative are assumed to be 2009 dollars unless otherwise stated.

Table 15. Environmental Measures

MEASURE	PROPOSED BY	CAPITAL COST	ANNUAL COST	LEVELIZED COST	ADOPTED BY STAFF
50 - 200 cfs minimum flow into stilling basin	Cooperative	N/A	$92,000 - $367,000[(a)]	$92,000 - $367,000	
Temperature & DO sensors	Cooperative	$60,000	$25,000	$28,900	
Air injection system	Cooperative	$150,000	$30,000	$39,800	
Striped bass monitoring program	Cooperative	$80,000	$80,000[(b)]	$85,200	
Operating MOA w/ TRA	Cooperative	$15,000	N/A	$1,000	
Raptor proof transmission line	Cooperative	$0[(c)]	N/A	N/A	
401 Water Quality Certification	Cooperative	$15,000	N/A	$1,000	
Corps Section 404 & 10 Permit	Cooperative	$20,000	N/A	$1,300	
Sand & Gravel Permit	Cooperative	$5,000	N/A	$300	
Stormwater Pollution Prevention Plan	Cooperative	$15,000	N/A	$1,000	
Erosion and Sediment Control Plan for Construction	Cooperative	$20,000	N/A	$1,300	
Recreation Plan	Cooperative	$50,000	N/A	$3,300	
Cultural Resources Survey/HPMP	Cooperative	$40,000	N/A	$2,600	

a Each 50 cfs increment up to 200 cfs results in approximately 1,500 MWh loss of generation
b $80,000 per year for 1st three years of operation
c Capital costs included in transmission line cost estimate

4.4 AIR QUALITY / GREENHOUSE GASES

Assuming a minimum flow of 200 cfs into the stilling basin, the Lake Livingston Project will produce approximately 124,000 MWh of electricity per year. The Project creates an environmental benefit by displacing generation from the operation of fossil-fueled plants that emit greenhouse gases. Table 16 provides the amount of annual emissions avoided by hydroelectric generation from the various types of fossil-fuel generation.

Table 16. Avoided Coal Plant Emissions from Hydroelectric Generation

POLLUTANT	COAL	GAS	OIL
NO_x (tons)	468	264	324
SO_x (tons)	2,029	0	416
CO_2 (tons)	119,685	76,141	110,371

5.0 CONCLUSIONS AND RECOMENDATIONS

5.1 COMPARISON OF ALTERNATIVES

[*To be supplied*]

5.2 COMPREHENSIVE DEVELOPMENT AND PREFERRED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation, the protection, mitigation of damage to, and enhancement of fish and wildlife, the protection of recreational opportunities, and the preservation of other aspects of environmental quality. Any license issued shall be such as in the Commission's judgment 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 proposed Lake Livingston Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on our independent review of agency and public comments filed on this project and our review of the environmental and economic effects of the proposed project and its alternatives, we selected the proposed project, with staff-recommended modifications, as the preferred option. We recommend this option because: (1) issuance of an original hydropower license by the Commission would allow the Cooperative to operate the project as an economically beneficial and dependable source of electrical energy for its customers; (2) the 24 MW of electric energy generated from a renewable resource may offset the use of fossil-fueled, steam-electric generating plants, thereby conserving nonrenewable resources and reducing atmospheric pollution; (3) the public benefits of this alternative would exceed those of the no-action alternative; and (4) the recommended measures would protect and enhance fish and wildlife and recreational resources, without impairing the reservoir's principal water supply functions.

[To be completed]

5.3 UNAVOIDABLE ADVERSE IMPACTS

With the exception of the land used for the construction of the hydroelectric and transmission line facilities, there would be no long-term impacts expected on land use of the Project area. Construction of the proposed Project would impact approximately 45 acres of terrain. Most of this area, along the transmission corridor, is pasture land or open field with only a small area of woody vegetation. The hydroelectric generation plant and ancillary building area would impact a footprint area of about 12 acres, all on lands previously disturbed during the construction of Lake Livingston Dam and its appurtenant structures. This area consists primarily of early successional stage scrub vegetation and maintained lawn, which is not a unique or valuable habitat. Permanent loss of wildlife habitat would be minimal.

The Project has the potential to injure or kill a small proportion of the fish that are entrained into the turbines. Most of the fish passing through the turbines are expected to be shad and will likely be consumed by the predators upon reaching the river even if injured or dying. Passing water through the turbines would reduce the volume of water that passes over the spillways and will likely cause a small, localized reduction in DO levels downstream of the dam. The Cooperative, however, proposes to implement a DO monitoring plan and provide, if necessary, DO enhancement measures, which should prevent any adverse effects on aquatic species.

