6.0

ECONOMIC AND SOCIAL EFFECTS OF PLANT OPERATION

TABLE OF CONTENTS

CHAPTER 6.0

ECONOMIC AND SOCIAL EFFECTS
OF PLANT CONSTRUCTION AND OPERATION

LIST OF TABLES

6.0 ECONOMIC AND SOCIAL EFFECTS OF PLANT CONSTRUCTION AND OPERATION

Construction and operation of the Seminole Plant Units No. 1 and No. 2 will have a variety of effects on residents of the area surrounding the proposed site as well as on people in other parts of the state and region. The purpose of this chapter is to identify to the extent possible the recipients of these effects, and to quantify the project benefits or costs to the groups affected.

Socioeconomic effects are often classified into "direct" and "indirect" effects. Synonymous descriptors are "internal" and "external" effects. Direct, or internal effects are those affecting primarily the owners, operators, and users of the facility; the costs of constructing and operating a generating plant are borne by these groups, and the users are charged a price for the electrical energy they consume. Indirect or external costs and benefits impact on people and interests in the vicinity of the project who, because of their proximity to the site and its activity, experience changes in their local environment -- such as traffic congestion, temporary population increases, increased spending by project personnel, and the like. Many of these effects are difficult to measure, and qualitative judgments often must be made as to the relative values of costs and benefits.

The section is divided into two parts. Section 6.1 deals with direct or internal effects, and consists of an analysis of the monetary values of the power generated and sold. Section 6.2 addresses indirect or external effects, and describes estimated changes in employment, population, income, and the use of private and public services in the site area. Baseline data are drawn from Section 2.10.

For the purpose of the economic analysis, a 30-year operating life for each generating unit was assumed. However, it is recognized that the actual operating life may be longer.

6.1 DIRECT (INTERNAL) ECONOMIC EFFECTS

6.1.1 Direct Benefits: Energy Sales

The principal direct benefits of the Seminole Plant will be those inherent in the uses of the electrical energy by consumers of the several distribution cooperatives purchasing power from Seminole Electric Cooperative, Inc (SECI). As a not-for-profit producer of power, SECI charges rates just sufficient to cover total costs of generation and transmission. It is not possible to measure in dollar terms exactly how much the power (SECI) produces is worth to its consumers. Measurement of value is complicated by the fact that electrical energy *per se* is of little use to the typical user; it is what the energy does -- to illuminate, create mechanical power, and heat or cool enclosed space, and so forth -- that is useful, and the factors governing the demand for such services depend on a number of things besides the cost of electricity. However, it can be said that a reliable, relatively low-cost source of electrical energy for homes, businesses, industry, and institutional uses is essential to our social and economic welfare in an advanced industrial economy and society.

It is well recognized, moreover, that shortfalls or curtailments in the supply of electric power are the cause of economic and social disruptions, which can range from being mildly annoying or inconveniencing to chaotic. Accordingly, the primary criteria for judging the merits of a proposed steam-electric generating facility are whether reliable alternatives exist and whether the proposed facility is the most economical means of ensuring the additional generating capability.

The arguments for SECI's development of wholly-owned generating capability with the station are presented in Section 1. Most important among these are the greater reliability of supply for the SECI member cooperatives, in the face of increasing siting problems for neighboring utilities with rapidly expanding service requirements of their own (thereby constraining the future availability to SECI of purchased power), and the economies of SECI's tax-exempt status and accessability to low-cost capital.

On the basis of past and projected trends in energy demand and sales, SECI is projecting that its members' kilowatt-hour (kwh) requirements will expand between 1976 and 1986 at rate of between 10 and 11 percent per year. Energy consumption by the 11 system members are expected to rise from 3.10 billion kwh in 1976 to 8.46 billion kwh in 1986. Peak system load over the same period is estimated to rise from 802.3 megawatts (MW; 1,000 kilowatts equals one MW) to 2,234.8 MW. All but 14 MW of the 1976 load was borne by neighboring utilities (mainly Florida Power Corporation (FPC) and Florida Power & Light Company (FP&L). In 1975, SECI purchased as tenants in common 14 MW of the 825 MW Crystal River Unit 3, a nuclear unit owned 90 percent by FPC.

With the proposed two 600-MW units in operation by 1986, SECI will be able to carry slightly more than one-half its estimated 1986 system peak load and, assuming a 68 percent capacity factor, supply about 85 percent of its members' energy requirements in that year (7.15 billion kwh out of a total requirement of 8.46 billion kwh), assuming no sales of unit power to other utilities.

6.1.2 Direct Costs

Seminole Plant Units No. 1 and No. 2 will involve the expenditure of over $925 million in capital investment by mid-1985, when Unit No. 2 is planned to commence full commercial operation. Annual operating costs with both units on line will exceed $300 million, of which fuel costs alone will account for $180 million, or 60 percent (1986 prices). Capital investment and operating costs include a substantial pollution control component, most of which are incurred by sulfur dioxide (SO_2) and fly ash control systems that remove those substances from the flue gas. Total costs of investment and operation are borne by the owner-cooperatives that comprise SECI. Ultimately, the costs are borne by the purchasers of the power generated, and the prices they pay include the costs of environmental protection measures built into the plant's operation.

Capital Investment Costs

Construction costs for the plant, including land, labor, and equipment, have been projected to total over $925 million* as follows:

Unit No. 1	$ 460,000,000	(1983 dollars)
Unit No. 2	465,170,140	(1985 dollars)
Total	$ 925,170,140	

*Source: SECI, May 1978

At nominal (nameplate) power ratings of 600,000 kilowatts (KW) per unit, the capital cost of the completed plant is $771 per KW of generating capability. Pollution control systems are estimated to account for approximately one-fifth of this figure.

Capital cost estimates are based on current (1978) costs of construction and equipment and have been escalated at a six percent annual rate to yield the above total values for each unit. Labor costs of construction will total an estimated $110 million (Autumn 1979 through Spring 1985, including escalation and fringe benefits).

Fuel Supply Costs

Illinois Basin bituminous coal will fuel the Seminole Plant. Each 600-MW unit will consume approximately 1.5 million tons annually. In 1986, with both units in regular operation (assuming a 68 percent average annual capacity factor) the fuel burn cost is projected at about $178.6 million (SECI, May 1978). Transportation of the coal will account for at least one-third of the delivered cost of the fuel.

Coal costs are predicted on a 1978 average cost of $1.60 per million Btu of coal with a heat value of 11,000-12,500 Btu per pound and a plant heat rate of approximately 10,000 Btu per kilowatt-hour generated. Coal prices are projected to escalate six percent annually (SECI, May 1978).

A 75-day average reserve stockpile of coal, or approximately 310,000 tons for each unit, will be maintained, but a storage area capable of 90 days supply is planned. The suppliers of the coal and the details of transporting it to the plant had not yet been determined at the time this report was prepared.

An oil-fueled power plant of equivalent size (1,200 MW) burning residual fuel oil would consume over 11 million barrels of oil per year at a cost of about $150 million (assuming a cost of $13 per barrel of oil). Natural gas is not available for new power plants, so no comparison of fuel costs is possible. Initial fuel cycle costs for a 1,200 MW nuclear power plant's first year of full operation would amount to about $20 to 25 million (including plutonium credit and shipping charges, but excluding waste disposal).

Operating and Maintenance (O&M) Costs

Labor and materials to operate the Seminole Plant (exclusive of fuel and fixed charges) are projected to cost $16.4 million in 1984, when Unit No. 1 is in full operation, and will rise to $34.2 million in 1986 with both units in operation. The plant's regular payroll is estimated to number 99 employees in 1983 and 1984, with a total annual wage and salary cost averaging $2.58 million (1983-84 rates). Unit No. 2 will require an additional 41 employees commencing in 1985, raising the annual labor cost to about $4.0 million for 140 persons. Wages and salaries are projected to escalate at a five-percent annual rate and are based on current (1978) levels and trends in generating station personnel costs. Labor costs include fringe benefits and employer's contributions, which typically comprise about 30 percent of total labor costs.

Materials and services utilized in operating and maintaining (O&M) the plant comprise about seven-eighths of total O&M costs, with plant labor accounting for the balance. In 1986, with both units in operation, total O&M costs (including labor) are projected at $34.2 million. Costs are based on current (1978) levels and trends of coal-fired steam generating plant operating costs, and assume a six percent annual rate of escalation.

Other Direct Costs

Other direct costs, which partly are a function of the level of operation of the plant, but also relate to fixed cost elements, include working capital expense, taxes, and insurance. Working capital is required primarily to maintain the 75-day fuel inventory. During 1984, working capital requirements are estimated at $2.2 million, rising to $5.0 million in 1986.

The Seminole Plant will be subject to property taxes on land, structures, equipment, and coal stockpile, and to a gross receipts tax. The basis for assessment of ad valorem property taxes has not been determined and therefore only gross estimates can be made of the additional revenues Putnam County jurisdictions containing the plant site would receive.

A more detailed analysis of potential tax liabilities is presented in Section 6.2.3. From that section, which is based on data from SECI, the Putnam County Appraiser's Office, and State of Florida sources, the following estimates of annual taxes are taken (data are for 1986, the first full year of operation with both units on line):

Estimated Taxes on Seminole Plant, 1986
(in millions of dollars)

Property Taxes, Putnam County	$ 9.21 million
State Gross Receipts Tax	5.90 million
Total	$15.11 million

Source: Section 6.2.3

As noted earlier, the tax estimates are not based on actual property valuations, and assume that current assessment ratios and tax ratios will remain constant. In fact, these parameters are likely to vary significantly over time.

