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JACKSON BLUFF HYDROELECTRIC PROJECT

FEASIBILITY ASSESSMENT REPORT

CITY OF TALLAHASSEE
FLORIDA

R.W. BECK AND ASSOCIATES
ENGINEERS AND CONSULTANTS

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MARCH 1979

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ENGINEERS AND CONSULTANTS

PLANNING
DESIGN
RATES
ANALYSES
EVALUATIONS
MANAGEMENT

GENERAL OFFICE
TOWER BUILDING
SEATTLE, WASHINGTON 98101
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FILE NO. FW-5102-HG1-QA
3006

March 14, 1979

Mr. Kenneth Morgan
Director of Electric Department
2602 Jackson Bluff Road
Tallahassee, Florida 32301

Dear Mr. Morgan:

Subject: Jackson Bluff Hydroelectric Project
Feasibility Assessment Report

We herewith submit the Feasibility Assessment Report describing our investigations and recommendations for reinstallation of hydroelectric generating facilities at Jackson Bluff Dam.

Our principal findings, conclusions and recommendations are set forth in the Summary of the Report. Details of the investigations, supporting data and conclusions are described in subsequent sections of the Report.

Respectfully submitted,

R. W. BECK AND ASSOCIATES

James V. Williamson
Partner and Assistant Manager
Western Design Office

CERTIFICATE OF ENGINEERS
CITY OF TALLAHASSEE
TALLAHASSEE, FLORIDA

FEASIBILITY ASSESSMENT REPORT
FOR THE
JACKSON BLUFF HYDROELECTRIC PROJECT

The technical data and material contained in this Report were prepared under the supervision and direction of the undersigned whose seals as professional engineers licensed to practice as such are affixed below.

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SUMMARY

This report summarizes the results of a feasibility assessment study under a DOE grant for the City of Tallahassee, Florida, to determine if it is economical to reinstall hydroelectric generating units at the existing Jackson Bluff Dam on the Ochlockonee River. The studies and investigations have included site reconnaissance, system loads, growth rate, site hydrology, conceptual project arrangements and layouts, power output, estimates of construction costs and annual costs, economic analyses, development of a design and construction schedule and a preliminary environmental review of the proposed Project.

The Jackson Bluff Hydroelectric Project consists of the reinstallation of power generating equipment at the Jackson Bluff powerhouse, addition of electrically driven hoists for five spillway gates, and the construction of a fuse-plug type auxiliary spillway. The State of Florida is currently considering constructing certain safety-related measures for Jackson Bluff Dam including repairs to, or replacement of, a downstream wall on the north side of the spillway; addition of a three-foot high retaining wall on the south side of the powerhouse; improvements to the approach wall conditions at the north end of the spillway, and the excavation of an earth overpour emergency (auxiliary) spillway in the saddle dam area. An economic analysis of the Project was also made assuming that the costs of these State repairs are borne by the Project.

The average annual discharge at the site is 1,692 cfs. The turbines will operate under a rated net head of 32 feet. The Project will have an installed capacity of 8,800 kW, consisting of two 3,200-kW units and one 2,400-kW unit, the same size as installed previously. The dependable capacity from the Project delivered

at the City's load center will be 6,659 kW. The average annual energy is 24,920,000 kWh of which 6,753,000 kWh is considered firm (prime), delivered at the load center.

It is estimated that the Jackson Bluff Hydroelectric Project, for an October 1983 scheduled on-line date, would have a Total Investment Cost of \$9,882,000, (equal to \$1,123/kW installed at that time frame) not including the State safety-related measures which have been estimated on a broad basis to cost \$552,000 at current price levels. The estimated annual cost for the first year of operation is \$1,156,000.

An economic analysis of the Project based on 30-year, 6-1/2% financing, shows a benefit-cost ratio of 1.27 during the first year of operation when compared to the most economic alternative of an equivalent new simple-cycle combustion turbine unit, combined with fuel replacement of existing older oil-burning steam units. A comparison of the Project to this alternative over the first ten years of Project operation shows a total ten-year present worth savings (October 1983 level) of \$4,486,000. This savings is reduced to \$4,160,000 if the costs of the safety-related remedial measures now being considered by the State are reimbursed as part of the cost of the Project.

The Project poses no unusual technical problems and no significant adverse environmental effects are anticipated. It shows sufficient promise of technical, economic and financial feasibility, to justify the City entering into the next phase of work, the FERC License Application, as soon as possible so that the Project can be completed within the time frame scheduled herein. Concurrently with this, the City should initiate efforts to arrange financing for the Project including making application to the DOE for a demonstration project grant under the second PON, responses to which will be solicited shortly.

SECTION I

INTRODUCTION

1. DEPARTMENT OF ENERGY PROPOSAL AND GRANT

In response to a Program and Research Development Announcement by the Department of Energy (DOE), the City of Tallahassee, Florida (City) submitted a proposal dated February 13, 1978, to study the feasibility of re-installing hydroelectric generating facilities at the existing Jackson Bluff Dam with financial assistance from the DOE.

The City's proposal was approved by the DOE and the grant was awarded to the City with the feasibility study work to be performed pursuant to Cooperative Agreement No. EW-78-F-07-1763 between the City and the DOE.

2. AUTHORIZATION

R. W. Beck and Associates (Beck) was retained by the City to prepare this Feasibility Assessment of reinstalling hydroelectric generating facilities of about 8,800 kW at Jackson Bluff Dam. Beck was authorized to proceed with the study by an Agreement for Engineering Services executed October 10, 1978.

3. SCOPE OF SERVICES

The scope of work was planned to provide engineering services to determine the preliminary feasibility of developing hydroelectric power at the Jackson Bluff Dam on the Ochlockonee River. The proposed development is referred to as the Jackson Bluff Hydroelectric Project (Project). The scope includes the following:

a. Expected configuration and capacity of the hydropower facility.

b. Estimated performance characteristics of the hydroelectric power facility including the potential for peak power production and an estimate of average annual energy production.

c. Expected impact of the hydropower installation on other known water resource needs of the area and the current use of the reservoir.

d. Marketing potential of the power produced.

e. Information made available to Beck relating to necessary requirements of the Federal Energy Regulatory Commission (FERC), the U.S. Army Corps of Engineers (Corps), and other appropriate Federal, State, regional and local agencies.

f. Estimated capital investment per installed kilowatt and total estimated cost per kWh.

g. Anticipated annual operation and maintenance costs.

h. Anticipated project life.

i. An initial assessment of the environmental impact and socio-economic and institutional factors.

j. An initial assessment of the safety hazard, if any, introduced by the addition or rehabilitation of a power plant and other hydropower appurtenances.

k. Appropriate analyses and recommendations as to the engineering acceptability of the proposed site for hydroelectric power development.

1. Investigation of the availability of a suitable turbine(s), generator(s), and accessories required for the proposed hydroelectric power development.

m. Development plan (schedule) for putting power on-line.

n. Furnishing technical data to the Client to support reports required by the Cooperative Agreement to be submitted to DOE by the Client.

4. BACKGROUND TO PRESENT STUDIES

The Jackson Bluff Project was operated as a hydroelectric facility under FPC License until 1970, when the License was suspended by Florida Power Corporation. The State agreed to accept ownership and operation of the Project as a recreation facility, and the power company removed the turbines, generators, transformers and appurtenant generating equipment. This, of course, was just prior to the oil crisis.

In July 1977, the Army Corps of Engineers completed a report entitled "Estimate of National Hydroelectric Power Potential at Existing Dams."⁽¹⁾ This report was prepared in response to a Presidential request to determine the potential for additional hydropower installation at existing dams throughout the United States, especially at small sites. This report concluded that the development of hydroelectric power at existing dams is of such importance as to justify the rapid selection and development of small-scale hydropower demonstration projects. It recommended that some of the demonstration projects be developed at retired hydropower sites, and listed Jackson Bluff Dam as one of ten retired sites out of 771 available sites throughout the country listed by FERC having the greatest potential.

In November 1978, the City of Tallahassee submitted an Application for a Preliminary Permit to the FERC in order to secure

and maintain priority for obtaining a License under the Federal Power Act while procuring data and performing the acts necessary to perfect an application for such a License.

Numerous reports have been prepared during the Project's history which address safety related aspects of project features. The most comprehensive report on the Project in its recent history is the safety inspection report prepared for the Florida Power Corporation by Law Engineering Testing Company in February 1967.⁽²⁾ The Law investigations were accompanied by an underwater inspection in late 1966 by Logan Diving and Salvage Company. The investigations included stability analyses of the concrete and earth structures; coring of concrete specimens followed by compressive strength tests and petrographic analyses; study of piezometer readings with respect to time and rainfall; and surveys of cracks in the concrete structures including establishment of gauge points and measurement of crack openings with respect to time.

Subsequent annual inspections of the Project were made for the State of Florida by Robert C. Price, Consulting Engineer, in May 1972,⁽³⁾ July 1973,⁽⁴⁾ and August 1974.⁽⁵⁾ Beck made inspections of the Project in 1976 and 1977 for the State of Florida, and the results of these inspections are contained in reports dated December 1976⁽⁷⁾ and January 1978.⁽⁸⁾ The most recent safety inspection of the Project was conducted by the Corps in March 1978 as part of its Phase I inspection under the Dam Safety Act. The results of the Corps' inspection are contained in a report dated June 1978.⁽⁹⁾

Since this development was operated for many years for hydro generation, a considerable volume of information is available on generating and other statistics from FERC. Florida Power Corporation personnel have also provided information on project operation.

SECTION II

SITE CONDITIONS

1. GENERAL

Jackson Bluff Dam is located in northern Florida in the Panhandle Region on the Ochlockonee River about 20 miles west-southwest of Tallahassee. The site is situated in Leon, Gadsden and Liberty Counties and is located about 35 miles upstream from the mouth of the Ochlockonee River at the Gulf of Mexico. The general location of the Project is shown in Fig. 1.

2. TOPOGRAPHY

The area in the general vicinity of the project is relatively low in elevation with the land surface flat or gently sloping. The stream gradients in the Ochlockonee River basin are generally slight with numerous swamp and marshland areas near the streams in the basin. The stream drops an average of about 3.7 feet per mile between the headwaters of the stream and Jackson Bluff Dam. The land surface in the drainage basin varies in elevation from about El 50 in the vicinity of the project site to about El 450 at the headwaters of the Ochlockonee River, about 90 miles upstream from Jackson Bluff Dam in southern Georgia.

Jackson Bluff is a limestone bluff which rises about 50 feet on the south bank of the River. The north bank of the River at this point prior to dam construction was a broad floodplain about 3,500 feet wide extending into an area of low hills.

3. CLIMATE

The climate in the Ochlockonee River basin is generally typical for that of northern Florida with long, warm and relatively humid summers and mild winters which experience periodic intrusions of cool to occasionally cold air from the north. The seasonal

variations in temperature are similar across the entire drainage basin. The average annual temperature at Tallahassee, near Jackson Bluff Dam, is about 68°F, with monthly averages of 81.3°F in July and 53.9°F in December. Extreme temperatures range from 100°F to 10°F. The average annual temperature in the upper part of the drainage basin in Georgia is also about 68°F with monthly averages varying between about 82°F in July to about 54°F in December.

The average annual rainfall varies from about 57 inches in the lower part of the basin in the vicinity of Jackson Bluff Dam to about 49 inches in the upper portion of the basin in Georgia. Throughout the basin the greatest amounts of precipitation occur in July and August with the least occurring in December through February.

4. GEOLOGY

Jackson Bluff Dam and Lake Talquin are located in the Gulf Coastal Lowland and Northern Highland zones of the Coastal Plain Province, within which the entire State of Florida lies. The base of Jackson Bluff, and the riverbed immediately downstream of the Project, consists of a sandy limestone of Middle Miocene Age. Generally this formation is deeply weathered, with most of the lime having been removed in solution, and the remnant being sand and sandy clay which is found in the river bottoms. The upper portion of the Jackson Bluff formation consists of interbedded layers of sands, clays and sandy marls, with the uppermost material loose, fine to coarse sand with clay inclusions. The foundation for the dam is generally good but the limestone below the spillway and powerhouse is easily erodible, particularly since the original design of the Project did not include a concrete structure for dissipation of the energy of the spillway discharges prior to discharging onto the river bedrock downstream.

A reconnaissance was made of the site on December 6, 1978 in company with Consulting Engineering Geologist Kim de Rubertis. The purpose of the inspection was to note conditions which could affect feasibility of the proposed project features and to provide data for preliminary cost estimates. The Consultant's report is included in Appendix A.

SECTION III

EXISTING DEVELOPMENT

1. GENERAL

The existing Jackson Bluff Dam is located on the Ochlock-onee River about 35 miles upstream from its mouth at the Gulf of Mexico. The drainage area above the Dam is approximately 1,720 square miles. The Project consists of a powerhouse on the south side of the river adjoining a limestone bluff, a gated concrete spillway occupying the main part of the riverbed, an earth dam extending northerly from the spillway across the floodplain to the low lying hills beyond and a low saddle dam which lies north of the north end of the main dam. The general arrangement of these project features is shown in Fig. 2.

In January 1927, the Federal Power Commission issued a License (FPC Project No. 682) to the Central Florida Power and Light Company for construction of a hydroelectric facility at this site. Construction was carried out in 1928 and 1929 and the development was operated as a hydropower plant by that company, and its successor, the Florida Power Corporation, until 1970. Notice for Surrender of License by the Florida Power Corporation was received by the Federal Power Commission on November 4, 1969 when the former Licensee donated the reservoir and 30,060 acres of land to the State of Florida for use as a public park. At the time of this transfer of rights, all turbogenerators were removed by the former Licensee. The current right of ownership is held by the State of Florida, Department of Natural Resources. This department currently holds a 99-year lease from the Bureau of State Lands of the State of Florida to operate this facility for public recreational purposes.

2. DAM AND SPILLWAY

a. Dam

Jackson Bluff Dam consists of an earth embankment composed of sandy-clay materials with a maximum height of about 40-feet, a crest at El 77, and with an upstream slope of 3:1 and a downstream slope of 2.5:1. The 3,600-foot long dam was originally constructed using semi-hydraulic placement methods. Following a failure in 1957 of a portion of the dam, it was reconstructed with flatter slopes in the sections which were completely washed out. Other portions which did not fail were bolstered with berms on the upstream and downstream sides. The embankment section now includes a blanket drain extending 25-feet upstream from the present downstream toe. The general arrangement of the dam is shown in Fig. 2. Typical sections of the dam are shown in Fig. 3.

About 1,000 feet north of the end of the main dam there is a small saddle dam about 550 feet long, which has a base width of 50 feet, and is only 8 to 9 feet high. Based on leveling measurements performed by the State, the saddle dam has a top elevation of 72.3 and hence is about 4.7 feet lower than the main dam. The general location of the saddle dam is shown in Fig. 2.

The yard area between the powerhouse and Jackson Bluff is at approximately El 74 and is, therefore, also lower than the crest of the dam (see Fig. 4).

Following reconstruction of the dam after its failure, some 19 piezometer wells were installed in the dam at three general locations along the axis, as shown in plan in Fig. 2. The purpose of these wells is to monitor the elevation of the phreatic seepage surface in the embankment. In addition, seven pipe drains (culverts) collect seepage from the blanket drain. These drains are located at about a 500 to 600-foot spacing along the length of the

dam. The overall seepage is visually monitored at Crow Branch, just before the creek enters the river downstream of the dam.

b. Spillway

The spillway is located between the south end of the dam embankment and the north end of the powerhouse and consists of a hollow, reinforced concrete structure with a crest at El 52.0. The total length of the spillway is 196 feet, with a net crest length of 175 feet. Details of the spillway are shown in Figs. 4 and 5.

Spillway discharges are controlled by seven radial gates, 25-feet by 17-feet, and a smaller trash gate. The tops of the gates in the closed position are at El 69. The upstream face of the spillway has a slope of 1.2:1 and consists of a slab spanning between the gate piers, with intermediate support piers midway between gate piers. The crest is a relatively thin T-beam slab, ogee-shaped, that terminates with a horizontal lip at El 36.5, which is well above the spillway apron at El 19 and 21. The radial gates are operated by electrically-driven cable hoists from two hoisting gantries which are moved manually from gate to gate on the spillway operating deck at El 74. Upstream of the gates, slots are provided for stoplogs to be inserted for maintenance.