No long-term recreational or cultural impacts are expected during the operation of the proposed Project. Other than portions of the alternative transmission corridor routes that would be visible from the FM roads or cemetery locations, no long-term aesthetic impacts are expected to occur as a result of the Project operations.

5.4 RECOMMENDATIONS OF FISH AND WILDLIFE AGENCIES

Under the provisions of section 10(j) of the FPA, each hydroelectric license issued by the Commission shall include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. Section 10(j) of the FPA states that whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency. In response to our Notice of Acceptance, the following fish and wildlife agencies submitted recommendations for the project: [FWS (______ ___, 2009) and Texas PWD (_______ ___, 2009)].

Table 5-__ lists the federal and state recommendations filed subject to section 10(j), and whether the recommendations are adopted under the Staff Alternative. Environmental recommendations that we consider outside the scope of section 10(j) have been considered under section 10(a) of the FPA and are addressed in the specific resource sections of this document and the previous section.

[To be completed by FERC staff following receipt of Agency recommendations]

5.5 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2) 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 18 comprehensive plans that may be applicable to the proposed Lake Livingston Project. No inconsistencies were found. A list of the plans reviewed, along with a brief summary of our findings, follows:

Texas Department of Water Resources. 1984. Water for Texas: a comprehensive plan for the future. GP-4-1. Austin, Texas. November 1984. Two volumes.

- The 1984 state water plan for Texas cited above has been revised numerous times and the current plan is: Texas Water Development Board. 2007. Water for Texas 2007. State Water Plan for Texas.

- The state water plan describes water supplied through the Trinity River system. Since the Project would not alter the timing or quantity of water moving through Lake Livingston or the Trinity River, it is consistent with the state water plan.

Department of the Army, Corps of Engineers. Fort Worth District. 1988. Final regional environmental impact statement: Trinity River and tributaries. Fort Worth, Texas. April 29, 1988. 148 pp. and appendices.

- This plan describes the need for flood control projects and their mitigation in Dallas, Denton, and Tarrant Counties. The proposed Project is outside the plan area and therefore is not affected by this plan.

Texas Parks and Wildlife Department. 1988. The Texas wetlands plan: addendum to the 1985 Texas outdoor recreation plan. Austin, Texas. May 1988. 35 pp.

- The 1988 wetland conservation plan for Texas has been revised and the current plan is: Texas Parks and Wildlife Department. 1997. Texas Wetlands Conservation Plan. Austin, Texas. July 1997. 64 pp.

- This plan encourages non-regulatory, voluntary, conservation and enhancement of wetlands particularly on private lands. It discusses the value of bottom-land hardwoods in the Trinity and other river basins. Since there are no bottom-land hardwoods in the Project area and the flow regime will not change, downstream bottom-land hardwoods or other wetlands are not expected to be affected. The Project is consistent with this plan.

Texas State Soil and Water Conservation Board. 1981. Soil and water conservation: the Texas approach. Temple, Texas. August 1981. 288 pp.

- This report describes the role of the Texas State Soil and Water Conservation Board in preventing soil erosion primarily from agricultural activities and reducing nonpoint source pollution from agricultural and silvicultural practices. The Project will not affect soil erosion or create nonpoint source pollution and therefore is consistent with this document.

U.S. Fish and Wildlife Service. 1979. Unique wildlife ecosystems of Texas. Department of the Interior, Albuquerque, New Mexico. February 15, 1979. 164 pp. and appendices.

U.S. Fish and Wildlife Service. 1985. Land protection plan for Texas/Oklahoma bottomland hardwoods and migratory waterfowl. Department of the Interior, Albuquerque, New Mexico. January 15, 1985. 30 pp.

- The preceding two plans are updated by the U.S. Fish and Wildlife Service, Region 2. East Texas Ecosystem Plan, FY 2004 and Beyond. East Texas Ecosystem Team. 24 pp.

- This plan describes activities the FWS will take and encourage other organizations to take to protect and restore important habitat like bottom-land hardwoods and wetlands in southeast Texas including the Project site and the lower Trinity River Basin. The Project would not affect the plan since it will not directly impact any wetlands and the flow regime would not change which in turn should not change the status of currently-existing wetlands downstream of the Project.