Insurance costs are estimated on the basis of capital invested in the plant. A fixed charge rate of between 0.25 percent and 0.35 percent has been projected, which would yield a premium of between $2.31 and $3.24 million per year.

Present Value of Direct Costs

The projected total cost of the resources that would be employed in the construction and operation of the Seminole Plant is approximately $20 billion. This figure is based on present estimates of the costs of labor, fuel, materials, equipment, and capital, all of which could vary significantly. The $20 billion value is the sum of costs over the period 1979-2015, assuming a six percent average annual rate of cost escalation.

The present value of total capital and operating costs is estimated at $4.9 billion in 1983 dollars (the year Unit No. 1 is scheduled to commence regular commercial operation). The present worth of projected capital and operating costs was computed using SECI's estimated cost of capital, 8.5 percent.

6.2 INDIRECT (EXTERNAL) SOCIOECONOMIC EFFECTS

Throughout this socioeconomic analysis, the primary impact area of Putnam County will be the major focus. Although there may also be various types of impacts occurring in the secondary impact area consisting of Alachua, Bradford, Clay, Duval, Flagler, Marion, St. Johns, and Volusia counties, the impacts in this secondary impact area are not expected to be nearly as noticeable, if at all, as the impacts occurring in Putnam County. Therefore, unless stated otherwise further discussions of potential impacts will refer to the primary impact area of Putnam County.

6.2.1 Demographic Impacts

The population of Putnam County is expected to experience a slight increase in growth above the medium scenario baseline case of Table 2.9-4 due to the construction and operation activities that are a part of the Seminole project. These population changes will result from two factors. First, construction-phase labor requirements are expected to bring new families into the Putnam County area. Second, operation-phase labor requirements are also expected to attract new families to Putnam County.

Construction-Phase Labor Requirements and Costs

Construction of the Seminole project will require hundreds of workers over a multi-year time period. Table 6.2-1, gives estimates of manpower requirements and a tentative construction schedule. Labor requirements can be disaggregated into two major categories - manual and supervisory. Construction activities are expected to commence in the fourth quarter of 1979, and end by the middle of 1985. From Table 6.2-1, it can be seen that manual labor requirements are expected to reach a peak of 903 workers on an average day during the third quarter of 1982. Supervisory labor requirements are expected to reach a peak of 111 workers on an average day during the second quarter of 1982. Total labor requirements should also peak during the second quarter of 1982, with approximately 1,013 individuals working at the Putnam Site on an average day.

It is not expected that Putnam County will be able to supply all the labor demanded by Seminole construction activities. Therefore, it is expected that some workers will migrate from outside Putnam County and become new County residents. However, it is anticipated that most of the construction workers will commute from the Jacksonville area, which has labor union jurisdiction over the Putnam Site on the west bank of the St. Johns River. It is also possible, however, that some workers may commute from the Gainesville or Daytona Beach areas, which are also sources of skilled labor within 60 miles of the site.

Commuters will not cause any direct increase in the permanent population of the primary impact area of Putnam County. They will, however, have an impact on the daytime population of the area in the vicinity of the site. The permanent population of Putnam County will be affected by relocaters, however, who will be the primary source of population increase in Putnam County during the construction phase activities. Table 6.2-2 presents data for the estimated distribution of manual and supervisory construction phase personnel among commuters, relocaters, and local residents. The data in this table are a key input to the socioeconomic projections presented in this report. It must be stressed that the data presented in Table 6.2-2 represent rough estimates of expected future events, and that no special significance should be attached to any of the point estimates presented in Table 6.2-2. Appendix H-3 discusses the derivation of these data in greater detail.

From Table 6.2-2, Column 12, it can be seen that approximately 65 construction workers are expected to move into Putnam County during 1982, the peak year of construction activity. This figure is relatively small, however, when compared to the anticipated 818 workers who are expected to commute to the Putnam Site on a daily basis.

Population increase in Putnam County due to construction phase activities will not be confined to the migration of construction workers and their families into the county. As these construction workers spend their income, demand for goods and services within Putnam County will increase. As aggregate demand increases, additional employment will be induced in order to supply the incremental goods and services demanded. It is likely that some of the induced employment increases will result in induced population increases, beyond the direct population increases attributable to the demand for construction manpower. Table 6.2-3 gives an indication of the magnitude of construction phase labor costs. In Section 6.2.2, the data in Table 6.2-3 will become a key element in the formulation of Seminole project income projections. For now, however, it is sufficient to state that there will be both a direct and induced component to population changes during the construction phase.

Operation Phase Labor Requirements and Costs

The first unit of the Seminole project is expected to come on line during the middle of 1983. Table 6.2-4 presents estimates of the number of employees required annually.

As in the case of the construction phase, it is not expected that Putnam County will be able to supply all the labor demanded for operation phase activities. When Seminole Plant Unit No. 1 comes on line in mid-1983, jobs for approximately 99 employees will be created. In mid-1985, when Unit No. 2 comes on line, an additional 41 jobs will be created. It is anticipated that a significant proportion of the operating phase employees hired by SECI will migrate into Putnam County along with their families, leading to a population increase.

Total labor cost for the operation phase is also presented in Table 6.2-4. As operation phase employees spend this income, they will induce more employment in Putnam County. Hence, as in the construction phase, operation phase population increases should induce additional population increases as people move into Putnam County to help supply the additional goods and services demanded by the new operation phase employees and their families.

Population Impacts

Baseline population projections (without consideration of the proposed plant) for Putnam County have been presented in Table 2.9-4. Three scenarios are presented in this table, each reflecting different assumptions concerning the degree of migration into a given county. For Putnam County in the year 1985, the medium scenario baseline population projection is 48,500 people. The low scenario projection is 44,900 people, 8.0 percent below the medium scenario projection. The high scenario projection is 52,200 people, 7.6 percent above the medium scenario. Thus, the baseline population projection for Putnam County in 1985 can be restated as 48,500 plus or minus 8 percent depending upon one's assumptions regarding migration. The "plus or minus 8 percent" represents a range of values in which the actual 1985 population is estimated to fall.

It can be seen from Table 6.2-5, Column 5, that the Putnam County population projection for 1985 is 49,146. This projection reflects the situation expected to occur with the Seminole project. This estimate for 1985 is only 1.3 percent above the baseline medium scenario projection of 48,500, and easily falls within the confidence interval of plus or minus 8 percent for Putnam County in 1985. The implication of this analysis is that the population increase induced by the Seminole project will not be great enough to fall outside the confidence interval for the baseline case.

It can also be seen from Table 6.2-5 that the greatest demographic impact is expected to occur in 1983 when the population of Putnam County with the project is projected to be 48,251, or 1.6 percent above the baseline projection. Considering that the range of values for 1983 baseline projections is on the order of plus or minus 8 percent, it becomes apparent that even in the year of peak demographic impact, the population in Putnam County as a result of the Seminole project will not be significantly different from the population projected for the baseline case. After construction is completed and both units are in regular operation, the permanent change in the county's population over baseline projections would be 526 persons, or a maximum of one percent of the total county population. Appendix H.4 discusses the methodology used in assessing demographic impacts.

6.2.2 Economic Impacts

Employment Impacts

Putnam County employment will increase due to the Seminole project for two reasons. First, there will be a direct employment increase of workers during construction and operation of the Seminole project. Second, there will be induced employment from increased demand for goods and services in Putnam County.

In Table 2.10-6, employment projections for ten industrial sectors are presented for the years 1980 to 2000. In these baseline employment projections, the finance, insurance, and real estate sector; the transportation, communication, and public utility sector; the government sector, and the construction sector are projected to experience the most rapid rates of employment growth through the year 2000. These same four sectors will probably experience the most significant employment impacts due to the Seminole project. The construction sector will grow due to the direct demand for construction labor during the construction phase. The transportation, communication, and public utility sector will grow due to the direct demand for operating personnel once the Seminole units come on line. The finance, insurance, and real estate sector will grow due to the demand for banking services, insurance, and housing by the relocaters to Putnam County. Finally, depending on the way in which the Putnam County authorities handle the potentially large property tax revenues from the Seminole plant, the government sector could experience significant increases in employment as public services expand due to increased revenue.

Employment increases resulting from Seminole construction and operation phase activities are presented in Table 6.2-6. The peak year of employment impact is expected to be in 1983 when total Putnam County employment is expected to be 3.3 percent above the baseline employment of 16,378. Over the life of the plant, Seminole operation phase activities can be expected to cause an increase in employment of about 2.0 percent above the baseline employment projections. For a detailed discussion of employment projection methodology, refer to Appendix H.5.

Income Impacts

Putnam County income is expected to increase due to the Seminole project for two reasons. First, there will be a direct income increase resulting from the wages paid directly to labor during the construction and operation phases of the Seminole project. Second, there will be an induced component to the income increases. As the Seminole construction and operation phase employees and their dependents spend that income in Putnam County, the demand for goods and services will increase.

Putnam County personal income impacts are presented in Table 6.2-7. Direct and induced personal income impacts due to construction phase activities are presented in Column 3 of this table. Income generated due to construction activities is expected to peak in 1982 at a level of $9.2 million.

Direct and induced income generated due to operation-phase activities will first appear in 1983 when the first unit begins operation. In 1985, direct and induced operation-phase income will rise to $4.0 million as the second unit begins operation.