Immediately downstream of the main concrete spillway structure on the right side (north) is a sheet pile training wall to protect the earth dam and its foundation from erosion by spillway discharges. A sheet pile training wall on the left (south) side of the river immediately downstream of the powerhouse protects Jackson Bluff from erosion by spillway discharges as well as the discharges from the powerhouse. Both sheet pile walls have been driven to an unknown depth into the bedrock foundation. The north training wall has been provided with a concrete slab at the foundation contact downstream of the original concrete training wall, the upper portion of which was removed by spillway discharges several years ago. The location of the existing training walls is shown in Fig. 4.

The approach condition at the north end of the spillway is unsatisfactory. During high spillway discharge the approach velocity is high enough to move the rock protection from the embankment upstream. This has happened a number of times in the past, and the material removed has been replaced with larger rock which still, however, continues to move. It is not known how much of the earth material in the embankment has been replaced by rock, and hence there could be quite a thin "impervious" zone at this critical location. There could be, therefore, a risk of embankment failure at this location during a major flood.

c. Condition of Dam and Spillway

Safety inspection reports on the Jackson Bluff Project have been performed by various firms and agencies in recent years as discussed previously. Safety inspections were made in 1967, 1972, 1973, 1974, 1976, 1977 and 1978. The two most recent safety inspection reports, dated January 1978 and June 1978, were performed by Beck and the Corps, respectively.

Based on the safety inspections, it is evident that the earth embankment remains in good condition and no erosion or surface slides have been observed. The crest and downstream slope are protected by a well-established grass cover which is burned each year permitting an inspection for rodent activity. The upstream slope of the dam is protected from erosion by riprap and the general procedure is for project personnel to periodically inspect it for deterioration by walking along the slope at the waterline. Riprap is replaced in depressed areas on the upstream slope and adjacent to the north abutment wall of the spillway on a continuing basis with good quality and suitably graded rock. The low saddle dam located to the north of the dam remains in good condition.

Based on the visual and underwater inspections made during the last safety inspection in 1977 and more recent visual inspections made by Beck, there appears to be no significant change

in the condition of the concrete in the spillway structure since prior inspections. The previously reported cracked concrete in the spillway face and piers and resultant exposure of reinforcing steel which has been noted for many years still exists.

The most serious safety related item is considered to be the significant distortion of the north training wall structure, so that the overall structural integrity of the wall remains seriously impaired. Certainly if this wall were to fail, the dam would also.

Another item of immediate and substantial concern to the safety of the structure is the scouring which is occurring at the approach wall at the spillway's north end. The State has under consideration a proposal to prepare plans and specifications for remedial measures to correct these and other safety related items. The proposed remedial measures are discussed in some detail in Section VI. It should be noted that the Corps relates to similar items which need remedial action, but the major thrust of that agency's concern is the inability of the structure to pass the PMF resulting from interpretation of the guidelines for the Dam Safety Act.

3. RESERVOIR

The reservoir created by Jackson Bluff Dam is called Lake Talquin and is presently operated as a recreation facility as part of the State Park System. The reservoir level is generally maintained between El 68 and 69 for this purpose, with the normal pool level being about El 68.2. At this level the reservoir has a maximum depth of about 35 feet, a surface area of 9,200 acres and a volume of about 144,000 acre-feet. An area-capacity curve for the reservoir is shown in Fig. 6. The reservoir extends upstream from the dam for a distance of about 14.4 miles. The normal tailwater level downstream from the dam is about El 35 which provides a gross differential head between the normal reservoir level and the tailwater of some 33 feet.

4. POWERHOUSE

The powerhouse is an indoor-type with a brick superstructure and a reinforced concrete substructure. A plan and elevation of the structure is shown in Fig. 4 and a typical section through the existing powerhouse is shown in Fig. 5. The powerhouse does not presently contain any generation equipment, but the old governors continue to operate the wicket gates to provide downstream releases.

In the Beck 1977 safety inspection, the powerhouse superstructure was visually inspected and the water passages were inspected by a diver. No major structural deficiencies were observed or reported at that time. The turbine parts which had been left in the draft tubes have been removed. The draft tube inspection did not reveal a concrete erosion problem above tailwater. The underwater inspection did, however, reveal a small area of erosional undermining of the tailrace apron where it joins the south training wall. The surface of the reinforced concrete in the powerhouse and the brick in the superstructure is in generally good condition, being hard and sound in appearance without evidence of significant deterioration.

5. FORMER MECHANICAL AND ELECTRICAL EQUIPMENT

From 1929 until 1970 the powerhouse housed three fixed-blade propeller turbines direct coupled to vertically mounted generators. Two of the turbines were rated at 4,800 horsepower under a head of 32 feet, and one (the most southerly) was rated at 3,400 horsepower under 32 feet of head. The generators for the two 4,800 horsepower turbines had a rated output of 4,000 kVA and the generator for the 3,400 horsepower turbine was rated at 3,000 kVA. The total plant capacity was rated at 8,800 kW. Six transformers were located outside of and adjacent to the powerhouse along the upstream face of the powerhouse. Two of the transformers were rated at 4,000 kVA, one was rated at 3,000 kVA, and three were rated at 50 kVA.

6. TRANSMISSION

Power from the Jackson Bluff Project was delivered to the City of Tallahassee's distribution system by a 69-kV transmission line which still exists. This transmission line extends from the Florida Power Corporation substation next to the powerhouse, to the City's transmission and distribution system and is approximately 16.5 miles in length. Figure 7 shows the general location of the transmission grid in this vicinity.

7. HISTORICAL GENERATION

During the period from 1929 through 1970 the plant generated energy on an average annual basis in the amount of 22,122,000 kWh. This operation resulted in an average plant factor of 29% based on the 8,800-kW rating.

SECTION IV

LOADS AND RESOURCES

1. GENERAL

The power requirements of the City of Tallahassee are currently being supplied by two fossil fuel generating plants containing both steam and combustion turbines and one nuclear generating plant. Occasionally, purchases are also made from and sales to the Florida Power Corporation. Reinstallation of power generating equipment at the Jackson Bluff Dam is expected to provide an additional, relatively economic peaking power resource for the City. The power from the Project will also be used to replace a portion of the cost of fuel for the City's existing fossil-fuel steam generating units.

2. DISTRIBUTION SYSTEM

The distribution system of the City of Tallahassee includes eight bulk power substations and a network of transmission lines, including approximately 120 miles of existing and proposed 115-kV lines and 20 miles of existing and proposed 240-kV lines. In addition, several Florida Power Corporation owned substations and transmission lines are available for use by the City. Power from the Jackson Bluff Dam generating facility will be transmitted through the Florida Power Corporation's 69-kV transmission system for approximately 20 miles to the transmission system of the City of Tallahassee. The City's distribution system is shown in Fig. 7.

3. HISTORICAL LOADS

From 1969 to 1978 Tallahassee has experienced an average annual energy growth rate of 8.5% per year and a summer peak demand growth rate of 8.3% per year. Annual load growth rates for energy and peak demand have varied greatly in the past with the energy growth varying from -2.5% to 17.4%, and summer peak demand growth rate varying from 0.5% to 21.9%. The system load factor during this time period has averaged at about 50%. The historic seasonal peak demand and annual energy requirements for the City of Tallahassee are shown in Table IV-1.

The maximum monthly peak demands for the City of Tallahassee occur in the months of June through September. The minimum monthly peak demands generally occur in March and April. A breakdown of the monthly peak demands in percent of the annual peak is shown in Table IV-2.

During fiscal year 1977-1978 residential customer usage amounted to 45.6% of the total usage. Demand usage accounted for 45.3% in this same time period. A more detailed breakdown of customer usage amounts for the various city rate classifications is shown in Table IV-3.

4. FUTURE LOAD GROWTH

The City of Tallahassee has made an estimate of its future peak demand, summer and winter, and annual energy requirements for 1979 through 1988. In addition, the annual peak demand has been estimated through 1999. These forecasts are shown, respectively, in Tables IV-4 and IV-5.

For the period 1979 to 1988 the summer and winter peak demands and annual energy requirements have been estimated to increase on the average by 6.5% per year. For the forecasted period the winter peak demand was assumed to be 89% of the summer peak

demand. The average annual peak demand forecast follows this annual 6.5% increase through 1990, but thereafter, to 1999, is estimated to increase at a 3.1% average annual rate.

5. PRESENT AND FUTURE RESOURCES

The existing resources of the City of Tallahassee include two fossil fuel generating plants, containing both steam and combustion turbines, and one nuclear generating plant. The Sam O. Purdom generating plant has seven fossil fuel steam units with a combined maximum nameplate rating of 130 MW and two combustion turbine units with a nameplate rating of 30 MW. The Arvah B. Hopkins plant has two fossil fuel steam units with a 334 MW combined nameplate rating and two combustion turbine units with a 43-MW combined rating. The City also owns 11 MW of the Crystal River nuclear generating plant. This results in a total maximum nameplate rating of 548 MW. The existing generating facilities for the City of Tallahassee are listed in Table IV-6.

In addition to the proposed reinstallation of generating equipment at Jackson Bluff Dam, the City of Tallahassee expects to add an additional unit to the Arvah B. Hopkins plant and to enter into future Joint Participation Projects. The expected addition to the Arvah B. Hopkins plant will be a third combustion turbine unit, with a maximum nameplate rating of 50 MW and an expected in-service date of May 1985. The exact nature of the Joint Participation Projects is as yet unknown, but an on-line date of April 1987 is envisioned with an approximate rating of 200 MW. If the Joint Participation Projects prove to be unfeasible, a coal-fired unit would probably be installed in order to meet the requirements of the City's customers. In May 1984 four of the fossil fuel units at the Sam O. Purdom plant will be retired, representing a loss to the City's system of 30 MW. The proposed additions and changes to the City of Tallahassee's generating facilities are shown on Table IV-7.

It is considered that all of the power generated by the Jackson Bluff Project would be consumed by City customers, and that the marketing potential of the power from the Project is not a critical issue with regard to the economic feasibility of the Project. Hence, a study of the availability of an outside market for the power from the Project was not performed. It is considered reasonable to assess the viability of the Project on the basis of displacing or delaying new combustion turbine installations in the amount of the dependable capacity and firm energy from the Project. The additional (secondary) energy from the Project would reduce operation (fuel costs) of the City's older oil-fired units. The economic analysis in Section IX is based on this premise over the first 10 years of project operation.

JACKSON BLUFF HYDROELECTRIC PROJECT
CITY OF TALLAHASSEE

HISTORY OF SEASONAL PEAK DEMAND AND ANNUAL ENERGY REQUIREMENTS

<u>Year</u>	<u>Summer Peak Demand Net MW</u>		<u>Net Energy For Load - GWh</u>	<u>Load Factor %</u>	<u>Year</u>	<u>Winter Peak Demand Net MW</u>	
	<u>Interruptible</u>	<u>Total</u>				<u>Interruptible</u>	<u>Total</u>
1969	0	127	559	50	1969-70	0	90
1970	0	149	656	50	1970-71	0	115
1971	0	160	708	51	1971-72	0	126
1972	0	195	802	47	1972-73	0	140
1973	0	202	910	51	1973-74	0	152
1974	0	203	885	50	1974-75	0	168
1975	0	216	947	50	1975-76	0	196
1976	0	227	971	49	1976-77	0	229
1977	0	234	1,076	52	1977-78	0	222
1978	0	256	1,145	51	1978-79	0	239

TABLE IV-1

TABLE IV-2

JACKSON BLUFF HYDROELECTRIC PROJECT
CITY OF TALLAHASSEEMONTHLY PEAK DEMANDS
IN PERCENT OF ANNUAL PEAK

<u>Month</u>	<u>Peak Demand (% of Annual Peak)</u>
January	88.89
February	73.73
March	66.24
April	67.17
May	84.89
June	95.57
July	100.00
August	96.44
September	93.18
October	76.10
November	72.34
December	78.13

JACKSON BLUFF HYDROELECTRIC PROJECT
CITY OF TALLAHASSEE

CUSTOMER USAGE FOR FISCAL 1977-78⁽¹⁾

<u>Rate Class</u>	<u>Usage (kWh)</u>	<u>Percent of Total</u>
Residential	476,942,486	45.6
General Service: Non-Demand ..	86,297,554	8.2
Demand: Secondary Metered	152,548,157	14.6
Primary Metered	320,871,135	30.7
High Load Factor	0	0.0
Traffic Control	154,034	0.0
Street Lights	5,915,605	0.6
Security Lights	<u>3,361,388</u>	<u>0.3</u>
Total	1,046,090,359	100.0

(1) New Rate Classes were initiated as of April 20, 1978,
and these consumption figures are the best estimates avail-
able for annual usage and the new rate classes.

JACKSON BLUFF HYDROELECTRIC PROJECT
CITY OF TALLAHASSEE

FORECAST OF SEASONAL PEAK DEMAND AND ANNUAL ENERGY REQUIREMENTS

<u>Year</u>	Summer Peak Demand Net MW		Net Energy For Load - GWh	Load Factor %	<u>Year</u>	Winter Peak Demand Net MW	
	<u>Interruptible</u>	<u>Total</u>				<u>Interruptible</u>	<u>Total</u>
1979	0	278	1,218	50	1979-80	0	247
1980	0	295	1,297	50	1980-81	0	262
1981	0	316	1,382	50	1981-82	0	281
1982	0	336	1,471	50	1982-83	0	299
1983	0	358	1,567	50	1983-84	0	318
1984	0	380	1,669	50	1984-85	0	338
1985	0	406	1,777	50	1985-86	0	361
1986	0	432	1,893	50	1986-87	0	384
1987	0	460	2,016	50	1987-88	0	409
1988	0	489	2,148	50	1988-89	0	435

TABLE IV-5

JACKSON BLUFF HYDROELECTRIC PROJECT
CITY OF TALLAHASSEE

FORECAST ANNUAL PEAK DEMANDS

<u>Year</u>	<u>Demand (MW)</u>
1979	278
1980	295
1981	316
1982	336
1983	358
1984	380
1985	406
1986	432
1987	460
1988	489
1989	522
1990	556
1991	573
1992	588
1993	608
1994	626
1995	644
1996	662
1997	684
1998	707
1999	730

JACKSON BLUFF HYDROELECTRIC PROJECT
CITY OF TALLHASSEE

EXISTING GENERATING FACILITIES

Plant Name	Unit No.	Location	Type	Fuel		Com'l In-Service mo/yr	Exptd. Retirmt. mo/yr	Gen. Max. Nameplate kW	Net Capability		
				Pri.	Alt.				Summer MW	Winter MW	
Sam O. Purdom		Wakulla Co. 2/4S/1E						<u>160,000</u>	<u>140</u>	<u>143</u>	
	1-2		F	HO	no	1/52	5/84	15,000	14	16	
	3		F	HO	NG	1/52	5/84	7,500	7	8	
	4		F	HO	NG	4/54	5/84	7,500	7	8	
	5		F	HO	NG	4/58	Unknown	25,000	22	22	
	6		F	HO	NG	1/61	Unknown	25,000	22	22	
	7		F	HO	NG	6/66	Unknown	50,000	46	45	
	GT-1		CT	LO	NG	12/63	Unknown	15,000	11	11	
	GT-2		CT	LO	NG	5/64	Unknown	15,000	11	11	
Arvah B. Hopkins		Leon Co. 26/1N/2W						<u>377,570</u>	<u>344</u>	<u>364</u>	
	1		F	HO	NG	5/71	Unknown	75,000	78	80	
	2		F	HO	NG	10/77	Unknown	259,250	225	238	
	GT-1		CT	LO	NG	2/70	Unknown	16,320	14	16	
	GT-2		CT	LO	NG	9/72	Unknown	27,000	27	30	
Crystal River		Citrus Co. Red Level, FL							<u>11</u>	<u>11</u>	
	3		N	N	—	3/77	Unknown	11,133	11	11	
TOTAL SYSTEM AS OF DECEMBER 31, 1978									<u>548,703</u>	<u>495</u>	<u>518</u>

Legend: F = fossil steam, CT = combustion turbine, N = nuclear, HO = heavy oil (#6), LO = Light Oil (#2), NG = Natural gas.