U.S. Fish and Wildlife Service. 1989. Texas bottomland hardwood initiative: a component of the Lower Mississippi Valley joint venture - North American waterfowl management plan. Department of the Interior, Nacogdoches, Texas. October 1989. 59 pp.

U.S. Fish and Wildlife Service. Canadian Wildlife Service. 1986. North American waterfowl management plan. Department of the Interior. Environment Canada. May 1986.

U.S. Fish and Wildlife Service. 1990. North American waterfowl management plan, Gulf Coast joint venture plan. Department of the Interior. June 1990. 35 pp.

- The preceding 3 documents deal with provision of food and habitat for migratory waterfowl. The Project would not affect plan goals because it would be in an area that is managed for safe human access and industrial use and is not utilized by waterfowl.

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.

- The Project would not change the existing flow regime in the Trinity River below Lake Livingston and therefore should not affect the Gulf of Mexico striped bass management plan which has involved stocking of striped bass in estuarine waters.

National Marine Fisheries Service. 1995. Gulf sturgeon (*Acipenser oxyrhynchus desotoi*) Recovery/Management Plan. Prepared by the Gulf Sturgeon Recovery/Management Task Team. September 15, 1995. 79 pages and appendices.

U.S. Fish and Wildlife Service and Gulf States Marine Fisheries Commission. 1995. Gulf sturgeon recovery/management plan. Atlanta, Georgia. September 15, 1995.

- The preceding two plans refer to recovery of the Gulf sturgeon which has not been reported from Texas waters and is not considered a member of the Texas fish fauna. The Project would not affect Gulf sturgeon recovery.

National Park Service. 1982. The nationwide rivers inventory. Department of the Interior, Washington, D.C. January 1982.

- The inventory has been revised several times and the current citation for the Nationwide Rivers Inventory is: National Park Service’s Nationwide Rivers Inventory (http://www.nps.gov/ncrc/programs/rtca/nri/hist.html, accessed February 2009).

- This document relates to any federal action that can affect a specifically designated water body in the Nationwide Rivers Inventory. Neither the Trinity River or any of its tributaries is included in the current Nationwide Rivers Inventory, therefore the Project is consistent with this plan.

U.S. Fish and Wildlife Service. 1986. Whooping Crane recovery plan. Department of the Interior, Albuquerque, New Mexico. 283 pp.

- The whooping crane recovery plan has been revised three times since 1986 and the current plan is: USFWS. 2007. International Recovery Plan Whooping Crane (Grus americana) Third Revision. http://ecos.fws.gov/docs/recovery_plan/070604_v4.pdf
- Whooping cranes do not use the lower Trinity River either for nesting, overwintering or migration, therefore the Project is not expected to affect whooping cranes.

U.S. Fish and Wildlife Service. Undated. Fisheries USA: The recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C. 11 pp.

- This document deals with the efforts of FWS and its regional offices to encourage and enhance recreational fishing and protect conditions and habitat for recreational species of fish. The Trinity River immediately downstream of Lake Livingston Dam and in the vicinity of the proposed discharge from the Project is a valuable recreational fishery for striped bass and blue catfish. The applicant has proposed to take actions necessary to protect this recreational fishery, and if effects appear, to mitigate those effects as necessary and enhance the recreational fishery.

Texas Administrative Code. Natural Resources and Conservation. Title 31. Rule §57.157. Mussels and Clams. Austin, Texas. 2006.

- This rule identified a portion of the Trinity River from which mussels cannot be harvested. The reach of the Trinity River where harvest of mussels is prohibited is upstream of the proposed Project boundary. Construction associated with this project is not expected to significantly impact mussels in Lake Livingston or the Trinity River; therefore, the Project is not expected to be affected by or inconsistent with this rule.

Texas Parks and Wildlife Department. 1999. Seagrass Conservation Plan for Texas. Austin, Texas. January 1999. 79 pp.

- Seagrass in Trinity Bay, over 120 river miles downstream from the proposed Project, is the closest seagrass to the project site. Since the Project will not affect flow regimes, the project is not expected to affect seagrass.

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- The 1990 outdoor recreation plan has been revised and the current plan is: Texas Parks and Wildlife Department. 2005. Land and Water Resources Conservation and Recreation Plan. Austin, Texas. January 2005. 134 pp.

- This plan directs the Texas PWD to protect, and encourage other entities to protect, water quality, water quantity, and recreational fishing opportunities. The Project may affect water temperature and dissolved oxygen levels in the Trinity River immediately downstream of Lake Livingston. As proposed by the Cooperative, the Project will ensure its activities do not cause state water quality standards to be exceeded. It proposes to monitor temperature and dissolved oxygen during critical periods and take necessary action to ensure temperature and dissolved oxygen levels do not harm fish or the recreational fishery.