Income impacts are projected to peak in 1982 when the change from the baseline case is expected to be around 2.5 percent. Thereafter, total personal income impact as a percentage of the baseline income projection will decline steadily. By 1987, the income impact due to the Seminole project will have declined to only 0.1 percent of the baseline income projection. For a more detailed discussion of income impact projection methodology, refer to Appendix H.6.

There is another scenario that must be presented in this discussion of income impacts of the Seminole project. Due to uncertainty regarding the way in which Putnam County will handle the increases of property tax revenues, property tax impacts have not been considered in the formulation of demographic, employment, or income impact projections. Up to this point, this analysis has made the implicit assumption that property tax millage rates would be adjusted so that property tax revenues remain essentially constant, in real dollars, after the Seminole project is in the operation phase (implying a large measure of property tax relief to existing property holders).

One could assume, however, that property tax millages will not be changed from the current 1978 levels, and that Putnam County could experience a significant increase in property tax revenue as a result of the Seminole project. (See Section 6.2.3 for a more detailed discussion of property tax impacts.)

Assuming that the 1978 rate of 16.326 mills remains unchanged, approximately $11.7 million in property taxes would be paid by SECI to Putnam County in 1985. Assuming that the taxing jurisdictions spend this additional tax revenue locally, approximately $33.1 million in additional income would be generated in Putnam County's economy in 1985 alone, after all induced and multiplier effects are considered. Thus, assuming no change in the tax rate, the total income impact of the project in 1985 would be $38.2 million as opposed to $5.1 million as shown in Column 5 of Table 6.2-7. When property taxes are considered, the income impacts of local consumption by construction and operation phase personnel become small in comparison. Whereas the change from the baseline case is about 1.0 percent for 1985 when property taxes are not considered (Column 7 of Table 6.2-7), the change from the baseline income for 1985 becomes 6.4 percent when property taxes are considered.

Thus, it becomes evident that property tax is the key variable in the determination of income impacts resulting from the Seminole project. Since income changes influence employment changes, demographic changes, and the demand for public services, it becomes evident that a wide range of impacts is possible, all depending on how Putnam County handles the property tax issue.

For the remainder of this impact analysis, it will be assumed that property tax revenues and county expenditures will remain relatively constant in real per capita dollars throughout the duration of the Seminole project.

6.2.3 Public Finance Impacts

Construction and operation of the Seminole Plant will generate new tax revenues for several jurisdictions in Putnam County and for the State of Florida. Ad valorem taxes on the land, structures, equipment, and coal stockpile of the plant in the form of real and personal property taxes will be the source of additional revenues for local governments in the County, while the gross receipts tax will be the main source of new state level taxes. As a cooperative, SECI is exempt from state and federal income taxes, but it does pay property and gross receipt taxes. Moreover, the SECI distribution cooperatives pay sales tax on the power sold to ultimate consumers.

No official estimates of the taxes that will be paid by the Seminole Plant are available. The reasons are: (1) the bases for assessing the value of the land, improvements, and fuel supply at the proposed site have not been established by the Putnam County Assessor; (2) the price of the electrical energy to be sold to the member cooperatives has not been firmly estimated; and (3) tax rates for future years cannot be precisely predicted. Accordingly, it is only possible to estimate the general order of magnitude of various tax revenues, which in no way represent forecasts of tax rules and rates that may be in effect in the future.

Property Tax Impacts

It is uncertain how much of the expected capital cost (or other basis) of the Seminole Plant will be assessed for real and personal property taxes in Putnam County, and how much of the assessed valuation will be exempt. Also, the coal stockpile that will be maintained at the plant (a 75-day supply on the average) will be subject to property taxes. If it is assumed that 100 percent of the capital investment cost of the plant is the assessed valuation of the facility and that pollution control facilities are exempt, (such facilities will account for about 20 percent of the total capital cost), then the gross taxable value of the Seminole Plant would be on the order of $740 million. The net taxable value of the plant would average approximately one-half that figure, since the assessment would have to be on the undepreciated portion of the original capital cost of the plant. Thus, over the 30-year operating lives of each unit (No. 1, 1983 to 2012; No. 2, 1985 to 2014), property taxes on the plant would decrease each year, ceasing in the year 2015. The coal stockpile is also subject to a property tax, but it is assessed for tax purposes at a lower ratio (10 percent) than the plant. (Subsequent to completion of research, it was learned that the assessment ratio for the coal stockpile was reduced to one percent of full value.) In contrast to the plant's assessable value, the coal stockpile's taxable value will rise through the years, assuming cost escalation continues. Thus, the annual property tax on the coal inventory will rise through time until the plant approaches retirement and the fuel reserve is used up.

Table 6.2-8 summarizes the above discussion and supplies estimated values for property tax revenues under the stipulated assumptions. Changes in investment and fuel costs, assessment ratios and millage rates would, of course, materially affect the estimates. The table shows estimated taxable values and taxes at several points in time to illustrate the effects of depreciation (on plant taxes) and fuel price escalation on tax revenues. Assessment ratios and the millage rate are held constant, which implies that tax authorities in Putnam County would take full advantage of the increase in the county's assessed value resulting from the Seminole project. There is no basis in fact, it is emphasized, to assume that the jurisdictions would necessarily follow this policy. The two units are assumed to enter the tax rolls on January 1, 1983 and 1985, respectively, being exempt from property taxes until the year of their commissioning. Reviewing Table 6.2-8, property tax revenues on the plant would be at a maximum in 1985, amounting to approximately $11.7 million. Thereafter, they would decline. The values for 1999, the mid-point in time for the plant, represent a rough average. In 2012, Unit No. 1 is completing its final year of operation, Unit No. 2 has two more years, and the coal stockpile has reached its highest value. In 2013 and 2014 the stockpile is needed for only one unit, and will be used up in the final year. On the basis of the above assumptions, total real and personal property taxes that would accrue to Putnam County jurisdiction from the Seminole Plant would aggregate to $191.4 million over the 32-year period of 1983-2014.

Referring to the Baseline Section of the report that deals with Public Financing (specifically, subsection "Property Taxes"), it was noted that the assessed value of non-exempt real and personal property in Putnam County in 1976 amounted to $350.9 million (Table 2.10-17). Over the period 1972-1976, non-exempt assessed values had nearly doubled, with year-to-year changes on the order of 15 to 20 percent. If these rates of increase continue for the decade 1976-1985, non-exempt assessed values could be on the order of $1.4 billion to $2.2 billion by the mid-1980's. If it is assumed that the Seminole Plant is incremental to this trend, then its inclusion on the property tax bases would expand the rolls in, say, 1985 by one-third to one-half, a very substantial increase. To the extent that trends in assessed values were lower or higher than hypothesized above, the contribution of the Seminole Plant to the county's tax base would vary inversely. But the increment would still be very significant in real terms, and likely to offset by several times whatever increases in costs of public services that had occurred as a result of project-induced increases in local population.

According to information from the Putnam County Property Appraiser, the tax rate on the Seminole Plant site land in 1977 was 16.458 mills:

Jurisdiction	Amount	Percent
County	8.250 mills	50.1%
School District	8.070 mills	49.0%
St. Johns River Water Management District	0.138 mills	0.9%
	16.458 mills	100.0%

Source: Putnam County Property Appraiser, 1977.

The Putnam County School District's share, 49 percent, produced revenues projected at $3.3 million (Section 2.10, Table 2.10-21), which amounted to 26 percent of the District's total revenues. Assuming that in 1985 the District has the same share of the total property tax levy (assumed to be the same as in 1978: 16.326 mills), the Seminole plant's property taxes would yield about $5.7 million to the school system. The balance of $6.0 million (Table 6.2-8) would go to the County, with a small proportion accruing to the St. Johns River Water Management District.

Population impacts of the construction and operating phases of the Seminole project have been estimated in Section 6.2.1. The numbers of school-age dependents of immigrating personnel will reach a maximum of 250 in 1983, and decline to a long-term increment of 175 by 1986 (Section 6.2.4). As is evident, their numbers are relatively small in comparison to the potential increase in the school district's financial resources and thus its ability to provide for their classroom and instructional requirements.

It should be noted that the project-induced increases in demand for various public services during the construction phase precede the placement on the tax rolls of the assessed value of the plant. As a result, a cash flow problem of a short-term nature may develop for agencies dealing with transient and relocated personnel and traffic. Ultimately, their budgets will reflect the increase in the county's tax base, but in the interim, advance planning will be necessary to anticipate changes in service level requirements. Planners will benefit from a continuing dialogue with Seminole project management with respect to the timing and magnitude of construction activities. Impacts of the project on local government service loads are likely to be small and localized, as will be discussed in some greater detail in Section 6.2.4 and 6.2.5.

Other Tax Impacts

The principal "other" tax that the Seminole Plant will generate is a gross receipts tax, paid to the State. This tax is a 1.5 percent levy on the gross revenues from sales of SECI-generated power to member cooperatives and other utilities. Estimates of this tax's yield are uncertain due to the preliminary nature of generating cost estimates and the possibility that the tax rate might change. Seminole estimates that it would charge 46.2 mills per kilowatt-hour in 1983 for power sold from Unit No. 1. The units are planned to operate at a 68 percent capacity factor, which translated into a gross output per year for each 600-MW unit of 3,574.08 million kilowatt-hours. At 46.2 mills per kwh, the two units combined would produce 7,148.16 million kwh per year worth $330.24 million. The gross receipts tax, at 1.5 percent, would yield $4.95 million.