JACKSON BLUFF HYDROELECTRIC PROJECT
CITY OF TALLAHASSEE

PLANNED AND PROSPECTIVE GENERATING FACILITY ADDITIONS AND CHANGES

Plant Name	Unit No.	Location	Type	Fuel		Const. Start mo/yr	Comp'l In-Service mo/yr*	Gen. Max. Nameplate kW	Net Capability	
				Pr1.	Alt.				Summer MW	Winter MW
Jackson Bluff Dam		Gadsden-Leon-Liberty Co. 21/13/4W	H	-	-	4/82	10/83	8,800	8.8	8.8
Arvah B. Hopkins		Leon Co. 26/1N/2W								
(PR)	GT-3		CT	LO	HO	5/84	5/85	50,000	50	50
Sam O. Purdom		Wakulla Co. 2/4S/1E								
	1-2r		F	HO	no		5/84	(15,000)	(14)	(16)
	3-4r		F	HO	NG		5/84	(15,000)	(14)	(16)
Unknown Unit ⁽¹⁾	(	U N K N O W N	)				4/87	(Unknown)	<u>200</u>	<u>200</u>

* This column is to be used also for dates for retirements and changes.

LEGEND: F = Fossil steam, CT = combustion turbine, H = hydro, HO = heavy oil (#6),
LO = light oil (#2), NG = natural gas.

- (1) This addition reflects the City of Tallahassee's desire to enter into future Joint Participation Projects when these projects develop. If, for some reason, Joint Participation Projects do not develop or are not feasible, the City will take the necessary action to provide sufficient capacity to adequately supply it's customers. A unit which would be commercially available by the summer of 1987 would probably be coal fired as nuclear units would require longer lead times.

SECTION V

HYDROLOGY

1. GENERAL

The Ochlockonee River drainage basin is located in the Panhandle Section of Florida and extends in a generally northeasterly direction into southwestern Georgia. The river basin varies in elevation from about El 450 at the headwaters to sea level at the mouth of the Gulf of Mexico. The river flows generally in a southwesterly direction from its headwaters for about 110 miles until it meets Telogia Creek. At that point, the river turns and flows the remaining 36 miles of its 146-mile length in a generally southeasterly direction to its mouth at the Gulf of Mexico.

The Ochlockonee River drains an area of 1,720 square miles above Jackson Bluff Dam. Besides Lake Talquin, the reservoir behind Jackson Bluff Dam, there are two other lakes of significant size in the drainage basin. These two lakes are Lake Jackson and Lake Iamonia, neither of which are located on the main stem of the river.

2. HISTORICAL STREAMFLOWS

Historical streamflows in the Ochlockonee River basin have been well documented by numerous United States Geological Survey (USGS) gaging stations in the basin. Records of the elevation and storage in Lake Talquin are available from January 1930 through the present, from USGS Gage No. 0232990, Lake Talquin near Bloxham, Florida. Records of the streamflow in the Ochlockonee River at a point 3,000 feet downstream from the gated spillway at the dam are available from July 1926 through the present from USGS Gage No. 02330000, Ochlockonee River near Bloxham, Florida. Based on these records, the average annual runoff for the period of water year 1927 through 1975 below Lake Talquin is 1,692 cfs, which corresponds to

an average runoff of about 13.4 inches per year in the drainage basin above the dam. The lowest streamflows of the year usually occur in the months of October and November when the average monthly flows are 1,031 cfs and 722 cfs, respectively. The highest flows usually occur in the month of March during the spring runoff, when the average monthly flow is 3,066 cfs. A tabulation of the average monthly flows in the Ochlockonee River below Jackson Bluff Dam at the stream gage near Bloxham, for the period of water year 1927 to 1970, is shown in Table V-1. These streamflows have been used in this study for the purposes of determining project power output. A flow duration curve for these flows is shown in Fig. 8.

3. MINIMUM DOWNSTREAM RELEASES

Historically there have been periods with zero releases in the river below Jackson Bluff Dam for short intervals of time, such as during periodic safety inspections. No concise data is presently available which defines a minimum downstream release requirement for purposes of recreation, water quality or fish and wildlife purposes. For the purpose of computing power output from the Project in this study, a minimum downstream release of 50 cfs was used. This estimate of a low-flow release allowance is the minimum mean monthly flow of record and was included in the power studies to provide for a minimum release in the event a low-flow allowance is required as part of the operational constraints of the hydroelectric plant.

4. FLOOD MAGNITUDES AND FREQUENCIES

a. Flood History

The Ochlockonee River basin experiences flooding mostly in the winter and spring months, although floods have occurred in almost every month of the year. According to USGS records, the maximum flood of record at the stream gage downstream of the dam near Bloxham occurred on September 23, 1969, and had a daily mean

discharge of 73,200 cfs, with an instantaneous peak flow of 89,400 cfs. However, studies indicate that based on the capacity of the existing spillway at the dam, and recorded stage levels in Lake Talquin during that flood, the actual peak flow passed over the spillway at the dam on September 22, 1969, including flow through the powerhouse, was more likely in the neighborhood of 67,000 cfs. This discrepancy is discussed in more detail below. Based upon an analysis of flood events for the entire period of record, a flood-frequency curve for the gage at the Ochlockonee River near Bloxham was developed for the 1976 safety inspection report and is shown in Fig. 9.

b. Probable Maximum Flood

The Corps published a safety inspection report on Jackson Bluff Dam in June 1978 as part of a National Dam Safety Program.⁽⁹⁾ In this study, the Corps developed a Probable Maximum Flood (PMF) hydrograph for the purpose of evaluating the adequacy of the existing spillway to pass this flood. The PMF developed by the Corps for that study was based on an analysis of the flood which occurred in the project area in 1948 and a Probable Maximum Precipitation (PMP) which was obtained from the U.S. Weather Service Hydrometeorological Report No. 51.⁽¹⁰⁾ The 6-hour PMP used was 14.3 inches and the peak PMF inflow derived was 309,059 cfs. It should be noted that based on extrapolation of the discharge frequency plot in Fig. 9, this would correspond to a frequency of recurrence of about 1 in 30,000 years.

5. SPILLWAY CAPACITY

a. Existing Capacity

A reservoir level of El 73 was chosen as the water surface level for which the maximum discharge capability of the existing spillway should be evaluated. This level would be one foot below the yard area at El 74 which is between the powerhouse and the

switchyard and four feet below the top of the main dam. The combined capacity of the gated spillway, turbines, and discharge through the saddle dam location, assuming a complete failure of the saddle dam, when the reservoir is at El 73 would be approximately 104,000 cfs. This flow corresponds roughly to a flood which has a frequency of recurrence of about 1 in 500 years. If the saddle dam did not fail, the total release from the reservoir from the service spillway and turbines alone would be about 74,000 cfs, ignoring the minor amount of overtopping of the saddle dam which would occur for this case.

b. Flood of Record

As discussed above, the USGS has recorded the maximum flood of record (instantaneous peak) at the gage near Bloxham to be 89,400 cfs at a stage elevation of 53.9 occurring on September 23, 1969. This value is based on an extrapolation of the USGS recorded gage heights and discharges for major floods at Bloxham (see Fig. 10). It has been estimated that approximately 8% of this flood flow can be attributed to inflow between the dam spillway and the gaging station. The Florida Power Corporation has reported that the saddle dam did not break during this flood and that the power plant was generating at capacity. With a reservoir level of El 71.6, the total peak discharge being passed over the service spillway and through the powerhouse would then be about 67,000 cfs. With 8% additional inflow between the dam and the gage, on this basis the discharge at the gage would be about 73,000 cfs, which is significantly less than the USGS value of 89,400 cfs. This discrepancy has not been resolved at this time.

c. Probable Maximum Flood

In the studies performed by the Corps for its safety inspection of March 1978, the PMF hydrograph developed by the Corps was routed through the existing spillway to determine whether the Project has adequate safety against the PMF flooding conditions.

With the beginning reservoir level at El 68.2, the reservoir rises to a maximum level of El 81.5 during the PMF, which overtops the main dam by 4.5 feet. This maximum reservoir elevation is based upon the assumption that the saddle dam fails completely during the flood and acts as an overpour earth spillway. The maximum discharge from the reservoir during the PMF was determined by the Corps to be 305,889 cfs. Since the main dam would be overtopped by 4.5 feet the likelihood of a major embankment failure in the dam is significant, and it was therefore concluded that the project cannot safely pass the PMF in its present condition. If the saddle dam did not fail completely, the reservoir would rise even higher, further increasing the likelihood of a major embankment failure in the event of a PMF.

A flood with a peak discharge equal to one-half the PMF peak discharge (154,530 cfs) was also routed through the existing Project in the Corps study. It was found that the maximum reservoir level resulting from this flood, assuming a complete failure of the saddle dam, would be El 76.5 and the corresponding peak outflow would be 147,400 cfs. This water surface level would allow flow to escape from the reservoir in the yard area at El 74 between the powerhouse and the switchyard and would also threaten the main dam with only one-half foot of freeboard below the crest at El 77. The existing spillway is therefore inadequate to pass one-half the PMF.

d. Criteria for Increase in Capacity

Following the safety inspection in 1968 the Corps rated the Jackson Bluff Dam as unsafe due to the fact that it could not pass a Probable Maximum Flood (PMF). This was determined on the basis that the structure is "large" (greater than 50,000 acre-feet in storage volume); and significant or high in terms of hazard potential (few or more than a few inhabitable structures). On this basis the recommended guidelines indicate a recommended spillway design flood equal to the PMF.

The dam is unquestionably large based on the Corps' criteria, but it is not considered that the hazard potential given by the Corps is correct. There are a number of permanent structures and trailers in the floodplain below the dam. However, these structures are presently subject to flooding every several years due to natural high water level and the Jackson Bluff Dam operator alerts the downstream inhabitants who leave the area until the flood subsides. It is considered that flooding will occur whenever the downstream water level reaches an elevation of about 48. On the other hand, the downstream water elevation even for the flood of record, which is some 30% of the PMF, is given by the USGS as El 53.9, some 6 feet over level at which flooding occurs. The river stage for the PMF would be significantly higher than this level. During the dam failure in 1957 the water level reached El 57.3, 3.4 feet above that of the flood of record, which is considered to be a reasonable basis for determining what would happen if the dam failed in the future due to overtopping as predicted by the Corps.

From an extrapolation of the tailwater rating curve in Fig. 7, it appears that the normal passage of a flood even less than half the PMF would cause a downstream water level greater than which occurred during the 1957 failure. Hence, whether the structure can pass even half the PMF under normal conditions is academic since the downstream structures would have been flooded out prior to this discharge being reached and the inhabitants would have left the area. Further, the damage to the structures would probably not be any more than it would with a failure of the dam since the effect on the downstream river level would be probably no more than one or two feet at the most.

On the basis of the above, it is believed reasonable to consider that the dam should be in a low hazard category and the spillway discharge capacity of the structure should be improved to discharge one-half of the PMF. For this reason, it is planned to provide for an emergency (auxiliary) spillway close to the saddle

dam which would initially consist of excavation of an earth overpour section with provision for blasting the saddle dam if a very large flood did occur, and then finally as part of the hydroelectric Project to replace the saddle dam with a fuse plug spillway. In this manner the combined capacities of the gated and auxiliary spillways would be adequate to discharge half the PMF with the reservoir level at about the crest of the dam.

JACKSON BLUFF HYDROELECTRIC PROJECT
OCHLOCKNEE RIVER AT BLOXHAM, FLORIDA
AVG. MONTHLY STREAMFLOW (cfs)
(USGS Gage No. 02330000)

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVERAGE
1926-27	1,200.	922.	781.	654.	1,130.	910.	361.	172.	429.	594.	680.	210.	670.
1927-28	154.	132.	488.	796.	1,380.	4,840.	6,410.	2,540.	654.	2,690.	6,840.	3,780.	2,566.
1928-29	3,420.	1,210.	1,170.	1,880.	2,560.	3,990.	1,950.	1,120.	847.	2,470.	2,270.	1,090.	2,001.
1929-30	2,690.	604.	1,010.	1,790.	3,590.	3,900.	4,960.	1,150.	817.	630.	1,190.	711.	1,908.
1930-31	875.	982.	1,950.	2,080.	1,290.	1,430.	1,480.	968.	388.	162.	702.	304.	1,052.
1931-32	82.	69.	171.	2,430.	1,200.	1,900.	1,070.	728.	1,940.	1,410.	2,930.	3,380.	1,443.
1932-33	3,300.	3,640.	2,130.	2,030.	4,960.	4,000.	6,140.	1,680.	534.	535.	684.	545.	2,493.
1933-34	163.	212.	383.	360.	500.	888.	402.	562.	1,170.	990.	651.	331.	552.
1934-35	169.	152.	186.	222.	700.	1,289.	563.	672.	359.	1,190.	2,179.	5,191.	1,069.
1935-36	743.	322.	939.	3,066.	4,205.	2,432.	3,119.	808.	841.	528.	1,715.	787.	1,608.
1936-37	1,620.	426.	1,204.	1,081.	3,392.	2,982.	4,520.	2,232.	1,631.	1,364.	1,647.	4,787.	2,224.
1937-38	2,448.	2,121.	1,713.	1,670.	1,508.	1,715.	1,186.	278.	662.	592.	1,112.	388.	1,283.
1938-39	408.	213.	316.	511.	1,001.	1,722.	1,140.	1,444.	2,960.	1,866.	1,944.	990.	1,209.
1939-40	471.	211.	456.	903.	1,792.	1,430.	2,016.	816.	750.	1,657.	1,320.	522.	1,024.
1940-41	90.	87.	524.	820.	809.	1,843.	1,369.	319.	255.	942.	963.	533.	714.
1941-42	699.	437.	612.	4,918.	3,044.	6,059.	2,794.	1,216.	2,714.	1,814.	1,401.	1,261.	2,246.
1942-43	1,425.	625.	1,095.	2,253.	2,142.	4,955.	1,852.	1,215.	1,083.	874.	1,076.	690.	1,610.
1943-44	215.	132.	234.	972.	2,400.	5,594.	4,934.	1,924.	524.	927.	1,654.	2,497.	1,827.
1944-45	805.	596.	726.	1,790.	1,875.	1,121.	1,271.	2,744.	271.	2,640.	3,778.	1,357.	1,587.
1945-46	633.	513.	1,817.	4,724.	2,883.	4,097.	2,211.	3,586.	1,747.	1,186.	2,007.	2,511.	2,328.
1946-47	1,088.	726.	724.	1,653.	1,538.	3,621.	5,234.	1,737.	2,149.	1,272.	1,106.	746.	1,796.
1947-48	862.	4,943.	5,625.	3,595.	3,437.	8,355.	13,240.	1,709.	1,095.	2,998.	5,347.	3,052.	4,519.
1948-49	1,611.	1,415.	3,349.	2,176.	3,611.	2,800.	4,762.	1,421.	716.	2,534.	2,138.	1,067.	2,293.
1949-50	825.	486.	660.	679.	702.	1,544.	1,796.	1,121.	1,152.	917.	761.	1,365.	1,001.
1950-51	248.	378.	362.	586.	461.	1,257.	2,146.	666.	462.	568.	552.	124.	650.
1951-52	146.	663.	2,208.	1,358.	3,156.	3,605.	2,354.	1,022.	681.	115.	729.	860.	1,397.
1952-53	310.	209.	554.	731.	2,061.	1,502.	3,212.	649.	413.	1,671.	917.	1,045.	1,097.
1953-54	949.	474.	3,557.	2,849.	1,074.	1,252.	632.	420.	260.	220.	300.	170.	1,019.
1954-55	50.	53.	126.	398.	592.	296.	1,036.	242.	102.	321.	338.	259.	316.
1955-56	73.	62.	159.	427.	1,417.	974.	424.	1,398.	410.	1,401.	336.	619.	638.
1956-57	765.	207.	265.	248.	243.	682.	1,091.	943.	2,017.	1,130.	435.	3,381.	948.
1957-58	3,260.	1,383.	2,630.	2,174.	2,351.	4,230.	6,752.	2,377.	2,055.	2,420.	1,732.	120.	2,626.
1958-59	56.	77.	83.	746.	3,815.	7,312.	3,437.	1,350.	3,894.	2,106.	1,466.	1,135.	2,114.
1959-60	2,314.	1,678.	1,503.	1,982.	4,114.	3,376.	6,541.	1,407.	1,276.	1,716.	969.	3,586.	2,518.
1960-61	2,825.	736.	697.	1,291.	2,329.	2,722.	5,222.	1,516.	1,031.	1,270.	1,030.	1,195.	1,815.
1961-62	156.	294.	629.	613.	964.	1,499.	3,754.	206.	240.	214.	284.	414.	766.
1962-63	253.	321.	854.	2,552.	3,030.	2,415.	817.	679.	625.	1,321.	614.	456.	1,158.
1963-64	465.	282.	961.	4,681.	4,239.	7,019.	2,994.	4,880.	683.	2,801.	3,963.	1,939.	2,914.
1964-65	3,813.	1,314.	8,913.	3,614.	9,203.	7,831.	5,162.	2,101.	4,470.	2,928.	2,015.	838.	4,326.
1965-66	1,357.	535.	1,399.	3,845.	5,463.	6,574.	1,366.	2,254.	2,542.	1,448.	2,915.	1,429.	2,583.
1966-67	912.	718.	781.	3,987.	3,133.	1,474.	637.	438.	584.	1,872.	1,117.	309.	1,329.
1967-68	186.	437.	657.	755.	682.	787.	390.	255.	428.	210.	207.	172.	429.
1968-69	79.	272.	619.	753.	1,132.	2,458.	1,034.	534.	600.	792.	1,099.	7,890.	1,430.
1969-70	1,169.	511.	1,447.	2,591.	3,660.	4,219.	3,596.	494.	852.	1,486.	3,525.	1,259.	2,060.
AVERAGE	1,031.	722.	1,288.	1,801.	2,381.	3,066.	2,895.	1,273.	1,121.	1,336.	1,605.	1,484.	1,663.