6.0 FINDING OF NO SIGNIFICANT IMPACT

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

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8.0 LIST OF PREPARERS

[*To be completed by FERC staff*]

9.0 CONSULTATION DOCUMENTATION

Table 17 provides the chronological list for agency consultations. Copies of the principal consultation documents are included in ***Attachment G***. (NOTE: ***Attachment G*** contains only the principal substantive correspondence with agencies and does not purport to be a comprehensive documentation of all communications between the Cooperative's licensing team and consulted entities.)

Table 17. Chronological List for Agency Consultations

DATES	PURPOSE	PARTICIPANTS
2007 Lake Livingston Hydroelectric Project Agency Consultations		
30-May-07	Meetings to provide Texas PWD and Texas CEQ with project overview and path forward.	Texas PWD: Mayes, MacRae, Loeffler et al
		Texas CEQ: Eden, Cowan, Stepney et al
		Project Team: Hargett, McCarty, Dubinsky, Wittliff et al
		TRA: Stevens et al
20-Jun-07	Meeting to provide Corps with project overview and path forward.	Corps: Machol and Bennett of Galveston District
		Project Team: Offield, McCarty, Dubinsky, Wittliff et al
21-Jun-07	Meetings to provide FWS, Texas CEQ-Region 10 and Trinity River Wildlife Refuge (TRWR) with project overview and path forward.	FWS: Erfling et al at Clear Lake office
		Texas CEQ-10: Air and Water program staff
		TRWR: Manager and staff.
		Project Team: Offield, McCarty, Dubinsky, Wittliff et al
24-Jul-07	Meeting to provide Alabama-Coushatta tribe with project overview and path forward.	Alabama-Coushatta Tribe: Bullock and Dickens
		Project Team: Wittliff
15-Aug-07	Telecons and email to coordinate with agencies on data and process as part of FERC ALP.	Texas CEQ: Archer of Clean Rivers Program
		GLO: Finley, Henneke, and Fisher of Coastal Management Zone (CMZ) Program
		Texas HC-SHPO:
		Project Team: Wittliff
16-Aug-07	Meeting to provide Dam Safety Program Manager with project overview and path forward.	Texas CEQ: Samuelson and Dam Safety Records
		Project Team: Wittliff

DATES	PURPOSE	PARTICIPANTS
17-Aug-07	Telecons and email with GLO that resulted in finding that CMZ did not apply to the project.	GLO: Fisher of Coastal Management Zone Program
		Project Team: Wittliff
21-Aug-07	Telecons and email with GLO regarding CMZ map.	GLO: Fisher of Coastal Management Zone Program
		Project Team: Wittliff
23-Aug-07	E-mail from GLO to Wittliff indicating that the Project does not impact Texas Coastal Management Program.	GLO: Fisher
		Project Team: Wittliff
23-Aug-07	Meeting to discuss project overview and path forward.	GLO: Henneke
		Project Team: Wittliff
2-Oct-07	Telecons and email with SHPO regarding cultural and historical sites in the area.	Texas HC-SHPO
		Project Team: Wittliff
10-Oct-07	Meeting with TRA on the results of initial agency meetings and path forward.	TRA: Stevens, Holder, et al
		Project Team: Hargett, Lawson, McCarty, Koleber, Rizzo, Dubinsky, Wittliff et al
12-Nov-07	Telecons and email to request meetings with agencies on aquatic and environmental studies.	FWS, Texas CEQ, and Texas PWD
16-Nov-07		Project Team: Wittliff
20-Nov-07	Meetings to discuss aquatic studies plan.	Texas CEQ: Lott, Loft, et al
		Texas PWD: Mayes et al
		Project Team: Lawson, McCarty, Koleber, Labay, Dubinsky, Wittliff et al
21-Nov-07	Telecons and email with agencies about follow-up on 11/20 meeting.	Texas CEQ: Lott
		Texas PWD: Mayes
		Project Team: Wittliff
		Project Team: McCarty
4-Dec-07	Requested meetings with agencies to discuss change in location for tailrace.	Texas CEQ: Lott
		Texas PWD: Mayes
		Project Team: Wittliff
		Project Team: McCarty
5-Dec-07	Telecons and email with agencies about proposed 12/14 meetings.	Texas CEQ: Lott
		Texas PWD: Mayes
		Project Team: Wittliff

