EXHIBIT A
PROJECT DESCRIPTION

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1.0 PROJECT DESCRIPTION

1.1 PHYSICAL COMPOSITION

1.1.1 Existing Facilities

The Lake Livingston Hydroelectric Project (Project) proposed by Applicant, East Texas Electric Cooperative, Inc. (Cooperative), will use the existing Livingston Dam and Lake Livingston located in southeast Texas on the Trinity River. The dam is constructed at river mile (RM) 129.2[1] San Jacinto and Polk Counties approximately 7 miles southwest of the City of Livingston. The reservoir extends 52 miles upstream of the dam at its normal pool level of elevation[2] 131.0 feet, covering approximately 83,000 acres of Trinity, Walker, San Jacinto, and Polk Counties. The dam and reservoir are owned, operated, and maintained by the Trinity River Authority (TRA) who provide for reservoir releases to maintain the normal pool level and supply downstream uses with adequate flows. Construction of the dam began in mid-1966 and was completed in 1969.

The dam was constructed as a water supply project for the City of Houston and communities adjacent to the lake. Houston owns 70 percent of the dependable water yield. The remaining percentage is owned by TRA who sells raw water to the cities of Huntsville, Livingston, Trinity, and Groveton, eight water districts, and two industrial users and ten irrigation users.

The existing facilities consists of the dam, spillway, outlet works, and various service buildings used by TRA staff for project-related activities as shown on ***Exhibit F-1***. Descriptions and summary of these facilities follow.

1.1.1.1 Dam

The dam is approximately 14,400 feet long following a near southwest-northeast alignment. Its height 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 dam consists of a basic earth embankment section, which extends for the full length of the dam with stabilizing upstream and downstream berms of varying dimensions. The slopes are 1 vertical (V) on 2.5 Horizontal (H).

The basic section is comprised of random fill with a central impervious core with vertical chimney and horizontal drains downstream of the core. The crest is at elevation 145.0 feet is 24 feet wide. A single-lane paved road along the crest provides TRA staff with access along the dam.

[1] All river miles are U.S. Geological Survey miles.
[2] All elevations refer to National Geodetic Vertical Data.

1.1.1.2 Spillway

The spillway is located within the main embankment about 1,400 feet from the east abutment. It is a concrete gravity structure with an ogee crest at elevation 99.0 feet. The releases over the spillway are controlled by 12 40-foot-long by 35-foot-high tainter gates. Concrete training walls and upstream and downstream aprons direct the water from the reservoir across the spillway and back to the river channel. A bridge for the access road and tainter gate equipment is supported by the gate piers and spans the entire spillway width. Deck level for this bridge is at elevation 145.0 feet.

1.1.1.3 Outlet Works

The outlet works are located within the embankment approximately 1,850 feet west of the spillway, consisting of a vertical inlet tower with five gates, a 550-foot-long by 10-foot-diameter conduit, a 170-foot-long stilling basin, and a concrete broad crested weir. The tower is a 90-foot-high concrete structure which has four 5-foot- high by 4-foot-wide sluice gates at various levels and a 10-foot-high by 8-foot-wide sluice gate at the base to allow limited quantities of water to be released from the reservoir from varying depths. Access to the tower is gained via a steel and concrete bridge. The outlet works also provide a means of maintaining water releases should the reservoir level fall below the crest of the spillway. A short channel downstream of the stilling basin directs flows back to the river.

1.1.1.4 Service Buildings

TRA has constructed several service buildings near the east abutment of the dam to assist their staff in the performance of their work. Included is a general office, a water quality laboratory, a maintenance compound, a boat house, and a fueling station. Also constructed in the same general area is a residence for the onsite manager.

1.1.2 New Facilities

The proposed project at Livingston Dam will be located adjacent to the east abutment. The project will require the construction of the following new facilities:

- A headrace channel
- An intake structure
- An earth embankment
- Penstocks
- A powerhouse

- A tailrace channel
- A switchyard
- A transmission line
- Access roads

Table 1. Descriptive Summary of Existing Project

Project Location	Southeast Texas
Counties	San Jacinto, Polk, Trinity and Walker
Stream	Trinity River
Dam	Livingston Dam
Type	Earth embankment with impervious core
Length	14,400 feet
Height	Varies up to 90 feet above river channel, crest at elevation 145.0 feet
Regulating Outlets	Twelve 40 foot long by 35 foot high tainter gates on spillway; one outlet works with a 10 foot diameter conduit
Reservoir	Lake Livingston
Drainage Area	16,583 square miles
Average Flow	8,450 cubic feet per second (cfs)
Normal Pool Level	Elevation 131.0 ± 0.5 feet
Reservoir Area	Approximately 83,000 acres at elevation 131.0 feet
Reservoir Storage	1,750,000 acre-feet (AF) at elevation 131.0 feet

In addition, the Project will require the relocation of some TRA maintenance shop and service buildings, part of an existing two-lane state road, and the purchase of approximately 25 acres of other adjoining properties. Details of these new facilities are shown on ***Exhibits F-1 through F-8*** and in the following descriptions.