SECTION VI

PROPOSED PROJECT ARRANGEMENT

1. GENERAL

The concept for the Jackson Bluff Hydroelectric Project is to install new generation equipment in the existing turbine openings. As part of this Project, certain modifications to the existing structures are considered necessary to complete the installation. These include installing electrically-driven gate hoists on five of the spillway gates, and moving the tow gantry frames to the other two; fabricating a floating bulkhead to allow dewatering of the draft tubes for repair and future maintenance and removal of the saddle dam and replacing it with an auxiliary fuse plug spillway.

The State is currently considering undertaking major remedial measures which are safety related. This includes repairs to the north downstream training wall and the approach wall of the spillway; addition of a small retaining wall between the powerhouse and Jackson Bluff (to raise that area to the same level as the dam crest); and excavation of a long earth overpour section adjacent to the saddle dam, which will provide additional (auxiliary) spillway capacity in the case of a very major flood. These safety related items being considered by the State have not been included in the cost of the Hydroelectric Project since they would be performed anyway as part of the dam safety program. However, an additional economic analysis has been made in Section IX assuming that the cost of these remedial measures was eventually borne by the power consumers.

2. REMEDIAL MEASURES UNDER CONSIDERATION BY THE STATE

a. North Downstream Training Wall

In its present condition the north training wall is considered to be overstressed and it is believed that an adequate margin of safety against failure does not exist. Severe distortion of the wall has taken place due primarily to soil loading from the berm area behind the wall. In addition, some undermining of the wall at the foundation and extensive rust pitting at the bottom of the sheet pile has taken place.

Due to this unsafe condition it is proposed to either repair or replace the present sheet pile wall. For the purpose of developing a broad estimate of cost of this item, it was considered that a new concrete retaining wall would be constructed. The new wall would be built entirely landward of the existing wall utilizing the existing wall both as a cofferdam and as the outside concrete form. The new wall would be placed in sections with adequate landside supports to prevent premature failure of the existing wall. The new concrete wall would be of an L-shaped design and would extend an additional 65 feet beyond the end of the present wall. The location of the wall is shown in Fig. 11.

b. Addition of Retaining Wall Between Powerhouse and Jackson Bluff

The yard area between the powerhouse and Jackson Bluff is currently at El 74.0, while the main dam has a crest elevation of 77.0. In order to provide equal protection in this yard area during major floods a 3-foot high concrete retaining wall will be built between the powerhouse and Jackson Bluff as shown in Fig. 11.

c. Spillway Approach Wall

The approach condition of the north end of the gated spillway is unsatisfactory. During high spillway discharges, the

approach velocity is high enough to move the rock protection on the embankment behind the wall.

For the purpose of establishing a broad estimate of the costs of remedial efforts at this location, it is assumed that the existing approach wall will be increased in height by a concrete section anchored to the old structure. Existing rock on the upstream slope would be removed and replaced with a heavier layer underlain by a rock filter zone. Parts of the embankment which have been lost by erosion would be replaced. This work would be performed with the lake drawn down a moderate amount.

d. Emergency (Auxiliary) Spillway Excavation

It is proposed to excavate an earth overpour emergency spillway section at the saddle dam location. This structure will increase the total discharge capacity from Jackson Bluff Dam to about half the Probable Maximum Flood.

The work would consist of excavating a flat earth overpour section approximately 1,000 feet long, adjacent to the existing saddle dam (300 feet north and 700 feet south of the saddle dam), with a similar crest elevation (about 4.5 feet below the crest of the main embankment). Clearing of trees and brush would be performed as necessary to allow the water to enter and discharge over this section. The saddle dam would be drilled at intervals, and the holes cased, to allow loading with dynamite and removal of the saddle dam by blasting in the case of a major flood. Assuming the power development goes ahead, this saddle dam would be replaced by an erodible fuse plug section as part of the project work, as discussed below.

3. POWER GENERATING EQUIPMENT

Three new turbine-generator units along with accessory transformers, switching gear, telemetering equipment, remote monitoring and control system equipment, and other mechanical and electrical equipment, will be installed at the existing powerhouse at Jackson Bluff Dam. In this report, it is proposed to reinstall fixed blade propeller turbines similar to those removed in 1970, thus eliminating the need for any modifications to the existing powerhouse substructure or superstructure. However, more detailed consideration should be given in the future to the optimum level of installed capacity and to the possibility of installing diagonal flow units as suggested by Allis-Chalmers which could result in increased capacity potential for the units.

Two of the turbines will be rated at 4,800 horsepower and the third at 3,400 horsepower, operating under a net head of 32 feet. The resultant total rated capacity of the plant will be 8,800 kW as before, with two units of 3,200 kW and one at 2,400 kW. The transformers will be located along the side of the building adjacent to the trashracks. A plan and section view of the powerhouse with the new generating equipment is shown in Fig. 13.

It is anticipated that some cavitation damage has occurred within the draft tubes both from past power operation and as operated by the State for flow releases. This damage will be repaired in conjunction with the reinstallation of generating equipment. A floating bulkhead will be fabricated to facilitate this work and to permit future dewatering of the draft tubes for inspection and maintenance.

4. SPILLWAY GATE HOISTS

At the present time the 7 radial gates are operated mechanically from 2 hoisting gantries which are moved manually

from gate to gate on the spillway operating deck. These two existing gantries will be permanently installed over two gates and 5 new motorized gate hoists will be installed over the remaining 5 gates. The new hoists will require erection of a structure supporting frame for each.

5. AUXILIARY SPILLWAY

A permanent concrete control sill will be constructed on the 1,000-foot long earth overpour section. The saddle dam will be replaced by a 550-foot long erodible fuse plug embankment section, as shown in Fig. 12. The crest elevation for the overpour section control sill will be 72.3 feet. The crest at the top of the fuse plug will also be 72.3 feet with the fuse plug sill elevation at 66.5 feet. The width of the fuse plug crest will be 15 feet with side slopes of 2 to 1.

SECTION VII

PROJECT OPERATION AND POWER OUTPUT

1. GENERAL

Power output studies have been performed using a mathematical model of the operation of the Project. These studies were conducted for the 44 years of average monthly historical streamflows from October 1926 to September 1970.

No attempt has been made at this stage of the investigation to determine the optimum method of plant operation. However, the power studies have been based on a scheme which is considered reasonable and provides a basis for the economic evaluation of the Project.

Efficiencies of 88%, 96% and 99% have been assumed for the turbines, generators and transformers, respectively. A hydraulic efficiency of 95% has been used, and transmission losses were not included in the month-by-month computations. The computer model utilized for the power studies simulates a month-by-month operation of the power plant in which the average monthly streamflows are passed through the plant and the monthly generation for each month was determined based on the operating scheme discussed below.

2. OPERATING CHARACTERISTICS

The Project would be operated as a daily peaking plant with storage in the reservoir being utilized whenever the amount of water required to sustain generation during the daily peaking period exceeded the natural inflow into the reservoir. Generation during off-peak periods would take place during those times when the reservoir is full, using the available incoming streamflow. Spill will occur when the reservoir is full and the streamflow is greater than the maximum hydraulic capacity of the generating units.

A minimum release of 50 cfs was assumed to be discharged from the reservoir during all periods of non-generation for purposes of downstream environmental mitigation and enhancement. This minimum flow is equal to the minimum monthly flow of record. The normal maximum reservoir elevation would be at El 68.5 and under the worst hydrologic conditions the reservoir would be drawn down to El 66.5. During the 44-year period of record used for the power studies, the reservoir was only drawn down to this minimum level two times. On an annual basis, the average reservoir drawdown would generally be less than one foot.

3. POWER OUTPUT

a. Operation Study Results

Based on the method of plant operation described above, power studies for the Project were performed on a monthly basis. The energy generated each month for the period of record is shown in Table VII-1. This tabulation of monthly energy values represents those available at the plant, with no allowance for transmission losses to the City's load center. Table VII-2 shows the end-of-month reservoir elevations for Lake Talquin for the period of record.

b. Dependable Capacity

The dependable capacity of a hydroelectric plant is considered herein as that available at the minimum reservoir elevation with the turbine wicket gates in the full open position. The minimum reservoir elevation is 66.5 which occurs twice during the period of record, December 1954 and December 1958. Under these flow conditions, 6,900 kW will be available as dependable capacity during the peak summer load, with daily operation for short periods, and utilizing the lake as peaking pondage. This will result in 6,660 kW dependable capacity being available at the City's load center, allowing for 3.5% transmission losses resulting from wheeling over the Florida Power Corporation transmission system.

c. Energy

Firm (prime) energy is that generated and delivered to the load center on an annual basis, during severe low flow conditions. For the purpose of this study, it is considered reasonable to base the available firm energy of the Project on the amount of energy which is generated during the calendar year with the second most adverse hydrologic period. This period then has a recurrence interval of once in 22 years, which is almost the life of an alternative combustion turbine installation. The amount of energy generated during the calendar year within the second worst hydrologic period (1968) was 6,998,000 kWh, which corresponds to a plant factor of 9.1%, based on the installed capacity. With 3.5% transmission losses for energy, the firm energy available at the load center would be 6,753,000 kWh.

The average annual energy generated for the period of record was 25,824,000 kWh which corresponds to an average annual plant factor of 33.5%. With 3.5% transmission losses, 24,920,000 kWh of average annual energy is available at the load center. The secondary energy generated is the annual energy which would be generated in excess of the firm energy. The secondary energy generated at the plant is therefore 18,826,000 kWh with 18,167,000 kWh being available at the load center.

4. ENERGY GENERATED PREVIOUSLY

Generation records for the Jackson Bluff Project obtained from the FPC for the period of 1927 to 1970 indicate that the average annual energy produced was 22,122,000 kWh, which is about 14% lower than the average annual energy produced at the plant from the power studies discussed above.

A part of this discrepancy can be attributed to the fact that the overall efficiencies of the generating units which existed

in the powerhouse were less than the efficiencies used in the power studies, which are based on operating characteristics of modern units.

The other major reason for the historical average annual energy generated being less than estimated above, relates to the difference in reservoir operation for the two methods. As was generally normal procedure in the past, the plant was apparently operated to obtain the maximum amount of prime energy which means that the reservoir was drawn down to firm up this prime energy. A review of the past records of lake levels indicates that this indeed was done, with the average lake level being about 67 feet rather than 68.5 resulting from the studies in this report. This probably increases the prime energy but reduces the average energy because of the reduction in head available. Since secondary energy has a substantially higher value than it did in the past, because it represents the cost of replacement oil fuel, the most economic method of operation is now considered to be to maintain a higher reservoir level, which results in an increased amount of average energy but less firm energy than previously.

JACKSON BLUFF HYDROELECTRIC PROJECT
PROJECT TOTAL ENERGY (MMH)