SECI has projected that costs of power generation will escalate at a six percent average annual rate. Assuming the rates charged for power rise at the same rate, over the 32 years the two units are in operation a total of $28.42 billion in gross revenues would accrue to SECI, upon which the 1.5 percent gross receipts tax would yield $426.3

million. The state charges a sales tax on sales of electric power. SECI is not liable to this sales tax, however, because it sells all of its power at wholesale to other cooperatives and utilities. Those latter entities, selling to ultimate users, will include a retail sales tax levy. The yield of that tax cannot be estimated, as the rates charged for power vary from utility to utility with respect to different customer groups.

Indirectly, the state will derive tax revenues from the Seminole project. The multiplier effect on local incomes of purchases made by project personnel during construction and operation will have a retail trade component also, which will generate sales and gasoline taxes on local spending. The amounts of these taxes arising indirectly cannot be estimated with precision. But if it is assumed that 50 percent of local consumption expenditures made in Putnam County are for taxable goods and services, then the income arising from the Seminole project would generate in its peak construction year, 1983, about $5 million in taxable sales (Table 6.2-7, Column 5, multiplied by 0.5), upon which the State 4 percent sales tax would yield $0.2 million. This may be compared to the $5.2 million in sales taxes collected in Putnam County in 1976.

The State gasoline tax of 8 cents per gallon yielded $1.9 million on sales in Putnam County in 1976 (Section 2.10.6). During construction (1979-1985) commuting workers from outside Putnam County -- who comprise the majority of the work force -- will purchase some of their fuel requirements within the County. From the projections of employment impacts (Section 6.2.2) and traffic impacts (Section 4.6.1), the estimate of 330 cars per day carrying commuting workers to and from the site during the peak commuting year of 1982 (assuming three workers per car) has been developed. Assuming each car uses 20 gallons of gasoline per week on the average, the 8 cent tax would yield $83.20 per car per year. With an average of 330 cars used for commuting in the peak years, total gasoline usage would amount to 351,000 gallons per year, yielding a gasoline tax revenue of $28 thousand. One-half of that amount probably would accrue to Putnam County.

6.2.4 Public Service Impacts

Housing

As construction and operation phase personnel relocate to Putnam County the demand for housing, both direct and induced, will increase. From Table 6.2-5, during 1983, the peak year of demographic impact, approximately 751 people will relocate to Putnam County. Assuming an average size of 3 persons per household, approximately 250 additional dwelling units will be required in Putnam County due to the Seminole project.

In Section 2.10.3, in 1976, there were approximately 1,567 standard dwelling units available for occupancy in Putnam County. Assuming that this figure would remain relatively constant in the baseline case, it does not appear that the Seminole project will cause any severe pressure on availability of housing in Putnam County. Increased upward pressure on real estate values, however, is a possibility.

Education

In Section 6.2.4, it was estimated that approximately 250 new households will migrate to Putnam County during 1983, the peak year of demographic impact. Assuming one school-age individual for each household, approximately 250 additional students can be expected to enroll in the entire Putnam County School District during 1983, the peak year of demographic impact.

From Table 2.10-14, the total student capacity in the Putnam County School District during the academic year 1977-1978 was 11,952. From Table 2.10-15, it can be seen that the projected total enrollment in the Putnam County School District for the academic year 1981-1982 is 10,333 students. Assuming this enrollment is a reasonable estimate of the baseline situation in 1983, it follows that the estimated enrollment with the addition of students from Seminole families would be around 10,583 students for 1983. This enrollment is substantially lower than the capacity of 11,952 students; thus it does not appear that the Seminole project will place any undue burden on the Putnam County School District.

Medical Facilities

In Section 2.10.4, a major new medical facility, the Putnam Community Hospital, began receiving patients on September 1, 1975. This section also indicates that the 1977 occupancy rate at Putnam Community Hospital was 80 percent. Given that the population in Putnam County is only expected to increase by 1.6 percent over baseline during 1983, the peak year of demographic impact, it does not appear the Seminole project will have any major adverse impact on the quality or quantity of medical services offered in Putnam County.

Fire Fighting Facilities

In Section 2.10.4, Putnam County had 327 firefighters in 1976, or 7.5 firefighters per 1000 population. Assuming no change in the number of firemen, inclusion of the project-induced population changes would reduce the ratio of firemen to 7.3 per 1000 population by 1983. This ratio still compares favorably with the general minimum standards of 2.4 firefighters per 1000 of population. Thus, it appears that the Seminole project will have no major adverse impact on the demand for firefighting services in Putnam County.

Additionally, SECI plans to contact the Palatka Fire Department to insure that communication channels can be established to provide prompt response to any fires that may occur during construction activities, and to insure that adequate equipment and personnel are available to fight major fires.

SECI also plans to locate hand fire extinguishers throughout the construction site to provide an immediate response to incipient fires. A fire brigade will be formed and trained in the use of the equipment located on the site (Section 3.9).

For fire protection during the operation phase of the Seminole project, one 300,000 gallon storage tank will be installed at the site. This tank will supply approximately three hours of water supply for fire fighting purposes. Additionally, one diesel-powered fire pump will be installed near the storage tank. This pump will have its own fuel oil storage tank and battery-powered electric starting system. Finally, an underground fire loop will be installed with about four fire hydrants located throughout the site.

Police Protection

Section 2.10.4 reported that Putnam County had 129 law enforcement officers in 1975, giving a ratio of 2.95 police officers per 1000 population. Assuming no change in the number of policemen, this ratio will change to 2.67 policemen per 1000 of population by 1983. This ratio compares favorably with recognized law enforcement standards which indicate that 1.75 to 2.00 officers are generally required per 1000 persons living within the area to be served. Therefore, it appears that the Seminole project will have no major adverse impact on the demand for police services in Putnam County.

Recreation

There is an abundance of recreational opportunities in Putnam County due to its close proximity to rivers, lakes, national forests, and the ocean. Given that population in Putnam County is expected to increase by only 1.6 percent above baseline in 1983, it is estimated that the demand for recreational activities will increase by a similar 1.6 percent. Thus, no major adverse impact on the supply of recreational opportunities is expected to occur as a result of the Seminole project.

6.2.5 Public Utility Impacts

Electricity

Putnam County receives electric power from the Clay Electric Cooperative, a member of SECI, and from FP&L. In view of the fact that SECI plans to install 1,200 megawatts of generating capacity in Putnam County by 1985, and that FP&L has recently installed 500 megawatts of generating capacity in East Palatka, it does not appear that Putnam County will experience any shortages of electricity as a result of the Seminole project.

Natural Gas

Although the City of Palatka receives natural gas from the Palatka Gas Authority, the rural areas of Putnam County are not served by any natural gas pipelines. The demand for natural gas in the City of Palatka as a result of the Seminole project is not expected to be measureable.

Water Supply

Section 2.10.5, reported that Putnam County does not presently provide water supply services within the county. Various incorporated municipalities, however, do supply water within their jurisdictions. Many residents of Putnam County, therefore, must rely on wells for water. The Seminole project will not cause a great increase in the household demand for water in Putnam County.

Sewage Treatment

Section 2.10.5 stated that Putnam County does not presently provide sewer services to county residents. The City of Palatka does, however, have a sewer system, which in 1976 had an 85.7 percent utilization rate. Population growth in Palatka due to the Seminole project can be expected to increase the utilization of the Palatka sewer system by one or two percent. Therefore, the Seminole project is not expected to have any major adverse impact on the Palatka sewer system.

Solid Waste Disposal

Section 2.10.5 stated that Putnam County provides no door-to-door collection services for solid waste. As a result of the lack of an extensive collection system, widespread roadside dumping has been a problem. Population increase due to the Seminole project could exacerbate this dumping problem.

Table 6.2-1

Seminole Construction-Phase Labor Requirements
(Average monthly employment per quarter)

Quarter/Year	Manual Labor	Supervisory Labor	Total Labor Force
4-1979	55	8	63
1-1980	165	24	189
2-1980	211	31	242
3-1980	261	39	300
4-1980	288	50	338
1-1981	365	53	409
2-1981	496	68	564
3-1981	666	81	747
4-1981	766	91	857
1-1982	901	107	1,008
2-1982	902	111	1,013
3-1982	903	100	1,003
4-1982	776	98	874
1-1983	558	81	639
2-1983	670	91	761
3-1983	677	85	762
4-1983	744	88	832
1-1984	739	92	831
2-1984	723	92	815
3-1984	630	75	705
4-1984	462	70	532
1-1985	161	46	207
2-1985	154	33	187
Total Man-Months	36,792	4,842	41,634

Source: Burns and Roe, Inc., April 24, 1978.

Notes:

Average monthly employment per quarter represents the average number of employees employed each month during any given quarter. A quarter consists of three months.

Manual labor includes all union craft labor.

Supervisory labor includes contractor supervisory and administrative personnel and construction management personnel.

Total man-months is calculated by multiplying average monthly employment per quarter times three months per quarter.

This table assumes that each laborer works a full man-month each month.

A man-month is equivalent to one laborer working 173.3 hours per month.

Table 6.2-2

Commuter Composition of Seminole Construction Labor Force
(Number of Laborers)

	MANUAL LABOR				SUPERVISORY LABOR				ALL LABOR			
Year (1)	Average Monthly Employment (2)	Commuters (3)	Relocaters (4)	Local Residents (5)	Average Monthly Employment (6)	Commuters (7)	Relocaters (8)	Local Residents (9)	Average Monthly Employment (10)	Commuters (11)	Relocaters (12)	Local Residents (13)
1979	55	47	3	5	8	6	2	0	63	53	5	5
1980	231	196	12	23	36	27	7	2	267	223	19	25
1981	571	485	29	57	73	55	14	4	644	540	43	61
1982	871	740	44	87	104	78	21	5	975	818	65	92
1983	662	563	33	66	86	65	17	4	748	628	50	70
1984	639	543	32	64	82	62	16	4	721	605	48	68
1985	157	134	8	15	40	30	8	2	197	164	16	17

Source: Burns and Roe, Inc., April 24, 1978, and Dames & Moore, June 1978.