1.1.2.1 Headrace Channel

Water for power generation will be directed from Lake Livingston to the intake structure by the headrace channel. Trapezoidal in section, the 300-foot-long channel will be excavated and dredged adjacent to the east abutment of the dam. The bottom of the channel will be at elevation 115.0 feet and at the intake structure where adequate submergence for the power intakes require lowering the headrace floor to the elevation 110.0 feet. The average bottom width of the channel is 100 feet. Side slopes will be 3H:1V. Lining in the form of the riprap will be placed in the bottom of the headrace

channel and along the channel water line to prevent scour and localized erosion by wave action.

Channel velocities will range from less than 0.1 up to about 5.0 feet per second (fps) depending upon reservoir releases and elevation. Floating barriers will be anchored at the channel entrance area to prevent passage of vessels and large floating debris into the intake structure.

1.1.2.2 Intake Structure

The intake structure will be of reinforced concrete located at the downstream end of the headrace channel and just downstream from the existing dam crest at the east abutment. It will direct the water for power generation to the penstocks through hydraulically efficient shaped openings, each complete with trashracks, closure gates with individual operators, stoplogs, and venting. A total of three intakes, one per penstock, will be proposed to provide for individual turbine operation.

Access will be provided across the top of the intake structure so that TRA access to all existing project structures remains unaffected.

1.1.2.3 Earth Embankment

The Project will require the construction of a short section of earth embankment to connect the existing abutment to the new intake structure and the existing dam. It will consist of a basic embankment extending easterly from the east abutment area of the existing dam to the new intake structure, and back to the existing dam. Total length of the embankment will be about 500 feet.

The embankment section will be constructed similar to the existing dam with a central impervious core, earth slopes, and riprap. An impervious cutoff will be constructed beneath the embankment to prevent flow from the headrace channel. The crest will be established at elevation 145.0 feet and will be 24-feet-wide. A single-lane paved road along the crest will maintain access to the existing dam.

1.1.2.4 Penstocks

The intake structure will connect directly to three 12-foot-diameter steel penstocks, each approximately 750 feet in length. Between the intake structure and the powerhouse, the penstocks will be exposed and supported by concrete foundations, except for the last portion of the penstocks which will be buried at the connection to the powerhouse.

1.1.2.5 Powerhouse

The powerhouse will be built of reinforced concrete sized to house 3 turbine/generator units, a service bay, and all auxiliary mechanical and electrical equipment for station operation. Contained within the powerhouse substructure will be the turbines and their waterways, the generators, access and equipment galleries, and the draft tube stoplog slots. A service bay will be provided for auxiliary station equipment and storage. The generator floor and the service bay floor will be at elevation 63.0 and 100.0 feet, respectively. The powerhouse will be protected against flooding up to elevation 106.0 feet which is approximately equal to the ½ Probable Maximum Flood (PMF) flood level and is about 10 feet above the record flood level.

The powerhouse substructure will consist of the single enclosure whose outside dimensions are approximately 136 by 65 feet. The powerhouse superstructure will be the same dimensions as the substructure, with the addition of an auxiliary service bay with approximate dimension of 66 feet by 65 feet. The finished roof will be at elevation 140.0 feet.

Access will be provided to the downstream area of the dam between the existing spillway and the new intake structure with a roadway just upstream of the new powerhouse, above the buried sections of the penstocks.

1.1.2.6 Tailrace

The tailrace will be a 1,200-foot-long open channel. It will extend from the downstream side of the powerhouse to the point where the tailrace merges with the river, about 1,000 feet downstream of the spillway. The tailrace will be excavated to a floor level of elevation 45.0 feet with a bottom width of 50 feet. Sides of the tailrace channel are expected to be vertical to elevation 85.0, with 3:1 slopes above elevation 85.0 to tie into the existing topography.

The maximum water velocity in the tailrace will not exceed about 5.0 feet per second.

1.1.2.7 Switchyard and Transmission Line

An outdoor electric switchyard located about 100 feet to the north of the powerhouse will provide the necessary increase in voltage and electrical protection for the Project interconnection to the grid. The generator bus will be connected by cables in a covered electrical trench to a 3 phase 13.8/138 kV step-up transformer rated at 30 MVA. Other associated equipment located with the approximately 70 by 100 foot switchyard will include breakers with protective relaying, disconnect switches, and lightning arresters.