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	TOTAL
1926-27	1,696.	1,255.	1,177.	954.	1,703.	1,327.	544.	225.	623.	895.	992.	291.	11,682.
1927-28	224.	223.	629.	1,161.	2,080.	4,996.	4,822.	3,826.	954.	4,047.	4,585.	5,411.	32,958.
1928-29	3,111.	1,647.	1,763.	2,742.	3,856.	5,221.	2,938.	1,688.	1,235.	3,722.	3,310.	1,643.	34,876.
1929-30	4,047.	822.	1,522.	2,610.	5,356.	5,227.	5,114.	1,733.	1,191.	949.	1,735.	1,071.	31,377.
1930-31	1,319.	1,337.	2,938.	3,033.	1,944.	2,085.	2,230.	1,459.	566.	225.	1,004.	458.	18,598.
1931-32	223.	220.	222.	3,154.	1,808.	2,771.	1,612.	1,097.	2,829.	2,125.	4,256.	5,053.	25,370.
1932-33	4,937.	4,896.	3,210.	2,960.	5,114.	5,220.	4,875.	2,532.	779.	806.	997.	821.	37,147.
1933-34	225.	246.	577.	525.	753.	1,295.	606.	847.	1,706.	1,492.	949.	499.	9,720.
1934-35	225.	224.	224.	257.	1,055.	1,880.	848.	1,013.	524.	1,793.	3,178.	5,061.	16,282.
1935-36	1,120.	454.	1,415.	4,448.	5,379.	3,547.	4,674.	1,218.	1,226.	796.	2,501.	1,186.	27,964.
1936-37	1,441.	580.	1,814.	1,576.	5,070.	4,330.	5,294.	3,363.	2,378.	2,055.	2,402.	5,184.	36,487.
1937-38	3,689.	2,887.	2,581.	2,435.	2,272.	2,501.	1,787.	414.	965.	892.	1,622.	585.	22,630.
1938-39	615.	268.	476.	745.	1,508.	2,511.	1,718.	2,176.	4,299.	2,812.	2,835.	1,492.	21,455.
1939-40	710.	274.	687.	1,317.	2,700.	2,085.	3,038.	1,230.	1,094.	2,497.	1,925.	787.	18,344.
1940-41	223.	221.	514.	1,196.	1,219.	2,688.	2,063.	481.	361.	1,419.	1,404.	803.	12,592.
1941-42	1,053.	595.	922.	4,965.	4,564.	4,733.	4,199.	1,832.	3,950.	2,734.	2,043.	1,900.	33,490.
1942-43	2,147.	851.	1,650.	3,286.	3,228.	4,951.	2,791.	1,831.	1,579.	1,317.	1,569.	1,040.	26,240.
1943-44	300.	224.	248.	1,417.	3,617.	4,821.	5,124.	2,899.	764.	1,397.	2,412.	3,763.	26,986.
1944-45	1,213.	811.	1,094.	2,610.	2,825.	1,635.	1,915.	4,126.	389.	3,973.	5,236.	2,045.	27,872.
1945-46	954.	698.	2,738.	5,042.	4,329.	5,213.	3,332.	5,350.	2,548.	1,787.	2,927.	3,783.	38,701.
1946-47	1,640.	988.	1,091.	2,411.	2,318.	5,227.	5,052.	2,617.	3,134.	1,917.	1,613.	1,124.	29,132.
1947-48	1,299.	4,791.	4,976.	5,190.	5,135.	4,305.	4,256.	2,575.	1,597.	4,497.	4,868.	4,576.	48,065.
1948-49	2,428.	1,926.	5,008.	3,173.	5,387.	4,072.	5,195.	2,141.	1,044.	3,817.	3,118.	1,608.	38,917.
1949-50	1,243.	661.	995.	990.	1,058.	2,252.	2,706.	1,689.	1,680.	1,382.	1,110.	2,057.	17,823.
1950-51	360.	514.	545.	855.	695.	1,833.	3,234.	1,004.	674.	856.	805.	224.	11,599.
1951-52	223.	809.	3,327.	1,980.	4,727.	5,204.	3,547.	1,540.	993.	223.	967.	1,296.	24,836.
1952-53	467.	261.	835.	1,066.	3,106.	2,190.	4,809.	978.	602.	2,518.	1,337.	1,575.	19,744.
1953-54	1,430.	645.	5,309.	4,141.	1,618.	1,826.	952.	633.	369.	309.	437.	225.	17,894.
1954-55	222.	219.	175.	229.	778.	432.	1,561.	349.	223.	356.	493.	380.	5,417.
1955-56	222.	220.	222.	232.	2,135.	1,420.	639.	2,107.	598.	2,111.	490.	933.	11,329.
1956-57	1,153.	258.	391.	348.	351.	995.	1,644.	1,421.	2,941.	1,703.	634.	5,054.	16,893.
1957-58	4,879.	1,882.	3,958.	3,170.	3,543.	5,204.	4,755.	3,582.	2,997.	3,647.	2,526.	224.	40,367.
1958-59	221.	220.	59.	649.	5,408.	4,497.	5,135.	2,034.	5,228.	3,174.	2,138.	1,710.	30,473.
1959-60	3,487.	2,365.	2,265.	2,890.	5,386.	4,884.	4,796.	2,120.	1,861.	2,586.	1,413.	5,350.	39,403.
1960-61	4,244.	1,002.	1,050.	1,883.	3,510.	3,961.	5,055.	2,284.	1,503.	1,914.	1,502.	1,801.	29,709.
1961-62	225.	368.	948.	894.	1,453.	2,186.	5,412.	284.	334.	298.	412.	624.	13,438.
1962-63	369.	437.	1,287.	3,720.	4,544.	3,522.	1,231.	1,023.	911.	1,991.	895.	687.	20,617.
1963-64	701.	395.	1,448.	5,059.	5,377.	4,551.	4,491.	5,146.	996.	4,209.	5,223.	2,922.	40,518.
1964-65	5,408.	1,788.	4,342.	5,217.	4,287.	4,401.	5,067.	3,166.	5,143.	4,395.	2,938.	1,263.	47,415.
1965-66	2,045.	728.	2,108.	5,231.	5,008.	4,636.	2,058.	3,397.	3,706.	2,182.	4,235.	2,153.	37,487.
1966-67	1,374.	977.	1,177.	5,221.	4,694.	2,150.	960.	660.	852.	2,821.	1,629.	466.	22,981.
1967-68	247.	616.	990.	1,101.	1,028.	1,148.	588.	373.	624.	291.	276.	225.	7,507.
1968-69	222.	224.	898.	1,098.	1,706.	3,584.	1,558.	805.	875.	1,193.	1,603.	4,537.	18,303.
1969-70	1,762.	696.	2,180.	3,775.	5,419.	5,205.	5,365.	744.	1,242.	2,239.	5,093.	1,897.	35,617.
AVERAGE	1,553.	948.	1,636.	2,431.	3,160.	3,380.	3,173.	1,864.	1,593.	2,008.	2,128.	1,950.	25,824.

TABLE VII-1

JACKSON BLUFF HYDROELECTRIC PROJECT
END-OF-MONTH RESERVOIR ELEVATION (ft)

WATER YEAR	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	AVERAGE
1926-27	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1927-28	68.3	68.0	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.4
1928-29	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1929-30	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1930-31	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.4	68.5	68.5	68.5
1931-32	67.8	67.1	67.0	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.2
1932-33	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1933-34	68.4	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1934-35	68.5	68.2	68.3	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1935-36	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1936-37	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1937-38	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1938-39	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1939-40	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1940-41	67.9	67.2	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.3
1941-42	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1942-43	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1943-44	68.5	68.1	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1944-45	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1945-46	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1946-47	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1947-48	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1948-49	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1949-50	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1950-51	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.1	68.5
1951-52	67.9	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.0	68.5	68.5	68.4
1952-53	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1953-54	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1954-55	67.5	66.7	66.5	68.0	68.5	68.5	68.5	68.5	67.9	68.5	68.5	68.5	68.0
1955-56	67.7	67.0	66.8	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.2
1956-57	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1957-58	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.1	68.5
1958-59	67.2	66.5	66.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.1
1959-60	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1960-61	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1961-62	68.4	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1962-63	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1963-64	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1964-65	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1965-66	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1966-67	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1967-68	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
1968-69	67.8	68.3	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.4
1969-70	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5
AVERAGE	68.4	68.3	68.3	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5	68.5

SECTION VIII

ESTIMATED CONSTRUCTION COST AND SCHEDULE

1. GENERAL

A cost estimate for the installation of new hydroelectric generating equipment and the required remedial work at Jackson Bluff Dam was prepared based on the preliminary arrangement and dimensions described herein. Quantities were established for major civil features to which unit costs were applied. The cost of the turbines was estimated on the basis of a preliminary cost estimate obtained from Allis-Chalmers. The correspondence containing this information is included in Appendix B. Additional amounts were added to these costs to include the cost of governors and installation costs. For the generators and other items of equipment, costs per kilowatt were used from experience with similar installations, and in part developed from preliminary pricing information from equipment suppliers.

The civil work costs are based on contractor bid prices adjusted to a January 1979 level. These contractor bid prices have a built-in escalation which is assumed to apply to the 18-month construction period. Assuming completion of the work in this period, this corresponds to the Project being on-line July 1980. As discussed later, additional escalation was applied to these costs to arrive at the estimated cost for the Project to actually enter service by October 1983, considered to be the earliest practical on-line date and corresponding to a bid price level of April 1982.

2. BASIS OF COSTS

a. Direct Construction Cost

The Direct Construction Cost consists of the total of all costs directly chargeable to the construction of the Project and, in essence, represents a contractor's bid.

Indirect costs are defined as those costs which are added to the Direct Construction Cost to result in the Total Construction Cost. Indirect costs include an allowance for contingencies, engineering and owner administration.

b. Contingencies

To allow for unforeseen difficulties during construction, and to reflect omissions of the smaller cost items in the estimates, an allowance of 15% was applied to the Direct Construction Cost estimates.

c. Engineering and Owner Administration

Engineering costs for the Project were based on a comparison with actual costs for similar work. The item includes all preliminary engineering work, field investigations, feasibility and environmental studies, FERC licensing, design, field inspection of construction, and owner administration. An allowance of 15% of the Direct Construction Cost plus Contingencies was included for this item.

d. Total Construction Cost

Total Construction Cost consists of the sum of the Direct Construction Cost, Contingencies, and Engineering and Owner Administration.

e. Interest During Construction

Based upon experience, a schedule of expenditures during the construction phase was determined. An annual interest rate of 6-1/2% was used to determine interest during construction, with re-investment interest at 6-1/2%.

f. Escalation

The preliminary cost estimate for this Project has been considered at a January 1979 bid level which is assumed to include escalation for an 18-month period. Bid prices for the anticipated actual project schedule have been escalated from the January 1979 bid level to an April 1982 bid date (corresponding to a project in-service date of October 1983) at an average annual rate of 7% for the 3.25-year period.

g. Total Investment Cost

Total Investment Cost for the conventional economic analysis consists of the Total Construction Cost plus Interest During Construction escalated to the in-service time frame. It represents the total investment in the Project. The Total Capital Requirements (bond issue amounts) including financing costs and reserve funds, are established in Section IX.

3. CONSTRUCTION COST ESTIMATE

A cost estimate summary for the installation of new generating equipment at Jackson Bluff Dam and the related modifications to the existing Project is shown in Table VIII-1. The estimated Total Investment Cost for construction completed in July 1980 (current costs corresponding to a January 1979 bid price level) is \$7,931,000, which is equivalent to \$901/kW. This Total Investment Cost escalated to an in-service date of October 1983 is \$9,882,000 equivalent to \$1,123/kW. Details of the preliminary cost estimate are shown in Table VIII-2.

A broad estimate of the costs of the safety related remedial measures currently under consideration by the State is \$552,000. This cost is not directly related to the hydro Project installation and therefore is not included in the project cost estimate. However, as discussed previously, an alternative economic analysis is

performed in Section IX to show the effect on the feasibility assuming that these costs were all absorbed by the Project.

4. DESIGN AND CONSTRUCTION SCHEDULE

A design and construction schedule is shown in Fig. 14. This schedule shows initial operation of the plant by October 1983, which is considered to be the earliest possible date for completion of any development considering the time requirements for further investigations, FERC License application and processing, design and construction. The schedule provides 18 months for the processing of the FERC License Application, which is considered to be a reasonable period assuming no or limited hearing procedures. The schedule further contemplates the initiation of the design and contract documents phase work about halfway through the estimated licensing period. At this time, an indication of the approval of the License should be possible as input from Federal, State and local agencies and other interested groups becomes available.

The schedule shows the FERC License Application being sent to the FERC by the City by July 1980. Final design and preparation of contract bid documents would proceed at about April 1981 with bidding and award of the major civil contract and major equipment contracts in early 1982.

TABLE VIII-1

JACKSON BLUFF HYDROELECTRIC PROJECT
CONSTRUCTION COST SUMMARY

Item	Cost
1. Preparatory Work	\$ 75,000
2. Auxiliary Spillway	223,000
3. Powerhouse	5,191,000
4. Spillway Gate Hoists	<u>150,000</u>
DIRECT CONSTRUCTION COST	\$ 5,639,000
Contingencies	<u>846,000</u>
Subtotal	\$ 6,485,000
Engineering and Owner Administration	<u>973,000</u>
TOTAL CONSTRUCTION COST	\$ 7,458,000
Interest During Construction	<u>473,000</u>
TOTAL INVESTMENT COST	\$ 7,931,000
(Bid 1/79, On-Line 7/80)	
Escalation	<u>1,951,000</u>
TOTAL INVESTMENT COST	\$ 9,882,000(1)(2)
(Bid 4/82, On-Line 10/83)	

(1) - A broad estimate of cost of the safety related remedial measures currently under consideration by the State is \$ 552,000. If this were included in the cost of the hydro project, the on-line total investment would be \$ 10,434,000.

(2) - Equal to \$1,123/kW installed at that time frame.

CONSTRUCTION COST ESTIMATE

Bid Price Level January 1979

PROJECT Jackson Bluff Hydroelectric Project FEATURE Preparatory Work LOCATION Florida W.O. FW-5102-HG1-QA

TYPE EST: PLANNING- TAKE-OFF JJD PRICED RLW CALC CHKD. AWP APPROVED JVW DATE February 1979

[illegible]

R. W. Beck and Associates

CONSTRUCTION COST ESTIMATE

Bid Price Level January 1979

PROJECT Jackson Bluff Hydroelectric Project FEATURE Auxiliary Spillway LOCATION Florida W.O. FW-5102-HG1-0A

TYPE EST. — PLANNING —

TAKE-OFF.....JJJ

PRICED RLH

 CALC. CHKD. AWP

APPROVED JWV

DATE February 1979

ITEM AND DESCRIPTION		QUANTITY	UNIT	MAT'L	LABOR	UNIT COST	TOTAL
2.	AUXILIARY SPILLWAY						\$223,000
2.1	Removal of Existing Saddle Dam						
2.1.1	Stripping	1,000	CY			2.00	2,000
2.1.2	Excavation	3,500	CY			2.00	7,000
2.2	Excavation	1,000	CY			2.50	3,000
2.3	Concrete Sill Structure						
2.3.1	Concrete	1,600	CY			75.00	120,000
2.3.2	Cement	8,000	CF			3.00	24,000
2.3.3	Steel Reinforcing	120,000	LB			0.40	48,000
2.4	Fuse - Plug						
2.4.1	Impervious Fill	230	CY			8.00	2,000
2.4.2	Pervious Fill	900	CY			2.00	2,000
2.4.3	Riprap	800	CY			15.00	12,000
2.4.4	Riprap Base	230	CY			9.00	2,000
2.4.5	Crushed Rock Base	60	CY			9.65	1,000

TABLE VIII-2

CONSTRUCTION COST ESTIMATE

Bid Price Level January 1979

Florida

FW-5103-HG2-0A

PROJECT Jackson Bluff Hydroelectric Project POWERHOUSE

LOCATION

W.O.

TYPE EST. PLANNING

TAKE-OFF PTC/FEB PRICED PTC/FEB CALC CHKD. DKS/PC

APPROVED JVW

DATE February 1979

ITEM AND DESCRIPTION		QUANTITY	UNIT	MAI'L	LABOR	UNIT COST		TOTAL
3.	POWERHOUSE							\$5,191,000
3.1	Civil Work							
	3.1.1 Care and Diversion of Water		LS					100,000
	3.1.2 Draft Tube Repair and Turbine Pit Modifications		LS					100,000
3.2	Mechanical Equipment							
	3.2.1 Turbine - 4800 HP including Governor	2	EA			650,000	(Installed)	1,300,000
	3.2.2 Turbine - 3400 HP including Governor	1	EA			540,000	(Installed)	540,000
	3.2.3 Misc. Mechanical Equip. & Piping		LS					150,000
3.3	Electrical Equipment							
	3.2.1 Switchyard Equipment							
	3.2.1a Transformers		LS					110,000
	3.2.1b Accessory Switching		LS					174,000
	3.2.2 Power Plant Elect. Equip.							
	3.2.2a Generators		LS					2,197,000
	3.2.2b Accessory Elect. Equip. including monitor and control system		LS					520,000

TABLE VIII-2

CONSTRUCTION COST ESTIMATE

Bid Price Level January 1979

PROJECT	Jackson Bluff Hydroelectric Project	FEATURE	Spillway Gate Hoists	LOCATION	Florida	W.O.	FW-5102-HG1-OA
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TYPE EST: PLANNING TAKE-OFF PTC PRICED PTC CALC CHKD. DKS APPROVED JVW DATE **February 1979**

[illegible]

TABLE VII-2

SECTION IX

ECONOMIC ANALYSIS

1. GENERAL

In a typical economic analysis for a hydroelectric project, the annual cost of a proposed project is compared with the annual value of the project power output allowing comparisons to be made between the benefits and costs of the project which will show the viability of developing the project. The value of the power generated by the project is considered to be the cost of an equivalent amount of power from the most economical alternative source. The annual cost of the project includes all costs for debt service, operation, maintenance, interim replacements, insurance and taxes. In this analysis, the most economical alternative source of power for the City is considered to be a simple-cycle combustion turbine generating plant with the identical dependable capacity and firm (prime) energy capability as the Jackson Bluff Project. This combustion turbine is considered to be substituting for a part of the City's proposed future generation program. Energy generation from the Project, produced in excess of the firm energy (secondary energy), is assumed to replace energy that would otherwise be generated by older, oil-burning steam units. The value of this secondary energy will therefore be compared to additional fuel purchases for these older steam units.

The economic analyses presented herein consist of the following comparisons: (1) the estimated cost of power from the Project during its first year of operation versus the cost of an equivalent amount of power from the alternatives considered (value or benefit) from which the benefit-cost ratio is determined; and (2) the estimated total cost of power from the Project during the

first ten years of operation versus the estimated cost of an equivalent amount of power from the alternative considered for the same ten-year period, on a present-worth basis. For each of the above comparisons, the analyses will be performed for two cases. First, it will be assumed that the safety-related remedial measures currently being considered by the State will not be included in the capital requirements for the financing of the Project. Second, it will be assumed that the cost of the measures currently being considered by the State will be reimbursed through the same bond issue used to finance the Project, and the cost of those measures will therefore be included in the capital cost of the Project.