Notes:

All figures on this table are estimates that represent one possible scenario for the commuter composition of the Seminole construction labor force. No special significant should be assigned to any of the individual point estimates.

A commuter is a worker who commutes daily from outside Putnam County to the site inside Putnam County. A weekly commuter is considered to be a relocater. In this table, the "commuter" column gives the average number of commuting employees who are commuters each month. thus, the sum of commuters, relocaters, and local residents for manual labor equals the average monthly employment in any given year.

A relocater is a worker who has moved into Putnam County from outside Putnam County, or who is a weekly commuter. The "local resident" column gives the average number of these employed each month.

A local resident is a worker who has a permanent domicile in Putnam County for the duration of the Seminole project. The "local resident" column gives the average number of local residents employed each month.

See Appendix H.3 for a discussion of the assumptions used in the preparation of this table.

Table 6.2-3

Seminole Construction-Phase Labor Costs
(Thousands of Dollars)

Quarter	Manual Labor	Supervisory Labor	Total Labor Cost
4-1979	$ 271.9	$ 49.8	$ 321.7
1-1980	829.8	149.5	979.3
2-1980	1,226.7	209.1	1,435.8
3-1980	1,573.3	263.1	1,836.4
4-1980	1,825.4	337.4	2,162.8
1-1981	2,366.8	357.6	2,724.4
2-1981	3,707.4	494.0	4,201.4
3-1981	5,031.7	588.5	5,620.2
4-1981	5,713.5	661.2	6,374.7
1-1982	6,627.5	777.5	7,405.0
2-1982	7,093.5	864.1	7,957.6
3-1982	7,096.8	778.5	7,875.3
4-1982	6,218.6	762.9	6,981.5
1-1983	4,273.3	630.6	4,903.9
2-1983	5,557.3	755.6	6,312.9
3-1983	5,769.4	705.8	6,475.2
4-1983	6,306.5	730.7	7,037.2
1-1984	6,384.9	764.0	7,148.9
2-1984	6,656.3	811.7	7,468.0
3-1984	5,826.3	661.7	6,488.0
4-1984	4,293.9	617.6	4,911.5
1-1985	1,392.2	405.9	1,798.1
2-1985	1,330.4	291.1	1,621.5
Total	$97,373.4	$12,667.9	$110,041.3

Source: Burns and Roe, Inc., April 24, 1978.

Notes:

Construction labor costs represent total wage package rates, including union fringe benefits and travel allowances for manual labor, and complete payroll wage rates, excluding non-payroll mark-ups, for supervisory labor.

Labor costs are escalated to the period designated through the use of past and present union wage agreements for manual labor, and historical data for supervisory labor.

Table 6.2-4

Seminole Operation Phase
Labor Requirements and Costs

Year (1)	Number of Employees (2)	Labor Cost (Million Dollars) (3)
1983	99	2.52
1984	99	2.64
1985	140	3.93
1986	140	4.13
1987	140	4.33
1988	140	4.55
1989	140	4.78
1990	140	5.02
1991	140	5.27
1992	140	5.53
1993	140	5.81
1994	140	6.10
1995	140	6.40
1996	140	6.72
1997	140	7.06
1998	140	7.41
1999	140	7.78
2000	140	8.17
2001	140	8.57
2002	140	9.00
2003	140	9.46
2004	140	9.93
2005	140	10.42
2006	140	10.95
2007	140	11.50
2008	140	12.07
2009	140	12.67
2010	140	13.31
2011	140	13.97
2012	140	14.67

Source: Seminole Electric Cooperative, Inc., May 2, 1978, and Dames & Moore, June 1978.

Notes:

Labor costs have been escalated at 5 percent per year.

Unit No. 1 will begin commercial operation in June 1983.

Unit No. 2 will begin commercial operation in June 1985.

Table 6.2-5

Seminole Construction and Operation Phase Demographic Impacts

Year (1)	Putnam County Baseline Population Projections (Medium Scenario) (2)	Incremental Population Change Due to Seminole Project (3)	Aggregate Population Change Due to Seminole Project (4)	Putnam County Seminole Project Population Projections (Medium Scenario) (5)	Percent Increase From Baseline Case (6)
1978	44,400	0	0	44,400	0.0
1979	45,200	38	38	45,238	0.1
1980	46,000	105	143	46,143	0.3
1981	46,500	180	323	46,823	0.7
1982	47,000	165	488	47,488	1.0
1983	47,500	263	751	48,251	1.6
1984	48,000	-15	736	48,736	1.5
1985	48,500	-90	646	49,146	1.3
1986	49,600	-120	526	50,126	1.1
1987	50,700	0	526	51,226	1.0
1988	51,800	0	526	52,236	1.0
1989	52,900	0	526	53,426	1.0
1990	54,000	0	526	54,526	1.0
1995	58,200	0	526	58,726	0.9
2000	62,500	0	526	63,026	0.8
2005	66,400	0	526	66,926	0.8
2010	70,300	0	526	70,826	0.7
2015	74,250	0	526	74,776	0.7

Source: University of Florida, Bureau of Economic and Business Research, July 1977, 1978-2020 Projections of Population by County, and Dames & Moore, June 1978.

Notes:

The Putnam County Baseline Population Projections (Medium Scenario) in this table are identical to the medium scenario projections of Table 2.1.9-4. Baseline Population Projections. Interpolation was used to calculate figures for years not ending in a zero or a five.

The incremental population change due to the Seminole project (Column 3) represents the number of people expected to move into or out of Putnam County each year due to the Seminole project.

Aggregate population change due to the Seminole project (Column 4) represents the sum of all incremental population changes due to the Seminole project from 1978 to the given year.

The Putnam County Seminole Project Population Projection (Column 5) represents the sum of the baseline projection and the aggregate population change due to the Seminole project for any given year.

For a more detailed discussion of the demographic impact methodology utilized, refer to Appendix H.6.

Table 6.2-6

Seminole Construction and Operation Phase Employment Impacts

Year (1)	Putnam County Baseline Employment Projections (2)	Incremental Employment Change Due to Seminole Project (3)	Aggregate Employment Change Due to Seminole Project (4)	Putnam County Seminole Project Employment Projections (5)	Percent Increase From Baseline Case (6)
1978	14,958	0	0	14,958	0.0
1979	15,284	26	26	15,310	0.2
1980	15,610	89	115	15,725	0.7
1981	15,866	157	272	16,138	1.7
1982	16,122	139	411	16,533	2.5
1983	16,378	132	543	16,921	3.3
1984	16,634	-11	532	17,166	3.2
1985	16,890	-122	410	17,300	2.4
1986	17,082	0	410	17,492	2.4
1987	17,274	0	410	17,684	2.4
1988	17,465	0	410	17,875	2.4
1989	17,657	0	410	18,067	2.3
1990	17,849	0	410	18,259	2.3
1995	19,081	0	410	19,491	2.2
2000	20,347	0	410	20,757	2.0

Source: Jacksonville Area Planning Board, June 1976B, Regional Employment Study; Bureau of the Census, 1970, U. S. Census of Population; Burns and Roe, Inc., April 24, 1978; Seminole Electric Cooperative, Inc. May 2, 1978; U. S. Water Resources Council, January 1977, Guideline 5, Regional Multipliers; and Dames & Moore, June 1978.

Notes:
The Putnam County Baseline Employment Projections of Column 2 come from Table 2.1.10-6. Interpolation was used to formulate baseline projections for years not ending in a zero or five.

The incremental employment change due to the Seminole project, and the aggregate employment change due to the Seminole project refer to direct and induced employment changes. For a discussion of derivation of the data in Columns 3 and 4 of Table 6.2-6, refer to Appendix H.5.

Putnam County Seminole Project Employment Projections of Column 5 in Table 6.2-6 were calculated by summing the baseline projections of Column 2 and the aggregate employment changes of Column 4.

Table 6.2-7

Seminole Construction and Operation Phase Income Impacts
(in millions of nominal dollars)

Year (1)	Putnam County Baseline Personal Income Projection (2)	Personal Income Impact due to Construction Phase (3)	Personal Income Impact due to Operation Phase (4)	Total Personal Income Impact (5)	Putnam County Seminole Project Personal Income Projection (6)	Percent Change from Baseline Case (7)
1978	247.2	0.0		0.0	247.2	0.0
1979	275.9	0.1		0.1	276.0	0.0
1980	308.3	2.0		2.0	310.3	0.1
1981	339.3	5.8		5.8	345.1	1.7
1982	373.8	9.2		9.2	383.0	2.5
1983	412.0	7.6	2.6	10.2	422.2	2.5
1984	453.6	7.9	2.7	10.6	464.2	2.3
1985	499.6	1.1	4.0	5.1	504.7	1.0
1986	550.0		4.2	4.2	554.2	0.8
1987	605.8		4.4	4.4	610.2	0.1
1988	667.3		4.6	4.6	671.9	0.1
1989	734.8		4.9	4.9	739.7	0.1
1990	809.4		5.1	5.1	814.5	0.1
1995	1,298.9		6.5	6.5	1,305.4	0.1
2000	2,084.1		8.3	8.3	2,092.4	0.0
2005	3,296.5		10.6	10.6	3,307.1	0.0
2010	5,213.5		13.6	13.6	5,227.1	0.0

Source: Burns and Roe, Inc., April 24, 1978; Council of Economic Advisors, May 1978, Economic Indicators, Washington, D.C., Florida Dept. of Commerce, April 1977, Putnam County Economic Data; Jim Roach, June 2, 1978, Florida Power & Light Co., personal communication; Seminole Electric Cooperative, Inc., May 2, 1978; U. S. Corps of Engineers, December 1975, Projections of Economic Activity in Florida, Series E Population; U. S. Water Resources Council, January 1977, Guideline 5, Regional Multipliers, Washington, D.C.; and Dames & Moore, June 1978.