A 2.8 mile long single circuit overhead 138-kV transmission line will be constructed for the connection to the Entergy transmission system at a substation near Goodrich, Texas.

1.1.2.8 Access Roads

Several new roads will be constructed to gain access or maintain access to the intake structure, the main dam, the earth embankment, the powerhouse, and other project facilities. A total length of about 2,500 feet of paved surface is proposed.

1.1.2.9 Relocations and Other Modifications

Several of the existing TRA buildings, including the maintenance compound, will be relocated nearby. Exact position of these relocations will be determined during final project design. Total acquisition of non-TRA land will be approximately XXX acres.

1.1.3 Excavation and Fill Requirements

To the extent possible, excavation for the intake structure and headrace channel will be accomplished in the dry without the use of cofferdams. Excavation will begin at the downstream end of the headrace for construction of the intake structure and penstocks, followed by construction of the earth embankment. When these structures are complete, dry excavation will continue up the headrace channel until only a narrow earth section between the reservoir and headrace remain. This remaining section will then be removed by dredge or dragline to designated dimensions. Excavation for the powerhouse and tailrace channel will follow a similar approach where all excavation for the powerhouse and most of the excavation for the tailrace will be made in the dry, made possible with adequate dewatering systems to remove groundwater seepage from the excavations. Connection of the tailrace to the river will also be by dredge or dragline. Silt barriers will be erected where necessary to minimize suspended matter from entering the reservoir and river.

Total excavation required for the Project will be approximately 1,000,000 cubic yards of earthen materials of which about 50,000 cubic yards may be dredged. No excavation in rock is anticipated. To the extent possible, the excavated material will be used to construct the earth embankment or will be placed on the properly prepared downstream slope of the existing main dam. Any excess excavated material will be disposed of at a non-wetland site.

1.2 SURFACE AREA, ELEVATION AND STORAGE

Normal surface area at elevation 131.0 feet is approximately 83,000 acres. Gross storage capacity at this level is 1,750,000 acre-feet (AF). Because the reservoir is

operated on a run-of-river basis, no usable storage capacity at the site is considered to be available exclusively for power generation purposes.

1.3 TURBINES AND GENERATORS

Three vertical shaft, double regulated propeller turbines (adjustable blade runners with wicket gates) with direct drive synchronous generators will be installed. Each unit will be equipped with governors to maintain constant speed operation under varying load conditions and all associated control and operating equipment for local and remote operation. Each unit will be rated at approximately 8 MW.

The generating units will be designed with sufficient overload capacity built into each generator to sustain continuous operation at maximum turbine power. Primary generation for all units will be at 13,800 volts, 60 Hertz, 3-phase at 0.9 power factor. Auxiliary electrical equipment and accessories supplied with the generator will be static exciters, surge protection equipment, current transformers and neutral high impedance grounding equipment. Output of the generators will be supplied to an outdoor switchyard through indoor metal clad switchgear and power cables.

A summary of pertinent turbine and generator data is presented in ***Table 2***.

Table 2. Turbine and Generator Data

GENERAL PLANT DATA		
Number of units		3 8 MW
Total Project Capacity	Rated	24,000 kW
Total Project Flow	Design	4,500 cfs
	Minimum	600 cfs
Proposed Operation		Run-of-River/Remote control
Average Annual Energy		124,000,000 kWh
TURBINES		
Type	Kaplan	Adjustable blade runner with wicket gates, vertical shaft
Head Range	50 to 79 feet	
Design Flow	1,500 cfs	
RPM	240.0	
GENERATORS		
Type	Synchronous, vertical shaft, direct drive	
Primary Generation	13,800 Volts/60 Hertz/3-phase	
Power Factor	0.9	
Rated Output	9,500 kW	

1.4 INTERCONNECTION

A single overhead 138-kV transmission line will be required to interconnect the proposed Project to the grid. Interconnection will be made to a planned 138-kV transmission line through a substation to be located approximately 2.8 miles east of the proposed hydroelectric Project. The proposed transmission line and corridor is described in detail in ***Exhibit E***.

1.5 APPURTENANT EQUIPMENT

During periods where reservoir releases will be less than the minimum flow required for turbine operation (600 cfs), flow normally made through the powerhouse will be released from either the spillway or the outlet works. To prevent the possibility of no flow being released from the reservoir during the transition from power generation to spillage and vice versa, an electrical advisory system will be installed to insure proper sequential operation so continuous releases to the river are always maintained.

1.6 LANDS OF THE UNITED STATES WITHIN THE PROJECT BOUNDARY

There are no parcels of federally owned land within the project boundary.