For economic evaluation purposes, the useful life of the Project can be considered to be 50 years, although hydroelectric projects can have a longer useful life. FERC has used periods up to 100 years to evaluate hydroelectric projects and the procedure for filing license applications identifies that the basis for financial feasibility should be a period of 50 years, and that for economic feasibility is 100 years.

The City's Charter currently limits the period which bonds can be repaid to 50 years with historical practice being to provide for a bond term of 30 years. Therefore, a conventional economic analysis was made assuming bonds issued to finance the Project would be retired over a period of 30 years on a uniform debt service basis. There is, of course, a significant advantage to longer term financing, and many hydroelectric projects have been financed with 50-year bonds thus reflecting a financing period more representative of the economic life.

2. BASIS FOR COST OF ALTERNATIVE

a. General

For the purposes of this economic analysis the Jackson Bluff Hydroelectric Project is assumed to replace an additional simple-cycle combustion turbine generating unit with the same dependable capacity and firm energy output as the Project. It is assumed that this combustion turbine would be added to the City's system of generating resources in the future to become operational at the same on-line date as the Project. The cost of the combustion turbine unit is based on previous experience with similar units. The secondary energy from the Project is assumed to replace energy that would otherwise be generated by older, oil-burning steam units. The basic criteria for the economic feasibility analysis are shown in Table IX-1.

b. Combustion-Turbine Generation Costs

A Total Investment Cost of \$269/kW (on-line January 1979) was developed for a combustion turbine installation to deliver the output of the Jackson Bluff Project of 6,900 kW of dependable capacity and 7.00 million kWh of firm energy. This Total Investment Cost is then escalated at 7% per year to the same in-service date as the Project, October 1983. As shown in Table IX-2, this results in a Total Investment Cost of \$371/kW in that time frame. Including the financing costs and working capital, the Total Capital Requirements for the plant would be \$406/kW. Based on the criteria presented in Table IX-1, the total fixed annual costs for the plant are \$52.30/kW in the first year of operation. This is based on 6-1/2% financing with a 25-year term, which is the estimated useful life of such a project. The debt service remains constant throughout the operating period and all other costs are considered to be escalated at 7% per year.

In establishing the value of power from the Project, the total fixed annual cost of the combustion turbine alternative (per kW in the first year of operation which accounts for losses and forced outage reserves) is considered to be the value of the dependable capacity as delivered from the Project. The firm energy from the Project has a value based on the total variable annual costs of the combustion turbine unit. The total variable annual cost for the first year of operation is 62.7 mills/kWh.

c. Fossil Steam Generation Costs

The difference between the annual average and firm energy generated by the Project on an average annual basis is considered to have a value equal to the fuel cost from an older oil-burning steam generating unit, which is 27.1 mills/kWh (October 1978 price level) including a 5% variable cost associated with fuel handling. Assuming a 7% fuel cost escalation rate, this is equivalent to 39.4 mills/kWh for the first year of operation, October 1983 through September 1984.

d. Transmission Wheeling and Losses

It is assumed in this analysis that the alternative combustion turbine unit will be built close enough to the City's load center to allow the power generated from the unit to be transmitted over existing, City-owned transmission lines. Therefore, no transmission wheeling charges will be incurred. In addition, it is assumed that the transmission losses from the unit to the City's load center will be negligible.

e. Forced Outage Reserves

For the economic analysis, it is considered reasonable to use a forced outage reserve for the combustion turbine of 15% of the dependable capacity.

3. PROJECT COSTS

a. Capital Costs

The Total Investment Cost for the Project based on an on-line date of October 1983 was developed in Section VIII and is \$9,882,000 (\$10,434,000 with the reimbursement of safety related remedial measures being considered by the State included). The economic feasibility was based on this total investment requirement and on the basis of 30-year, 6-1/2% interest rate bond financing. The Total Capital Requirements for the 30-year, 6-1/2% interest, financing alternative is \$10,864,000 (\$11,467,000 with the reimbursement of safety related remedial measures being considered by the State), as shown in Table IX-3.

b. Annual Costs

(1) General

Annual costs consist of amortization costs and operating costs. Amortization and operating costs are shown for the first year of operation in Table IX-3.

(2) Amortization Costs

The major components of amortization costs are debt service of the bonded debt and earnings on the reserve fund. Earnings on reserve funds have been taken at 6-1/2%.

(3) Operating Costs

Operating costs consist of all costs required to operate and maintain the plant exclusive of amortization costs. Typically these costs include: operation and maintenance costs, administration and general expense, insurance, interim replacements, property

taxes paid to other government agencies, and transmission wheeling charges. Operating and maintenance costs are developed for a remote controlled plant but reflect the additional operating and maintenance costs which can be expected at the old Jackson Bluff Dam. Other costs are based on historic cost data published by the FERC and include administration and general, insurance and interim replacement. All of these costs have all been included in the economic analysis for the Project discussed herein.

A transmission wheeling charge of \$0.783/kW/month (1/79) has been used herein for the Project. This charge is for use of the 69-kV line owned by the Florida Power Corporation which will be used in transmitting Project power.

The total operating costs for the Project for the first year of operation is \$370,000 for the 30-year, 6-1/2% interest bonds.

(4) Total Costs

The estimated overall annual cost for the Project at the time it enters service is \$1,156,000 (\$1,200,000 with the reimbursement of safety related remedial measures being considered by the State) for 30-year, 6-1/2% interest.

c. Forced Outage Reserves

The experience with hydroelectric projects is that their reliability is significantly greater than thermal installations. It is considered reasonable to set aside a forced outage reserve of 5% of the dependable capacity of the Project as delivered to the load center. Hence, the value of this dependable capacity is reduced from 6,900 kW to 6,326 kW (including transmission losses) in terms of the economic feasibility analysis, and it is this number which is used in establishing the annual capacity benefit of the Project.

4. ANNUAL BENEFITS

The annual value, or benefit, from the Project is considered equal to the annual cost of the combustion turbine, fossil steam alternative. The values of capacity and energy, both firm and secondary, are derived in Table IX-4 using the basic information from Table IX-1. The delivered energy is the same as the Project and the cost per kW of the combustion turbine is adjusted so that it will deliver the same dependable capacity to the load centers as the Project with due allowance for forced outage reserves and transmission line losses. Table IX-4 shows that this alternative results in a total annual benefit to the Project during the first year of operation of \$1,470,000 which can be compared with the estimated annual cost of the Project of \$1,156,000 (\$1,200,000 with reimbursement of the remedial measures being considered by the State) for 30-year, 5-1/2% interest. This shows that the first year benefit-cost ratio is 1.27, which becomes 1.23 if reimbursement is made for safety-related items being considered by the State.

5. ANNUAL COSTS OVER A TEN-YEAR PERIOD

It is common current practice to perform economic analyses for hydroelectric projects over the first 10 years of project operation, to reflect the future escalation of costs of the alternative. If a longer period is used, the results are not considered meaningful since the value of the dollar continues to decrease. Annual costs have been developed for the Project and the alternative over the first ten years of operation. The debt service portion of the annual costs would remain fixed. However, other costs are considered to escalate at an annual rate of 7%, including transmission wheeling charges. The annual surplus or deficit amounts for the Project annual costs as compared to the benefits were developed on a present-worth basis and are summarized in Tables IX-5 and IX-6.

The Jackson Bluff Project would result in significant savings for the first ten years of Project operation amounting to \$4,486,000 (\$4,160,000 with reimbursement of safety-related remedial measures considered by the State included) on a present-worth basis.

6. RESULTS OF ECONOMIC ANALYSIS

The economic analysis shows that significant savings will result to the City from the reinstallation of generating equipment at Jackson Bluff Dam when compared to the estimated value of the power from this installation based on the most economic alternative of a combustion turbine combined with fuel replacement of existing steam units. With 30-year financing the Project shows a benefit-cost ratio during the first year of operation of 1.27 (1.23 with reimbursement of the remedial measures being considered by the State included). A savings of \$314,000 (\$270,000 with reimbursement of the remedial measures being considered by the State) over the combustion turbine alternative is estimated during the first year of operation. The cumulative present worth of these savings over the first 10 years of Project operation is about \$4.5 million and will increase during subsequent years of operation.

TABLE IX-1

JACKSON BLUFF HYDROELECTRIC PROJECT BASIC ASSUMPTIONS FOR ECONOMIC ANALYSIS

PROJECT:

On-Line Date -----	October 1983
Economic Life -----	50 Years
Bond Term -----	30 Years
Interest Rate -----	6.5%
Reinvestment Interest Rate -----	6.5%
Working Capital -----	4 Months of O&M
Operation and Maintenance (10/83) -	\$170,000
Administrative and General -----	39% of O&M
Insurance -----	0.1% of Total Investment Cost
Interim Replacements -----	0.3% of Total Investment Cost
Property Taxes -----	None
Transmission Wheeling Charge (1/79)	\$0.783/kW Month
Transmission Losses - Peaking -----	3.5%
Transmission Losses - Energy -----	3.5%
Escalation Rate -----	7%
Forced Outage Reserves -----	5%

COMBUSTION TURBINE:

Total Investment Cost (1/79) -----	\$269/kW
On-Line Date -----	October 1983
Economic Life -----	25 Years
Bond Term -----	25 Years
Interest Rate -----	6.5%
Reinvestment Interest Rate -----	6.5%
Working Capital -----	45 Days of O&M
Operation and Maintenance, Fixed Portion (10/83) -----	\$7.20/kW
Operation and Maintenance, Variable Portion -----	5% of Fuel Costs
Administrative and General -----	39% of O&M
Insurance -----	0.25% of Total Investment Cost
Interim Replacements -----	0.7% of Total Investment Cost
Property Taxes -----	None
Transmission Wheeling Charge -----	None
Transmission Losses - Peaking -----	Negligible
Transmission Losses - Energy -----	Negligible
Escalation Rate -----	7%
Forced Outage Reserves -----	15%
Cost of Fuel (10/78) -----	\$0.36/gal
Heat Rate -----	16,000 Btu/kWh
Heat Content of Fuel -----	140,000 Btu/gal

TABLE IX-1
(continued)

FOSSIL STEAM:

Cost of Fuel (10/78) -----	\$14.00/BBL
Heat Rate -----	11,000 Btu/kWh
Heat Content of Fuel -----	142,000 Btu/gal.
Transmission Wheeling Charge -----	None

TABLE IX-2

JACKSON BLUFF HYDROELECTRIC PROJECT
ESTIMATED COSTS OF ALTERNATIVE

COMBUSTION TURBINE (DEPENDABLE CAPACITY - FIRM ENERGY):

CAPITAL COSTS⁽¹⁾

Item	\$/kW
Total Investment Cost	\$ 371
Reserve Fund(2)	26
Bond Discount(3)	8
Working Capital	1
TOTAL CAPITAL REQUIREMENTS ...	\$ 406

FIXED ANNUAL COSTS⁽⁴⁾

Item	\$/kW
Net Debt Service(5)	\$ 31.59
Insurance	0.93
Operation and Maintenance	7.45
Administrative and General ...	2.91
Interim Replacements	2.60
Subtotal	\$ 45.48
Adjustment for Forced Outage	
Reserves	6.82
TOTAL FIXED ANNUAL COST	\$ 52.30

VARIABLE ANNUAL COSTS⁽⁴⁾

Item	mills/kWh
Fuel	59.7
Operation and Maintenance	3.0
TOTAL VARIABLE ANNUAL COSTS ..	62.7

EXISTING FOSSIL STEAM (SECONDARY ENERGY):

VARIABLE ANNUAL COSTS⁽⁴⁾

Item	mills/kWh
Fuel	37.5
Operation and Maintenance	1.9
TOTAL VARIABLE ANNUAL COSTS ..	39.4

TABLE IX-2
(continued)

- (1) Based on installation coming on-line in October 1983.
- (2) Equal to one year of interest (6.5%) on the Total Capital Requirements.
- (3) Equal to 2.0% of the Total Capital Requirements.
- (4) Values shown are for the first year of operation, October 1983 through September 1984.
- (5) Based on a bond with 25-year term at 6.5% interest; includes credit for interest earned on Reserve Fund.

TABLE IX-3

JACKSON BLUFF HYDROELECTRIC PROJECT
PROJECT ESTIMATED COSTS

Item		With Reimbursement of Safety-Related Items Currently Being Considered by State
CAPITAL COSTS (1)		
Total Investment Cost	\$ 9,882,000	\$10,434,000
Reserve Fund (2)	706,000	745,000
Bond Discount (3)	217,000	229,000
Working Capital	59,000	59,000
TOTAL CAPITAL REQUIREMENTS	\$10,864,000	\$11,467,000
ANNUAL COSTS		
<u>Amortization of Debt (4)</u>		
Net Debt Service	\$ 786,000	\$ 830,000
TOTAL AMORTIZATION COSTS	\$ 786,000	\$ 830,000
<u>Operating Costs (5)</u>		
Operation and Maintenance	\$ 176,000	\$ 176,000
Administration and General	69,000	69,000
Insurance	10,000	10,000
Interim Replacements	30,000	30,000
Transmission Wheeling Charge	85,000	85,000
TOTAL OPERATING COSTS	\$ 370,000	\$ 370,000
TOTAL ANNUAL COSTS	\$ 1,156,000	\$ 1,200,000

- (1) - Based on installation coming on-line in October 1983.
 (2) - Equal to one year of interest (6.5%) on the Total Capital Requirements.
 (3) - Equal to 2.0% of the Total Capital Requirements.
 (4) - Based on a bond with 30-year term at 6.5% interest; includes credit for interest earned on Reserve Fund.
 (5) - Values shown are for the first year of operation, October 1983 to September 1984.

JACKSON BLUFF HYDROELECTRIC PROJECT
ANNUAL PROJECT BENEFITS AND COSTS (1)

With Reimbursement
of Safety-Related Items
Currently Being Considered
by State

Item		
PROJECT ANNUAL COSTS:		
Total Amortization Cost	\$ 786,000	\$ 830,000
Operating Costs	<u>370,000</u>	<u>370,000</u>
TOTAL PROJECT COSTS	\$1,156,000	\$1,200,000
PROJECT ANNUAL BENEFITS:		
Capacity Value (2)	\$ 331,000	\$ 331,000
Firm Energy Value (3)	423,000	423,000
Secondary Energy Value (4)	<u>716,000</u>	<u>716,000</u>
TOTAL PROJECT BENEFITS	\$1,470,000	\$1,470,000
BENEFIT-COST RATIO	1.27	1.23

- (1) - Values shown are for the first year of operation, October 1983 through September 1984.
- (2) - 6,326 kW (6,900 kW less 3.5% for transmission losses and 5% Forced Outage Reserves) at \$52.30/kW.
- (3) - 6,753,000 kWh (6,998,000 kWh less 3.5% for transmission losses) at 62.7 mills/kWh.
- (4) - 18,167,000 kWh (18,826,000 kWh less 3.5% for transmission losses) at 39.4 mills/kWh.

JACKSON BLUFF HYDROELECTRIC PROJECT
10-YEAR PRESENT WORTH ANALYSIS

<u>Period</u>	<u>Project Cost(1)</u>	<u>Project Benefits(2)</u>	<u>Surplus or Deficit Amount</u>	<u>Surplus or Deficit Amount Present Worth (3)</u>
10/83-9/84	\$1,156,000	\$1,470,000	\$ 314,000	\$ 304,000
10/84-9/85	1,182,000	1,557,000	375,000	341,000
10/85-9/86	1,210,000	1,650,000	440,000	376,000
10/86-9/87	1,239,000	1,749,000	510,000	409,000
10/87-9/88	1,271,000	1,855,000	584,000	440,000
10/88-9/89	1,305,000	1,969,000	664,000	470,000
10/89-9/90	1,341,000	2,091,000	750,000	498,000
10/90-9/91	1,380,000	2,221,000	841,000	524,000
10/91-9/92	1,422,000	2,361,000	939,000	550,000
10/92-9/93	1,466,000	2,510,000	1,044,000	<u>574,000</u>
TOTAL PRESENT WORTH				\$4,486,000

(1) - Total operating costs escalated at 7% annually.