Notes:

The personal income impacts of Columns 3, 4, and 5 include direct and induced income changes.

For a more detailed explanation of the methodology used, refer to Appendix H.6.

Table 6.2-8

Hypothetical Putnam County Property Taxes from Seminole Plant
(in millions of dollars)

	1983	1985	1999	2012
Unit 1 -- Net Assessed Value[1]	$368.0	$368.0	$368.0	$368.0
less accumulated depreciation[2]	0.0	24.5	196.3	355.7
Net taxable value	$368.0	$343.5	$171.7	$ 12.3
Unit 2 -- Net Assessed Value[3]	$ 0.0	$372.1	$372.1	$372.1
less accumulated depreciation[2]	0.0	0.0	173.6	334.9
Net taxable value	$ 0.0	$372.1	$198.5	$ 37.2
Coal Stockpile (@10%)[4]	$ 1.5	$ 3.4	$ 7.7	$ 16.4
Total Taxable Value	$369.5	$719.0	$377.9	$ 65.9
Total Putnam County Tax (@16.326 mills)[5]	$ 6.0	$ 11.7	$ 6.2	$ 1.1
Total Taxes, 1983-2014	$191.4			

[1] $460,000,000 less 20% for exempt pollution control facilities. Assumes property enters tax rolls January 1, 1983.

[2] Straightline over 30 years. Unit 1 AV declines at $12.3 million per year, Unit 2 @$12.4 million per year.

[3] $465,170,400 less 20%, commencing January 1, 1985.

[4] Stockpile valuation based on estimated cost of coal (delivered) of $1.60 per million BTU (1978) for 75-day inventory with each unit burning 1.5 million tons per year of 12,000 BTU/lb. coal. Coal costs escalated to 1986 at 5.3% annually and 6.0% thereafter.

[5] 1978 millage rate, real and personal property.

Source: Appendix H, Table H-7.

7.0

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

SAJOD-RP 22 June 1978
Mr. David L. Lester

If you have any questions regarding the content of this letter, please do not hesitate to contact us.

Sincerely yours,

Gail G. Gren

GAIL G. GREN
Chief, Operations Division

TABLE OF CONTENTS

CHAPTER 7.0

RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

7.0 RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

7.1 LAND USE

7.1.1 Long-Term Pre-Emptive Use of Land

Seminole Plant Units No. 1 and No. 2 will be constructed on a site comprising about 2,000 acres in Putnam County, Florida. Although about 65 percent of this area will be left in its present state, the site in its entirety will be unavailable for other uses during both the construction and operating phases of the plant's life, or for approximately 40 years. Upon retirement, only the area of the sludge and ash disposal, or about 270 acres (Figure 3.1-1) might not be suitable for any useful purpose depending on the utlimate characteristics of the waste material.

Therefore, the proposed project would, at worst, place some long-term restrictions on development of approximately 270 acres of land. The balance of the land could be reclaimed for other uses after retirement.

7.1.2 Regional Significance of Pre-Empted Land

The 2,000-acre site required by Seminole Plant Units No. 1 and No. 2 represent approximately 0.008 percent of SECI's service territory and 0.4 percent of the land area of Putnam County. Nearly 65 percent of Putnam County is forested, and 5 percent is urban. Therefore, developed pre-emptive land use by the plant is not expected to have any measurable effect on land availability or use in Putnam County.

7.2 WATER USE

7.2.1 Use of Ground Water

During construction of Seminole Plant Units No. 1 and No. 2 an average of 0.034 million gallons per day (mgd) will be drawn from the Floridan Aquifer. When both units are operating at full capacity, approximately 0.6 mgd will be drawn from the same aquifer. This represents a 2.1 percent increase in ground water use in Putnam County based on 1970 estimates of withdrawal (Section 2.11.2).

Ground water use by the plant is estimated to have only a slight effect on nearby wells (a maximum 2.5-foot drawdown at the nearest well; Well D-1, a residential well; Appendix D.6) tapping the same aquifer. This effect is estimated to be felt only during the life of the station, and no permanent change in the aquifer is expected.

7.2.2 Use of Surface Water

Operating at full capacity, Seminole Plant Units No. 1 and No. 2 will withdraw about 15.8 mgd from the St. Johns River. Of this, about 13.4 mgd will be consumed by the cooling process (evaporation and drift) and other plant losses, and about 2.4 mgd will be returned to the St. Johns River.

The maximum consumptive loss of surface water, depending on the final station process selection and design, assuming the station operates at full capacity, will be about 21.0 mgd or 32 cubic feet per second (cfs). This compares to a calculated mean discharge of the St. Johns River of 7,613 cfs. Therefore, the consumptive losses will, at most, be less than one-half of one percent of the river flow. This use will extend over the operating life of the station, and no permanent effects of such use are expected.

7.3 AIR USE

7.3.1 Air Quality Performance of the Proposed Plant

As discussed in Section 5.1.2.2, computer modeling indicates that plant operation will result in an impact on air quality in the site area. For example, at full operating capacity, up to 85 percent of the allowable 3-hour Class II Prevention of Significant Deterioration (PSD) increment for SO_2 may be used up. However, this percentage consumption would apply only to a small geographical area. At other points and for other averaging times, a much lower percentage of Class II increments should be consumed based on modeling results. Modeling results also indicate that no ambient air quality standards should be threatened as a result of plant operation.

7.3.2 Regional Significance of Air Use

The plant's pre-empting a percentage of PSD Class II increments could have some effect on future industrial growth in the region. However, it is not expected that Seminole would consume a major portion of any increment (more than 50 percent) except within a small area less than 2 km from the Putnam Site for short-term concentrations of SO_2 alone. Therefore, the only industrial emission sources which could be significantly affected are those which would emit SO_2 and which would be located at points where they could interact with Seminole during the specific meteorological conditions which produce highest ground-level SO_2 concentrations attributable to Seminole.

Also of regional significance are impacts on nearest nonattainment and PSD Class I areas. Modeling results indicate that Seminole should have an insignificant effect (using EPA definitions of significance) on the Jacksonville particulate matter nonattainment area and on the Okefenokee National Wilderness PSD Class I area.

7.4 ENERGY USE

7.4.1 Coal Consumption

At average operation, Seminole Plant Units No. 1 and No. 2 will consume above 8,940 tons of coal per day, or about 114 million tons of coal over the 35-year operating life of the station.

7.4.2 Regional Significance of Coal Consumed

Completion of the proposed station will make 1,200 MW of electric power available to the citizens of Florida. SECI will have at its disposal a significant amount of independent generating capacity, and may at times have the option of providing power to other utilities, thus improving its own economic position and enabling it to provide electric service to its consumers at lower rates.

7.5 CONCLUSION

In summary, the construction and operation of Seminole Plant Units No. 1 and No. 2 are expected to:

1. Temporarily pre-empt a very small portion of the available land in the region;
2. Have very little temporary effect on ground water and surface water use in the site area;
3. Have an effect on regional air quality, but within statutory limits;
4. Consume about 114 million tons of coal over the operating life of the station; and
5. Produce about 250 billion kilowatt-hours of electrical energy over the operating life of the plant.

In view of the developing nature of the area, even at the lowest of SECI's load-growth projections, the project's relatively sparing use of water and air resources and the fact that the fuel use estimates are based on both lower-quality coal and base-load operation, the project appears defensible.

Further, the area is in need of additional electrical energy to support its continuing growth. Since the additional generating capacity under consideration is conservative (smaller than the load-growth esimates), the project appears to demonstrate a positive relationship between short-term use of environment and resources and maintenance and enhancement of long-term productivity.

8.0
REGULATORY COMPLIANCE MONITORING PROGRAM

TABLE OF CONTENTS

CHAPTER 8.0

REGULATORY COMPLIANCE MONITORING PROGRAM

LIST OF FIGURES

8.0 REGULATORY COMPLIANCE MONITORING PROGRAM

The purpose of an environmental monitoring program is to ensure compliance with applicable State and Federal regulations during the construction and operation of the project. Plans for the program have not yet been developed in detail. The scope of the monitoring program will be coordinated with regulatory agencies and will reflect regulatory requirements at the time the permits are issued. Compliance monitoring requirements will be included as conditions of the permits.

This section identifies expected requirements and describes a general monitoring approach that will eventually be shaped into a specific monitoring plan. This section includes (1) monitoring during construction, (2) monitoring during station operation, and (3) a management plan to assure compliance activities are carried out responsibly.

8.1 CONSTRUCTION MONITORING

This phase of the environmental monitoring program is directed to regulatory compliance measures relative to construction activities.

8.1.1 Dredging

As discussed in Section 4.4, impacts to the aquatic ecosystem from dredging activities should be minimal. Because of the short one to two week dredging period, upland disposal of spoil, and techniques available to control suspended sediments, monitoring should be limited to site surveillance to assure controls are being applied as required.