DATES	PURPOSE	PARTICIPANTS
14-Dec-07	Meetings with agencies to discuss the change in the tailrace location from above the weir to below the weir made necessary by the potential for the weir to be raised by as much as 8 feet in the future.	Texas CEQ: Lott et al
		Texas PWD: Mayes et al
		Project Team: Wittliff, Labay, Koleber, and McCarty
2008 Lake Livingston Hydroelectric Project Agency Consultations		
7-Jan-08	Letter from Texas HC-SHPO to Rob Reid (PBS&J)	Texas HC-SHPO: F. Lawrence Oaks
		Project Team: Rob Reid
10,14,15,28, and 29 Jan 08	Follow-up with Texas PWD to confirm receipt of PAD and solicit agency input.	Texas PWD: Mayes
		Project Team: Wittliff
23-Jan-08	Coordinated on expanded aquatic studies and Feb 08 meeting.	Texas PWD: Mayes
		Project Team: Wittliff
25-Jan-08	Sent aquatic studies plan to agency.	FWS: Erfling
		Project Team: Wittliff
28-Jan-08	Letter from Texas HC-SHPO to Kimberly D. Bose (FERC)	Texas HC-SHPO: F. Lawerence Oaks
		FERC: Kimberly D. Bose
30-Jan-08	Corresponded with Texas CEQ and Texas PWD as well as team on aquatic studies plan. Set up February 7 meeting with Texas PWD.	Texas PWD: Mayes
		Texas CEQ: Lott
		Project Team: Wittliff
4-Feb-08	Sent RS and BH at TRA a copy of the most recent aquatic studies plan along with Texas CEQ comments and feedback from Edith Erfling at FWS.	TRA: Stevens, Holder, et al
		Project Team: Wittliff
		Project Team: Wittliff
7-Feb-08	Met with Texas PWD and PBS&J regarding aquatic studies plan and WQ modeling.	Texas PWD: Mayes et al
		Project Team: Wittliff, Buzan, and Jensen
8-Feb-08	Corresponded with TRA on results of 2/7 meeting with Texas PWD.	TRA: Holder
		Project Team: Wittliff and Labay
19-Feb-08	Coordinated with TRA on aquatics study and agency negotiations.	TRA: Stevens and Clingenpeel
		Project Team: Wittliff et al

DATES	PURPOSE	PARTICIPANTS
20-Feb-08	Letter from FERC to McCarty regarding the approval of ALP	FERC: Robinson Project Team: McCarty
20-Feb-08	Coordinated with KM at Texas PWD about scoping meetings on March 26.	Texas PWD: Mayes Project Team: Wittliff
28-Feb-08	Project team conf. call with TRA on concerns by TRA regarding aquatic studies issues.	TRA: Clingenpeel et al Project Team: Lawson, Wittliff, and Labay
3-Mar-08	Letter to KM at Texas PWD forwarding changes to aquatics sampling plan and providing water data for his use.	Texas PWD: Mayes Project Team: Wittliff and Labay
26-Mar-08	Scoping meetings at the Livingston-Polk County Chamber of Commerce.	37 people attended (incl. 18 consultants and project team)
27-Mar-08	Landowner meeting re: alternative transmission routes at the Livingston-Polk County Chamber of Commerce.	12 citizens/landowners attended
24-Apr-08	Letter from Texas PWD to FERC with comments on PAD and SD1.	Texas PWD: Mayes FERC: Bose
24-Apr-08	Letter from FWS to FERC with comments on PAD and SD1.	FWS: Parris FERC: Bose
24-Apr-08	Letter from Universal Ethician Church to FERC with scoping comments and requests.	Church: Russell FERC: Bose
25-Apr-08	Letter from FERC to Brian Lawson with comments on the PAD and additional information request.	FERC: Pawlowski Project Team: Lawson
27-Aug-08	Letter from the Corps to Edd Hargett regarding use of the ALP and the need for a § 10/§ 404 permit.	Corps: Dodson Project Team: Hargett
14-Oct-08	Called Texas CEQ WQD (Chris Loft, Resource Protection) to obtain latest 401 application procedures for FERC licensing.	Texas CEQ: Loft Project Team: Wittliff
16-Oct-08	Followed up again with Chris Loft. Gregg Easley is the new 401 project manager. CL and GE both requested a copy of the aquatic study report when completed.	Texas CEQ: Loft and Easley Project Team: Wittliff