(2) - Variable annual costs of combustion turbine and existing fossil steam escalated at 7% annually.

(3) - Discount rate of 6-1/2%, October 1983 level.

JACKSON BLUFF HYDROELECTRIC PROJECT

10-YEAR PRESENT WORTH ANALYSIS

(With Reimbursement of Safety-Related Items Currently Being Considered by State)

<u>Period</u>	<u>Project Cost(1)</u>	<u>Project Benefits(2)</u>	<u>Surplus or Deficit Amount</u>	<u>Surplus or Deficit Amount Present Worth (3)</u>
10/83-9/84	\$1,200,000	\$1,470,000	\$ 270,000	\$ 262,000
10/84-9/85	1,226,000	1,557,000	331,000	301,000
10/85-9/86	1,254,000	1,650,000	396,000	338,000
10/86-9/87	1,283,000	1,749,000	466,000	374,000
10/87-9/88	1,315,000	1,855,000	540,000	407,000
10/88-9/89	1,349,000	1,969,000	620,000	438,000
10/89-9/90	1,385,000	2,091,000	706,000	469,000
10/90-9/91	1,424,000	2,221,000	797,000	497,000
10/91-9/92	1,466,000	2,361,000	895,000	524,000
10/92-9/93	1,510,000	2,510,000	1,000,000	<u>550,000</u>
TOTAL PRESENT WORTH				\$4,160,000

(1) - Total operating costs escalated at 7% annually.

(2) - Variable annual costs of combustion turbine and existing fossil steam escalated at 7% annually.

(3) - Discount rate of 6-1/2%, October 1983 level.

SECTION X

ENVIRONMENTAL CONSIDERATIONS

1. GENERAL

This section evaluates the potential for significant adverse environmental impacts created by the proposed reinstallation of hydroelectric generation facilities at the existing Jackson Bluff Dam. The primary purpose of this section is to identify any significant adverse impacts that could be caused by the Project.

From on-site observations and discussions with relevant agencies, a basic outline of issues and sources was constructed. Follow-up telephone conversations and data acquisition were made on those issues believed to be significant.

2. STREAMFLOWS

On an average basis, the proposed mode of daily operation for the Project during a typical weekday will consist of a base (off-peak) release for about 20 out of 24 hours of at least 1,100 cfs. Peaking releases could be expected to be approximately 3,700 cfs for a four-hour peaking period. The difference in water surface elevation between peak and off-peak releases in the channel below the dam will be around 6 feet or less. However, the operation of the plant is expected to be such that these downstream fluctuations are gradual and no worse than that which occurred during the period when generation equipment was previously installed at the powerhouse. Peaking operations and the resulting downstream fluctuations in water surface levels are not ordinarily expected to occur during the weekend.

The variations in flows and water surface elevations during peaking periods will impact downstream use of the river. These impacts will generally occur only in the daytime during weekdays and therefore will not affect weekend fishing activities and recreational use of the river.

The Ochlockonee River is designated as an outstanding Florida water and as such falls under the jurisdiction of the Department of Environmental Regulation (DER). A permit will be required from DER for construction.(11)

Provisions for setting minimum flow requirements exist in Florida State Law but none have been set in the Lake Talquin area. Future minimum flow regulations would come under the jurisdiction of Northwest Florida Water Management.(12) During the FERC License Application preparation more detailed operation studies would be made to identify ranges of flow fluctuation so as to minimize downstream impacts and to protect water quality.

3. RESERVOIR LEVELS

As discussed in Section VII, the proposed method of Project operation for hydroelectric generation involves maintaining Lake Talquin at a normal maximum level of El 68.5, with the reservoir being drawn down to El 66.5 only twice during the 44-year period of record. On an annual basis, the average reservoir draw-down would be less than one foot. Lake Talquin is currently operated at a lake level of approximately El 68. Historical data (1929-1959) shows a wide variation from a minimum of 48.7 feet in October, 1958 to a maximum of 70.70 feet on April 5, 1948. The flood of September 22, 1969 caused a higher lake level (71.16 feet) than found in the period 1929-1959.

Out of the possible 6,483 days from January 1, 1960 through September 1977, 156 days or 2.4% of the days had water levels less than 66.5 feet and 646 days or 10.0% of the days had water levels greater than 68.5 feet. On 802 days then or 12.4% of the possible days the lake level fluctuations were out of the proposed range. Thus, the proposed lake level fluctuations fall within present and historical operating levels and the environmental impacts of such lake level fluctuations are expected to be insignificant.

The reinstallation of the new generating units at the existing powerhouse and the installation of the new gate hoists at the existing spillway is not expected to degrade water quality in Lake Talquin or in the Ochlockonee River below the dam. Water quality may be temporarily degraded by construction activities involving work on the auxiliary spillway. Accordingly, the overall impact to water quality in Lake Talquin and Ochlockonee River resulting from development of the Project is expected to be small.

4. RECREATION

Lake Talquin is a high recreational use area. There are numerous fishing camps offering boats, motors, guides, meals and lodging.(14) The proposed Project is not expected to have impacts on the recreational use of the Lake.

Downstream uses of the Ochlockonee River include fishing, boating and hunting which will be impacted by the river level fluctuations discussed above. Since peaking operation of the power plant (and resulting downstream water level fluctuations) is not expected to ordinarily occur over the weekend, the impact to weekend recreation use is expected to be insignificant or non-existent.

5. FISH AND WILDLIFE

Lake Talquin is a well used sport-fishing lake. Channel catfish and white catfish thrive in sufficient numbers to support a local commercial fishery. Other abundant species include large-mouth bass, redear sunfishes, threadfin shad and bluegill.⁽¹³⁾

Lake Talquin is a designated fish management area. The designation was made in 1970, and the State of Florida Game and Fresh Water Fish Commission (FGFWFC) acquired regulatory control.⁽¹⁴⁾ The proposed Project is not expected to have impacts that might affect the quality and quantity of fish populations.

6. FLOODS

As discussed in Section V, the Corps of Engineers has developed a Probable Maximum Flood (PMF) for Jackson Bluff Dam. An order-of-magnitude study was made to estimate the incremental effects of flooding downstream of the dam assuming that a dam failure was occurring coincidentally with the PMF or 1/2 PMF. This analysis estimated the changes in flood elevations for the PMF and the PMF plus dam failure, and the elevation change from 1/2 PMF to 1/2 PMF plus dam failure.

Utilizing USGS historical flood data and topographic mapping, it was broadly estimated that for a one-half PMF event, the difference in downstream river levels with a dam failure and without a dam failure would probably be no more than one or two feet. The difference in water levels during a PMF event would be even less. As discussed in Section V, this indicates that damage to structures located downstream of the dam during floods of this magnitude would not increase significantly if the dam failed. Hence, on this basis it is considered that the structure should be modified to be able to discharge 1/2 PMF to meet Corps guidelines for dam safety.

7. STRATEGIC NATIONAL RESOURCES

Currently approximately 95% of the City of Tallahassee's energy supply is from fossil fuel generating stations (which utilize oil and natural gas) and approximately 5% is from nuclear generation. A national shortage of natural gas, fuel oil and the better grades of coal has occurred. The decreased supply of fossil fuel has been accompanied by significant increases in the cost of fuel, and of the power generated by facilities dependent upon these depletable resources.

It is estimated that the average annual energy generated by the Project will be 25,920,000 kWh, of which 6,753,000 kWh is considered firm and the remaining 18,167,000 kWh being secondary energy, all available at the load center. If used as a replacement for a portion of the generation by the City's fossil fuel generating stations, this hydro power would save about 2,179,000 gallons of fuel oil per year. Figured over the life of the Project of 50 years this would amount to over 2,594,000 barrels of oil.

8. SOCIO-ECONOMIC

A small commercial fishing industry consisting mainly of private individuals is presently supported by fresh water catfish in the Ochlockonee River and Lake Talquin.⁽¹⁴⁾ The present rapid urbanization of Tallahassee signifies that this region is quickly becoming the commercial and cultural center for northwest Florida. Lake Talquin and the Ochlockonee River are expected to satisfy part of the demand for recreational facilities for this urbanizing area.⁽¹⁵⁾ Thus, impacts on fishing, hunting and recreation may be important to the socio-economic function and status of the area.

There will be an economic gain in the area due to the employment of the construction workers. However, since the construction force required for the project will be relatively small the overall resulting beneficial economic impact will be correspondingly minor.

9. ARCHAEOLOGICAL/HISTORICAL

Since the lake levels and the power generation fluctuations are planned to fall well within historical levels, the inundation of historical and/or archaeological sites is not expected to be a problem. However, coordination with the Bureau of Historic Sites will have to be done during the FERC licensing process.

SECTION XI

CONCLUSIONS AND RECOMMENDATIONS

1. CONCLUSIONS

From the Feasibility Assessment Study of the Jackson Bluff Hydroelectric Project, it is concluded that:

a. The Project will consist of reinstallation of generating equipment at the powerhouse, installation of service spillway motorized gate hoists, and construction of a fuse-plug type auxiliary spillway. In addition to these Project-related items, the State of Florida is also considering certain safety-related remedial measures to be performed soon, consisting of repairs to, or replacement of, the existing north training wall; addition of a three-foot retaining wall at the powerhouse; modifications to the gated spillway approach wall; and excavation of an emergency (auxiliary) spillway in the saddle dam area.

b. The Project will have an installed capacity of 8,800 kW consisting of two 3,200-kW units and one 2,400-kW unit, the same size as installed previously. It will have a dependable capacity of 6,659 kW and will generate 24,920,000 kWh of energy on an average annual basis [6,753,000 kWh of which is firm (prime)] all delivered at the City's load center.

c. For the scheduled on-line date of October 1983, considered to be the earliest practical date, the Total Investment Cost of the Project is estimated to be \$9,882,000. A broad estimate of the cost of those safety-related measures currently being considered by the State is \$552,000 (January 1979 bid level).

d. For evaluating the firm energy and dependable capacity output of the Project, its cost based on 30-year revenue bonds at 6-1/2% interest, is compared with the most economical alternative of a new simple-cycle combustion turbine installation. The value of secondary energy from the Project is equated to savings in fuel cost of existing oil-fired thermal generation. The economic analysis over the first 10 years of Project operation shows a savings of \$4,486,000 on a present worth basis (October 1983 level). This present worth savings is reduced to \$4,160,000 if those safety-related measures currently under consideration by the State are reimbursed as part of the cost of the hydroelectric project. The first year benefit-cost ratio is 1.27 (1.23 with inclusion of the cost of the State safety-related items), which indicates a substantial degree of economic feasibility.

e. Development of the Project will result in some minor environmental changes, but no significant adverse environmental impacts are anticipated.

f. The Jackson Bluff Project shows sufficient promise of technical and economic feasibility to justify proceeding with the recommended investigations. This effort should proceed as soon as possible so that the Project can be completed to meet the proposed October 1983 on-line date.

2. RECOMMENDATIONS

It is recommended that the City:

a. Proceed promptly with further investigations and FERC Licensing of the Project, so that it can be scheduled to enter into service by the earliest practical date, considered to be October 1983.

b. Continue discussions with the State with a view to arriving at an agreement on the future operation of the Project, including the methods and cost.

c. Respond to the second DOE Hydroelectric PON (Program Opportunity Notice) when issued next month, with a view to obtaining a Federal grant this summer, which may defray up to 25% of the cost of installing generating facilities.

d. Explore with investment banker firms, the possibility of floating 50-year revenue bonds for the Project (because of the advantage of longer term financing to hydro development) and the probable interest rates associated with 30- and 50-year terms. These discussions could also include interim financing if considered necessary for expenditures prior to receiving bids for equipment and sale of the bonds.

SECTION XII

REFERENCES

CITED REFERENCES

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GENERAL REFERENCES

1. Georgia Institute of Technology. "Technical Report No. 2, Project 152-84, Spillway Model Studies, Jackson Bluff Dam," by H. R. Henry, April 10, 1950.
2. United States Geological Survey. "Flood of September 20-23, 1969 in the Gadsden County Area, Florida," by W. C. Bridges and D. R. Davis, 1972.

KEY MAP

R. W. BECK and ASSOCIATES			
ENGINEERS AND CONSULTANTS			
Seattle, Washington		Denver, Colorado	
General offices: Tower Building, Seattle, Washington 98101			
CITY OF TALLAHASSEE FLORIDA			
JACKSON BLUFF HYDROELECTRIC PROJECT			
PROJECT LOCATION MAP			
DATE: MARCH 1979	DRAWN: BBB	APPROVED: JAM	FIG: 1

NOTE:

Project feature details obtained from
FERC License exhibits and drawings
prepared by others for Florida Power
Corporation.

R. W. BECK and ASSOCIATES ENGINEERS AND CONSULTANTS Seattle, Washington Denver, Colorado General offices: Tower Building, Seattle, Washington 98101			
CITY OF TALLAHASSEE FLORIDA JACKSON BLUFF HYDROELECTRIC PROJECT JACKSON BLUFF DAM GENERAL PROJECT ARRANGEMENT			
DATE: MARCH 1979	DRAWN: BBB	APPROVED: JAM	FIG: 2

STATION	WORK UNDERTAKEN FOLLOWING 1957 FAILURE
0 + 00 to 10 + 50 ±	Original dam section to be strengthened.
10 + 50 to 15 + 40 ±	Damaged section to be removed and rebuilt.
15 + 40 to 21 + 70 ±	Washed out section to be rebuilt
17 + 70 ± to 20 + 70 ±	New steel sheet piling lapped 10 feet with existing sheeting.
21 + 70 ± to 26 + 50 ±	Damaged section to be removed and rebuilt.
26 + 50 ± to 31 + 50 ±	Washed out section to be rebuilt.
27 + 13 ± to 31 + 10 ±	New steel sheet piling lapped 10 feet with existing sheeting.
31 + 50 to 35 + 70 ±	Original section to be rebuilt.

NOTE:

Project feature details obtained from FERC license exhibits and drawings prepared by others for Florida Power Corporation.

R. W. BECK and ASSOCIATES

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Denver, Colorado

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CITY OF TALLAHASSEE
FLORIDA

JACKSON BLUFF HYDROELECTRIC PROJECT

MAIN DAM
TYPICAL SECTIONS

DATE:
MARCH 1979

DRAWN:
BBB

APPROVED:
JAM

FIG:
3

PLAN

ELEVATION
Looking upstream

Existing Florida
Power Corporation
69 kV switchyard

NOTE:

Project feature details obtained from FERC License exhibits and drawings prepared by others for Florida Power Corporation.

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CITY OF TALLAHASSEE
FLORIDA
JACKSON BLUFF HYDROELECTRIC PROJECT
EXISTING
POWERHOUSE AND SPILLWAY
PLAN AND ELEVATION

DATE: MARCH 1979 DRAWN: BBB APPROVED: SAM RE: 4

SECTION THROUGH POWERHOUSE
No Scale

SECTION THROUGH SPILLWAY
No Scale

NOTE:

Project feature details obtained from FERC license exhibits and drawings prepared by others for Florida Power Corporation.

R. W. BECK and ASSOCIATES ENGINEERS AND CONSULTANTS Seattle, Washington Denver, Colorado General offices: Tower Building, Seattle, Washington 98101			
CITY OF TALLAHASSEE, FLORIDA JACKSON BLUFF HYDROELECTRIC PROJECT EXISTING POWERHOUSE AND SPILLWAY SECTIONS			
DATE: MARCH 1979	DRAWN: BBB	APPROVED: JAM	RE: 5

NOTE:

Area-Capacity Curve taken from the June 1978 Corps of Engineers Safety Inspection Report for Jackson Bluff Dam.

R. W. BECK and ASSOCIATES

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Denver, Colorado

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**CITY OF TALLAHASSEE
FLORIDA**

JACKSON BLUFF HYDROELECTRIC PROJECT

AREA - CAPACITY CURVE

DATE:
MARCH 1979

DRAWN:
BBB

APPROVED:
JAM

FIG:
6

LEGEND:

- Florida Power Corp. existing facilities
- City of Tallahassee existing facilities
- - - City of Tallahassee proposed facilities
- Switching station
- △ Generating station
- Substation
- ▣ Proposed substation

R. W. BECK and ASSOCIATES
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Seattle, Washington Denver, Colorado

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CITY OF TALLAHASSEE
FLORIDA
JACKSON BLUFF HYDROELECTRIC PROJECT
EXISTING REGIONAL TRANSMISSION
AND GENERATION FACILITIES

DATE: MARCH 1979	DRAWN: BBB	APPROVED: JAM	FIG: 7
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NOTE:

Based on average monthly streamflows at Bloxham, Florida for the period 1927 to 1970. Data from USGS streamflow records.