8.1.2 Construction Runoff

As explained in Section 3.1.2, a system of drainage ditches or swales will be provided throughout the cleared area for the main station structures. These ditches will be designed to carry off excess water from large precipitation events. As shown in Figure 3.1-4, water carried by the drainage system will enter onsite lowlands and will not discharge offsite. Therefore, no monitoring will be required.

8.1.3 Ground Water

The ground water monitoring program begun in November 1977 will be continued during construction to document changes in ground water quality caused by construction to enhance the data base from which operational effects will be measured. Monitor wells described in Appendix D (Figure D-1) will be used during the construction and operational periods unless construction activities destroy one or more of them. If this occurs, new wells will be constructed in appropriate locations.

On a quarterly schedule, water levels, specific conductance, temperature, and pH will be measured. After construction begins, on a semi-annual basis, a complete chemical analyses will be made on samples from each well. The parameters to be included should be similar to that of the sampling program carried out from November 1977 through April 1978 (Appendix D.5).

8.2 OPERATIONAL MONITORING

8.2.1 Air Quality Monitoring

Operational monitoring activities will take into consideration the latest monitoring guidelines and the existence of other monitoring stations in the area of the Putnam Site. This section contains conceptual monitoring description divided into two sections; stack monitoring and ambient air quality monitoring. The stack monitoring section is more detailed than the ambient monitoring section since stack monitoring requirements and procedures are standardized.

Stack Monitoring

Federal New Source Performance Standards for fossil fuel-fired steam generators (40 CFR 60.45) prescribe stack monitoring requirements. For coal-fired generators, continuous sulfur dioxide (SO_2) monitoring is necessary if a flue gas desulfurization system is used to meet emission standards. A system of continuous nitrogen oxides (NO_x) monitoring is required if initial performance tests show that NO_x emissions are greater than 70 percent of the emission standard. Finally, if either continuous SO_2 or NO_x monitoring is necessary, then either continuous carbon dioxide (CO_2) or oxygen (O_2) measurements are also necessary.

In-stack opacity monitoring is also normally required for coal-fired generators. In the case of the Seminole Station, however, the exhaust gases will be saturated after leaving the flue gas desulfurization system. Since no re-heat will be applied, water vapor condensation is likely to occur within the stack or before. Opacity measurements would then have no value. If opacity monitoring is determined to be meaningful, a continuous opacity monitoring instrument meeting requirements specified in federal regulations will be provided. In addition to meeting these basic requirements, the instrument will include means for automatic zero calibration and correction, and span calibraton checks. Provision will be included for on-stack readout of measurement signals, zero and span calibration signals, and optical alignment. The instrument will provide linear outputs corresponding to optical density and opacity corrected for stack exit conditions, and will incorporate multiple switch selectable measurement ranges for each output, extending from 10 to 100 percent opacity or equivalent. A remote control unit will be provided. It will contain a measurement indicator, means for manual remote calibration, and dual independently adjustable alarms. It will also contain fault monitors to indicate the status of normal maintenance items including air purge filters, transmissometer windows, shutters, and on-stack electro optics.

A continuous SO_2 and NO_x measurement monitor, that also satisfies minimum regulatory requirements, will be installed. In addition to meeting these basic requirements, the instrument will corporate an <u>in situ</u> measurement technique providing a linear resoponse with pollutant gas concentration. If the instrument measurement is affected by stack gas temperature, the output will be automatically corrected for temperature effects including ideal gas-law volumetric considerations and spectral absorption variations. The instrument will also include a means for automatic and manual on-stack zero and span calibration checks - free from the interference effects of the flue gas - and will not require external calibration gases or light sources. Measurement ranges of 500, 1000, and 1500 parts per million, selectable from the control room, will be provided. A remote control unit with measurements indicator, manual calibration, alarm level detectors for each gas, and status indicators for all major maintenance/operational conditions will be included.

As required with continuous SO_2 and NO_x analyzers, either a continuous CO_2 or O_2 monitor is also required. An O_2 monitor is planned for installation on each of the Seminole Stations stacks. In addition to other features, the instrument will not require any sample extraction or conditioning. The oxygen sensor will be totally specific to the measurement or oxygen and will have no potential interferences. The instrument will incorporate means for unattended zero and span calibration checks which can be activated either automatically or manually. The output will be linear with percent oxygen and will include switch selectable measurement ranges of 0-2.5 percent, 0-10 percent, and 0-25 percent oxygen.

All necessary sampling ports, platforms, ladders, etc. will be provided in accordance with the latest revision of DER's "Standard Sampling Techniques and Methods of Anlaysis for the Determination of Air Pollutants from Point Sources."

Ambient Air Quality/Meteorology Monitoring

Ambient air quality monitoring will probably commence prior to plant operation, and will continue during the operational phase of each unit. Pre-operational monitoring will provide a thorough shakedown of monitoring equipment so that it will be functioning properly in time for the beginning of station operation and will provide confirmation of background conditions at startup.

Ambient air quality monitoring will consist of instruments to measure concentrations of total suspended particulates (TSP), sulfur dioxides (SO_2) and nitrogen oxides (NO_x). The NO_x monitor will also be capable of separating total NO_x into nitric oxide (NO) and nitrogen dioxide (NO_2) fractions. For better understanding of air quality measurements, a meteorological monitoring package will also be deployed to record wind speed, wind direction, temperature, and rainfall.

TSP concentrations will be determined using the EPA reference method, gravimetric analysis of filters exposed in a high-volume sampler for a period of 24 hours at a time. Filter handling will allow additional analyses as required.

Ambient concentrations of SO_2 will be measured continuously using an approved EPA reference or equivalent method. The monitoring device and associated calibration equipment will be housed in a temperature-controlled, weather-proof shelter. Measurements will be recorded continuously on a digital data logger, analog strip chart recorder, or both.

An EPA reference or equivalent monitor will also be used to measure concentrations of $NO/NO_2/NO_x$. Measurements will be made continuously and recorded for later analysis. NO_x monitoring devices will be housed along with SO_2 monitoring equipment in an enclosed, temperature-controlled shelter.

Continuous measurements of wind speed and direction will be made with sensors located atop a 10-meter meteorological tower. A temperature sensor, and possibly a relative humidity sensor, will also be installed on the tower. Measurements will be recorded for later comparison with ambient air quality data. Depending on regulatory agency requirements, an additional tower may be needed to measure wind conditions at a level much higher than 10 meters above the ground, where conditions more representative of stack height winds could be observed. Also as part of the meteorological monitoring program, a recording rain gauge is planned for installation at the site. Rainfall levels can be used to interpret certain types of air quality measurements; for example, high particulate concentrations during dry periods. Rainfall information will also be needed as part of the hydrological monitoring program to estimate runoff from coal piles and other sections of the site.

The number and location of ambient air quality monitoring stations cannot be specified at this time. Monitoring needs will depend in part on the characteristics of other monitoring programs existing in the vicinity of the Putnam Site during the year prior to startup of Unit No. 1. The characteristics in this case encompass location, monitoring equipment, calibration procedures, sampling frequency, data availability, and probability of long-term continued operation.

It is likely that one meteorological tower and at least two air quality stations, each equipped to monitor TSP, SO_2 and $NO/NO_2/NO_x$, will be included in Seminole's operational ambient air quality monitoring program. Impact analysis modeling (described in Section 5.1.2) indicates that highest short-term ambient concentrations will occur within 10 kilometers of the Seminole stacks. Additional modeling or assessment of previous modeling results will be needed to specify distance/direction combinations at which high concentrations are likely to occur often enough to be detected by a limited number of sampling stations. In reaching a decision on placement of monitoring sites, consideration will also be given to locating a station within a nearby residential area or near agricultural land where crops particularly vulnerable to airborn contaminants may be grown.

8.2.2 Intake Structure

Section 5.2.2.2 contains a description of an *in situ* model screen test to be conducted in 1979. The purpose of the test is to determine the smallest feasible screen-opening size under operating conditions in the St. Johns River. Referred to as a "fouling test," the experiment will give a good indication of the plugging and maintenance problems that can be expected for various screen-opening sizes and will provide a means for selecting the smallest opening that can be used without experiencing unmanageable fouling problems. Concurrently, as outlined in Section 5.2.2.2, a biological testing program will be conducted to assess the impingement and entrainment potential of the various screen-opening sizes. Thus, the results of the fouling test will include an assessment of the potential impacts to the aquatic ecosystem of the selected screens.

8.2.3 NPDES Monitoring

Sampling Points

The facility intake and four wastewater streams within the plant complex will be sampled to assure compliance with State of Florida standards for thermal discharges; and the U. S. Environmental Protection Agency (EPA) Effluent Guidelines and Standards for Stream Electric Power Generating Point Sources, 40 CFR 423. The four internal sampling locations wil be: 1) the treated effluent from the Central Wastewater Treatment System (Section 3.6.15), 2) the treated effluent from the Sanitary Treatment Facility (Section 3.7), 3) the cooling tower blowdown, and 4) the combined wastewater steam discharged to the St. Johns River.

Parameters and Schedule

The final selection of parameters and sampling frequency will be a result of agency consultation with the permit applicant. At a minimum, the parameters specified by the aforementioned effluent guidelines will be monitored; namely, flow, total suspended solids, pH, oil and grease, copper, iron, zinc, chromium, phosphorus, and total chlorine residual.