DATES	PURPOSE	PARTICIPANTS
7-Nov-08	Checked with Gregg Easley about 401 certification process and forms.	Texas CEQ: Easley
		Project Team: Wittliff
10-Nov-08	Called Kelly Holligan about 401 certification forms and process.	Texas CEQ: Holligan
		Project Team: Wittliff
13-Nov-08	Visited with Kelly Holligan at Texas CEQ about 401 certification for Hydro Project.	Texas CEQ: Holligan
		Project Team: McCarty and Wittliff
26-Nov-08	Coordinate with KM at Texas PWD on scheduling a 12/12 meeting on results of the aquatic studies.	Texas PWD: Mayes
		Project Team: Buzan, Labay, and Wittliff
3-Dec-08	Contacted Stevens and Clingenpeel at TRA about Dec 8 and 12 meetings with Texas CEQ and Texas PWD.	TRA: Stevens and Clingenpeel
		Project Team: Wittliff
5-Dec-08	Sent proposed agenda for Dec. 8 and 12 mtgs. to Texas CEQ and Texas PWD.	Project Team: Wittliff
8-Dec-08	Met with Texas CEQ about aquatic studies and water quality modeling reports.	Texas CEQ: Batcheller, Loft, Lott and Easley
		Project Team: Buzan, Labay, and Wittliff
12-Dec-08	E-mail from TCEQ to Wittliff indicating that the Cooperative does not need a separate water rights permit to operate the Project	Texas CEQ: Loft
		Project Team: Wittliff
12-Dec-08	Met with Texas PWD about aquatic studies and water quality modeling reports.	Texas PWD: Mayes and Botross et al
		Project Team: Buzan, Labay, and Wittliff et al
2009 Lake Livingston Hydroelectric Project Agency Consultations		
5-Jan-09	Called and emailed FWS Clear Lake to schedule meeting on aquatic studies.	FWS: Erfling
		Project Team: Wittliff
14-Jan-09	Response from Gregg Easley at Texas CEQ about water modeling scenarios, temperature standards, and DO standards.	Texas CEQ: Easley
		Project Team: Wittliff

DATES	PURPOSE	PARTICIPANTS
28-Jan-09	Letter from Rob Reid (PBS&J) to Debra K. Beene (Texas HC-SHPO) re: NHPA §106 consultation.	Texas HC-SHPO: Debra K. Beene Project Team: Rob Reid
19-Feb-09	Meeting with Polk County Judge Thompson regarding status of former Southland Park property and potential recreation access in the tailwater area of project.	Polk County: Judge Thompson Project Team: Thomas
23-Feb-09	Called on Easley, Loft, and Batchellor at Texas CEQ and Edith Erfling at FWS about review of the PD-APEA.	Texas CEQ: Easley, Loft, and Batchellor FWS: Erfling Project Team: Wittliff
24-Feb-09	Corresponded with Texas CEQ re: follow-up on PD-APEA.	Texas CEQ: Easley and Loft Project Team: McCarty and Wittliff
25-Feb-09	Responded to call from Chris Loft about comments on preliminary draft EA.	Texas CEQ: Loft Project Team: Wittliff
4-Mar-09	Letter from Texas HC-SHPO to Rob Reid (PBS&J) re: NHPA §106 consultation.	Texas HC-SHPO: F. Lawerence Oaks Project Team: Rob Reid
9-Mar-09	Email to Texas PWD and Texas CEQ regarding the PD-APEA and getting comments by 3/16 to be incorporated in the final submission of the draft APEA.	Texas CEQ: Easley, Loft, and Batchellor Project Team: Wittliff
11-Mar-09	Phone and email correspondence with TRA re: potential recreational access in Project tailwater area and related flood and safety concerns.	TRA: Holder, Stevens, Waters Project Team: McCarty
16-Mar-09	Email from Texas CEQ Water Rights Permitting & Availability Section commenting on PD-APEA.	Texas CEQ: Loft
17-Mar-09	Email from Texas PWD with comments on PD-APEA.	Texas PWD: Mayes

In addition to the consultation events listed above, there were numerous informal discussions and email exchanges between the Cooperative's environmental consultant, PBS&J, and the staffs of Texas PWD and Texas CEQ regarding the aquatic study plan and the water quality modeling program. There were also a number of meetings and discussions between the Cooperative's engineering and legal representatives and TRA staff concerning project design, property rights, and water rights issues.

Additional consultation documentation pertaining exclusively to the proposed transmission line is separately contained in ***Attachment A,*** Appendix A – Agency Correspondence.