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CITY OF TALLAHASSEE
FLORIDA

JACKSON BLUFF HYDROELECTRIC PROJECT

FLOW DURATION CURVE

DATE:
MARCH 1979

DRAWN:
BBB

APPROVED:
JAM

FIG: 8

R. W. BECK and ASSOCIATES

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CITY OF TALLAHASSEE
FLORIDA

JACKSON BLUFF HYDROELECTRIC PROJECT

FLOOD FREQUENCY CURVE

DATE:
MARCH 1979

DRAWN:
BBB

APPROVED:
JAM

FIG:
9

NOTE:

Water Surface Elevations and Discharges Taken From United States Department of Interior Geological Survey Data, Ochlockonee River Near Bloxha Florida

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Denver, Colorado

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CITY OF TALLAHASSEE
FLORIDA

JACKSON BLUFF HYDROELECTRIC PROJECT

TAILWATER RATING CURVE

DATE:
MARCH 1979

DRAWN:
BBB

APPROVED:
JAM

FIG: 10

Lake Talquin
Normal W. S. El. 68.5

PLAN

LEGEND:

▨ Project modification

NOTE:

Existing project details obtained from FERC license exhibits and drawings prepared by others for Florida Power Corporation.

R. W. BECK and ASSOCIATES
ENGINEERS AND CONSULTANTS

Seattle, Washington Denver, Colorado

General offices: Tower Building, Seattle, Washington 98101

CITY OF TALLAHASSEE
FLORIDA

JACKSON BLUFF HYDROELECTRIC PROJECT

PROJECT
MODIFICATIONS TO
POWERHOUSE AND SERVICE SPILLWAY

DATE: MARCH 1979	DRAWN: BBB	APPROVED: JAM	FIG: 11
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R. W. BECK and ASSOCIATES			
ENGINEERS AND CONSULTANTS			
Seattle, Washington		Denver, Colorado	
General offices: Tower Building, Seattle, Washington 98101			
CITY OF TALLAHASSEE FLORIDA			
JACKSON BLUFF HYDROELECTRIC PROJECT			
PROJECT MODIFICATIONS TO AUXILIARY SPILLWAY			
DATE: MARCH 1979	DRAWN: BBB	APPROVED: SAM	FIG: 12

LEGEND:

New equipment

10' 0 10'
Scale

R. W. BECK and ASSOCIATES ENGINEERS AND CONSULTANTS Seattle, Washington Denver, Colorado General offices: Tower Building, Seattle, Washington 98101			
CITY OF TALLAHASSEE FLORIDA JACKSON BLUFF HYDROELECTRIC PROJECT PROJECT MAJOR EQUIPMENT INSTALLATION			
DATE: MARCH 1979	DRAWN: BBB	APPROVED: JAM	FIG: 13

LEGEND:

- Major effort
- Continuing effort

R. W. BECK and ASSOCIATES ENGINEERS AND CONSULTANTS Seattle, Washington Denver, Colorado General offices: Tower Building, Seattle, Washington 98101			
CITY OF TALLAHASSEE FLORIDA JACKSON BLUFF HYDROELECTRIC PROJECT DESIGN AND CONSTRUCTION SCHEDULE			
DATE: MARCH 1979	DRAWN: BBB	APPROVED: JAM	FIG: 14

APPENDIX A

GEOLOGICAL RECONNAISSANCE REPORT

KIM DE RUBERTIS

CONSULTING ENGINEER

February 15, 1979

Mr. Val Maxim
R. W. Beck and Associates
200 Tower Building
Seattle, Washington 98101

Dear Mr. Maxim:

The purposes of this letter report are to describe the results of a geologic reconnaissance of the site of the existing Jackson Bluff Dam and to describe the site geology and how it relates to the design for the proposed project features.

1. GENERAL

Jackson Bluff Dam is located on the Ochlockonee River about 20 miles west of Tallahassee, Florida. A reconnaissance was made of the site on 6 December 1978 in the company of Messrs. Williamson, Maxim, and Street of R. W. Beck and Associates; Mr. Morgan of the City of Tallahassee; and Lt. Griffin of the Florida Department of Natural Resources.

The existing project consists of a main embankment dam, a saddle dam, a spillway, and a powerhouse. The main embankment is about 3,600 feet long with a maximum height of about 40 feet. A depression in the reservoir rim is closed by the saddle dam, a 550-foot long structure with a maximum height of about 9 feet. The spillway structure abuts the main embankment dam and consists of a hollow reinforced concrete section with a maximum structural height of about 60 feet. The indoor powerhouse is adjacent to the spillway. It has a reinforced concrete substructure, a brick superstructure, and rises to a maximum structural height of about 63 feet.

The proposed project would (1) reinstall generating units in the existing powerhouse and (2) make certain safety related modifications to the existing project features.

Reviewed in the preparation of this letter were safety inspection reports by R. W. Beck and Associates, dated January 1978, and by Law Engineering Testing Company, dated February 1967.

2. REGIONAL GEOLOGY

Jackson Bluff Dam and Reservoir are located within the Gulf Coastal Lowland and Northern Highland Regions of the Coastal Plain Province.

a. Geologic History

The geologic history of the region is one of deposition in a stable marine environment. Tertiary and Quaternary marine sediments have been deposited upon Precambrian basement rocks. The region has not experienced great deformation within the Tertiary to Recent record.

b. Stratigraphy

The rocks of north Florida are relatively young clastic sediments consisting mainly of clays, limestones, and sandstones. These rocks are seldom well indurated and vary widely in composition and hardness. Post-Miocene to Recent overburden mantles rock throughout the region. The overburden generally is comprised of sands and occasional clays.

c. Geologic Structure

The peninsula of Florida appears to be formed over an arch in the Precambrian basement rocks. Regional dips in the overlying sediments are developed at low angles in the direction of the Gulf of Mexico. Landforms, ridges and low hills of the region, are bedrock controlled. Recent faults of a regional nature have not been recognized at the surface.

d. Earthquake Hazard

As shown on Fig. 1, the site is located within Seismic Hazard Zone 1 as designated by the Corps of Engineers. Earthquake hazard is minor and is not considered to have an influence upon the future stability of existing structures or upon the design for the proposed project features.

3. SITE GEOLOGY

The site occupies the Ochlockonee River Valley with the reservoir extending about 15 miles upstream. Jackson Bluff, a low limestone ridge, forms the left abutment at the site.

a. Geologic History

The site geologic history conforms to the history of the region: marine deposition in a stable environment.

b. Stratigraphy

The rocks at the site are of Miocene Age -- the Hawthorn and Jackson Bluff Formations. The Hawthorn Formation crops out at the base of the left abutment and is believed to form the foundation for the powerhouse and spillway. It is a sandy limestone. The Jackson Bluff Formation overlies the Hawthorn and consists of

interbedded poorly indurated fossiliferous sands, clays, and sandy marls. A mantle of post-Miocene to Recent sands blanket bedrock throughout the site.

c. Geologic Structure

The outcrop at Jackson Bluff shows flat lying beds. Well developed joint sets were not noted, nor were any faults observed in the site area.

4. ORIGINAL DESIGN AND CONSTRUCTION

The original design and construction drawings for the embankment dam, powerhouse, and spillway were not reviewed for the purposes of this report. The reader is referred to Chapter 3 (History of the Project) of the previously cited safety inspection report prepared by Law (1967). This reference details the known facts concerning design, construction, and operating history. The operating history includes several generations of modifications and repairs and explains the embankment failure which occurred in 1957. The Beck Report continues the history of the Project through 1978.

5. CURRENT CONDITION

The safety inspection report by Beck (1978) summarizes the current conditions and details a number of recommendations to remedy certain existing conditions which bear upon the continued safety of the project. The highest priority recommendations are (1) to repair or replace the north training wall; (2) to construct an emergency spillway to accommodate an increased design flood; (3) to effect repairs to the spillway approach channel at the embankment dam; and (4) to motorize the travel mechanism of the gate hoists. The reconnaissance did not reveal other conditions not summarized in previous reports.

6. PROPOSED PROJECT

The proposed reinstallation of generating units in the now vacant existing powerhouse bays will not involve excavation into the powerhouse foundation and is not believed to result in any loads or discharges upon the foundation not considered in the original design. It is considered that the geologic conditions at the site will have no impact upon the design for reinstalling generation.

The recommendations for remedial work involve several geological considerations.

The proposal to repair or replace the north training wall requires attention to three factors. The first of these is to retain continuous support of the toe of the earth embankment. Embankment stability during remedial work would be enhanced by drawing down the reservoir as much as possible, at least to the crest

of the spillway. Any solution should respect the need to provide positive drainage at the restored toe of the embankment. Lastly, the Law Report (1967, p. 9) states: "The riverbed was excavated to the irregular limestone rock and cavities and fissures in the rock filled by dental methods." This indicates the probability of encountering an irregular foundation for sheet piling and/or concrete structures.

The proposal to construct an emergency spillway at the site of the existing saddle dam envisions the use of naturally occurring on-site materials for the major structural portion of the fuse plug. The available materials appear to be loose, poorly graded, fairly clean sands, and these should be adequate for fuse plug construction. Consideration should be given to controlling seepage through the section, to providing drainage, and to preventing undesirable erosion from wave action at the upstream face.

The proposal to effect repairs to the spillway approach channel at the embankment dam has the purpose to prevent further erosion of embankment material during spillway discharge. Apparently, embankment material is being plucked from the corner behind the approach channel training wall by high velocity flow and/or an eddy. Riprap has been selectively placed to impede further erosion but has not been entirely effective. The seepage path through the embankment at this point (adjacent to the right spillway wall) is the shortest of all points along the embankment. If riprap is considered as a part of the solution employed to remedy the problem, it is suggested that provisions to adequately bed the riprap be made to prevent loss of fines. Depending upon the solution selected for the north training wall, it may be desirable to lengthen the seepage path through the section adjacent to the right spillway wall.

The proposal to motorize the travel mechanism of the gate hoists does not involve geologic considerations.

As conceptual solutions to the desired remedial work develop, an exploration and testing program should be devised to furnish appropriate design information -- for example, depth to and nature of bedrock surface under north training wall, gradation and shearing resistance of fuse plug material, configuration and condition of original wing wall at the right spillway approach channel. Elaborate and costly exploration and testing is not foreseen to be required.

If you have any questions regarding this letter, please let me know.

Yours very truly,

Kim de Rubertis

Figure 1

APPENDIX B

CORRESPONDENCE FROM GENERATING
EQUIPMENT MANUFACTURERS

BOX 712 • YORK, PENNSYLVANIA 17405 / 717 792-3511

YORK PLANT
HYDRO-TURBINE DIVISION

February 12, 1979

R. W. Beck and Associates
Tower Building
Seattle, Washington 98101

ATTENTION: Mr. Val A. Maxim
Principal Engineer

SUBJECT: Jackson Bluff Dam
Your File No. FW-5102-HG1-QA-3103
Allis-Chalmers Proposal No. 6-36252-J

Gentlemen:

Please refer to your letter of January 26, 1979, addressed to our Mr. Joseph Hangeland requesting information regarding supplying new turbines (to fit in existing wheel cases), generators and governors for the Jackson Bluff Dam, Tallahassee, Florida.

By copy of this letter to Siemens-Allis, we are requesting they provide preliminary information covering new generator units to match the vertical mixed flow diagonal turbine units proposed herein.

We have investigated the feasibility of increasing the capacity of the original turbines using an eight bladed diagonal flow turbine runner. This design was selected because of the extreme high setting of existing turbine embedded parts with respect to elevation of the tailwater. Enclosed are two (2) prints each of Curve No. 6-36252-J-1 and 6-36252-J-2 dated February 8, 1979, showing the expected performance of the units which were originally rated at 4,800 horsepower and 3,400 horsepower respectively. Because of the insufficient data supplied with your letter, we have made an estimate as to the diameters of the original turbine runners using the drawings enclosed with your letter. For the single small units (3,400 HP) we estimate turbine runner diameter to be 104" using the dimensions provided on the draft tube drawing no. 19. We estimate that the two larger units rated at 4,800 HP had a diameter of approximately 125" using Power House Substructures drawing no. 30 which you provided.

In deriving the expected performance we have not considered various parameters including the following:

- a. Overall dimensions of the existing water passageways including spiral case, wicket gate area and draft tube.

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- b. Sufficient wicket gate servomotor stroke to achieve the increased capacity.

The maximum output recommended for operation with the minimum tailwater elevation at 35.0 feet is 6170 horsepower for the large 125" units, and 4,500 for the small 104" unit under a net head of 32 feet. This limit recommendation resulted from our studies of the existing model test cavitation data of the proposed runner. A normal pitting guarantee could be made for the recommended limiting output of 6,170 horsepower and 4,500 horsepower in their respective cases.

We have made a table of various dimensions from the existing model of the prototypes required size. The following dimensions are submitted for your review:

	<u>Proposed Replacement Dimensions or Step-up Dimensions from Model to fit in original case of 4800 HP rating</u>	<u>Proposed Replacement Dimensions or Step-up Dimensions from Model to fit in original case of 3400 HP rating</u>
a. Runner discharge diameter	125 inches	104 inches
b. Number of runner blades	8 blades	8 blades
c. Gate pin circle diameter	150.0 inches	124.0 inches
d. Pad height (wicket gate plus clearance height)	51.06 inches	42.48 inches
e. Number of wicket gates	20 wicket gates	20 wicket gates
f. Gate opening at cavitation limit.	11.98 inches	10.83 inches
g. Speed	112.5 rpm	138.5 rpm
h. Distance from distributor centerline to the bottom of the runner	68.89 inches	57.31 inches
i. Maximum runaway speed	210.4 rpm	252.9 rpm

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We were unable to compare the above dimensional information with the existing units because of the insufficient data supplied. Our proposed replacement runners may not fit exactly into the present wheel case, therefore some modifications may be required in both the turbine output and the cavitation limits after additional studies are made.

Naturally we would recommend the customer consider an overhaul of the entire remaining turbine when installing the new runner, shaft and packing box. Such work would included replacing packing, bushings and other miscellaneous items normally considered when doing an overhaul.

We would recommend a carbon steel runner (ASTM 27) with stainless steel overlay. Delivery of a replacement runner can be made in approximately sixteen (16) months after receipt of an order.

The estimated cost for a replacmenet mixed flow diagonal turbine runner of carbon steel with stainless steel overlay, new shaft, bearing and packing box would be \$447,000 for each large unit and \$375,000 for the small unit. This is a very preliminary price and is derived from previous contract runner prices as compared to securing actual casting quotations and preparing detailed estimating prices of the specific equipment being proposed.

Please contact the writer should you have any questions regarding the increased capacity of the existing turbine at Jackson Bluff Dam of the City of Tallahasee.

Very truly yours,

Richard F. Dague
Sales Engineer
Customer Service

RFD/kah

Enclosures

cc: Mr. Roger Braun, Manager, Marketing Services, Siemens-Allis, Inc.
West Allis

4000 4500 5000 5500 6000 6500 7000

HORSEPOWER

EFFICIENCY %

DISCHARGE (CFS)

ORIGINAL
RATINGCAVITATION LIMIT
WITH TAILWATER
AT ELEVATION
35. FT.32 FEET
NET
HEAD112.5 RPM
125" DIACURVE NQ6-36252-J-1
EXPECTED
PERFORMANCE
CURVEVERTICAL AXIAL
FLOW TURBINE

FOR: CITY OF TALLAHASSEE, FL.

JACKSON BLUFF DAM

BY: ALLIS CHALMERS CORP.

HYDRO-TURBINE DIV.

YORK, PA. 2/8/79 R.T.D.