Several internal wastewater streams, in addition to those outlined in this section, may be monitored, as required, to assure that the waste streams meet predetermined standards. These systems include the makeup demineralizing system (Section 3.6.3), the condensate polishing system (Section 3.6.4), and boiler chemical cleaning wastes (Section 3.6-14).

8.2.4 Ground Water Quality

The program described in Section 8.1.3 will be continued. The data obtained will provide an overall assessment of ground water quality changes, if any. Additional ground water quality monitoring wells will be constructed at specific locations where localized changes may be expected because of the proximity to contaminant producing facilities. For example, monitoring wells will be installed down gradient from facilities such as the coal pile and the solid waste disposal areas.

The additional wells will typically be four-inch diameter, cased, and will penetrate Layer 1 sands (Section 2.2). The well casing will be screened to allow sample extraction at any depth. Wells will be located as close as practical to the potential source of contamination. For example, if dikes or dams are provided to contain liquid or semi-solid wastes, the wells would be located at the toe of the embankment. This will ensure that changes in ground water quality will be detected as early as possible so that mitigating measures can be taken.

Samples will be taken in the four-inch diameter wells at the top and bottom, and at two intermediate points, for a total of four samples per well. Parameters listed for detailed analyses in Section 8.1.3 will be tested on these additional wells. Frequency of sampling will depend on the nature and volume of leachates and rate of ground water movement.

8.3. ENVIRONMENTAL REGULATORY COMPLIANCE MANAGEMENT

Seminole Electric Cooperative, Inc. (SECI) has proposed an environmental regulatory compliance department within SECI that will be independent of its production functions with sufficient authority and responsibility to meet environmental regulations, licensing, and planning needs of SECI.

Department objectives include:

1. To assure that the Executive Department is kept informed of existing and potential licensing, permitting, or other environmental regulatory requirements and their potential impact on SECI operations, and recommend appropriate action to be taken in achieving applicable compliance.

2. To assure that planning for new operating capacity (including generation, transmission, and distribution) is conducted with due consideration for existing and potential environmental regulations.

3. To act as the principal responsibility center within SECI for assuring coordinated preparation and timely filing of permit and license applications.

4. To act as the principal responsibility center for coordinating and applying the technical resources within SECI and those of outside consulting agencies to achieve compliance with applicable regulations.

5. To act as the principal liaison between local, state, and federal governmental agencies and SECI for all environmental licensing and regulatory activities.

6. To provide coordination and quality control of all water and air monitoring programs and to assure accurate and timely reporting of required information to regulatory agencies.

An organizational and functional chart is shown in Figure 8.3-1. The Environmental Engineer, reporting to the Director of Engineering, will provide the staff capacity to carry out the departmental objectives in areas of regulatory liaison, regulatory compliance, and compliance monitoring.

Regulatory Liaison

Environmental regulatory compliance activities will be coordinated through the Environmental Engineer. Liaison with local, state, and federal agencies, and SECI management and production departments will be maintained to identify and evaluate applicable regulations, develop programs for compliance activities, and assure compliance objectives.

Regulatory Compliance

The Environmental Engineer will be responsible for maintaining records of compliance activities and reporting results to appropriate local, state, and federal regulatory agencies.

Compliance Monitoring

The Environmental Engineer will be responsible for planning, organizing, staffing, and implementing testing and monitoring systems; assuring that the systems are operated to specified performance criteria; assuring that the resulting data are representative of the source sampled and that actions are taken to provide appropriate notice of corrected system malfunctions.

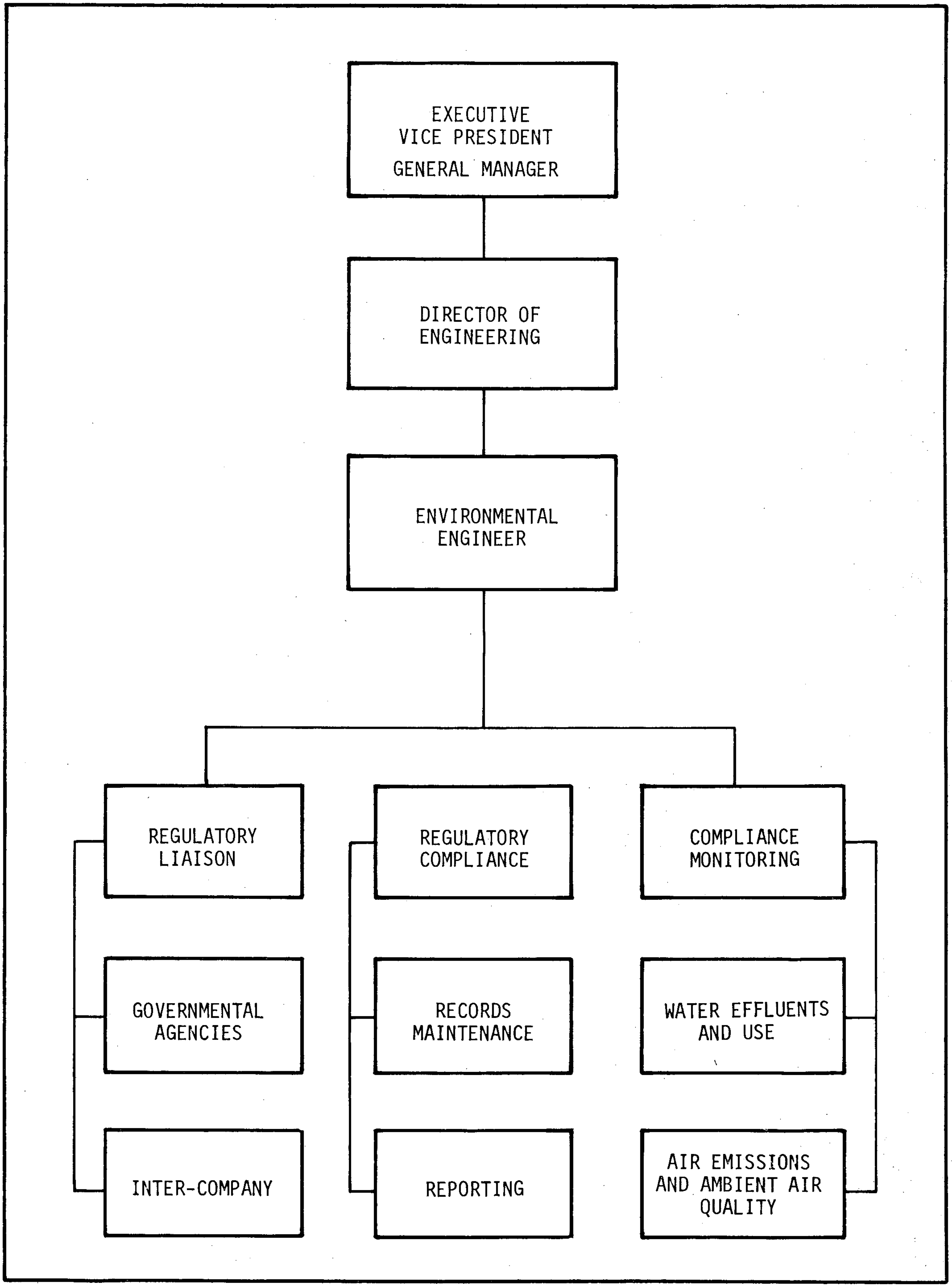


Figure 8.3-1. Environmental Regulatory Compliance Management.

9.0
ALTERNATIVES TO PROPOSED DEVELOPMENT

TABLE OF CONTENTS

CHAPTER 9.0

ALTERNATIVES TO PROPOSED DEVELOPMENT

TABLE OF CONTENTS (Continued)

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

9.0 ALTERNATIVES TO PROPOSED DEVELOPMENT

9.1 ALTERNATIVE ENERGY SOURCES AND SITES

9.1.1 Alternatives to New Generation

Alternatives to new generation are discussed in Section 1.3.

9.1.2 Alternatives Requiring New Generation

9.1.2.1 New Sites

9.1.2.1.1 Introduction

To develop the proposed project in a systematic, environmentally conscious manner allowing both sound engineering decisions and compliance with federal and state regulations, Seminole Electric Cooperative, Inc. (SECI) initiated a two-phase site selection and evaluation program in the Fall of 1976.

Phase I of the program, conducted by Stanley Consultants, Inc.,consisted of four basic tasks:

1. Preparation of a site selection methodology,
2. Coordination of the site selection study with appropriate governmental agencies,
3. Documentation of the site selection process, and
4. Recommendation of alternate site locations.

These tasks are described in Appendix K and are summarized in Section 9.1.2.1.2. The Phase I study resulted in the recommendation by Stanley Consultants of 11 site locations. Of these 11 locations, four were rated by Stanley as worthy of immediate detailed evaluation and property optioning.

Phase II of the site selection and evaluation program, conducted by Dames & Moore, consisted of environmental analyses of the four site locations recommended by Stanley Consultants. These analyses were designed to identify "fatal flaws" that would jeopardize the use of these sites for power generation. As with Phase I, Phase II was coordinated with appropriate governmental agencies. A discussion of Phase II is provided in Section 9.1.2.1.3.

9.1.2.1.2 Phase I Site Selection Study

Before siting investigations were begun, general plant design and site requirements were established, as follows:

1. The base plant was assumed to have two 600-MW (net) coal-fired generating units with electrostatic precipitators and flue gas desulfurization (FGD);

2. 20,000 gallons per minute (gpm) of makeup water would be required;

3. 3 million tons per year of coal would be required;

4. 425,000 tons of ash per year would be produced;

5. Up to 840,000 tons of FGD sludge per year would be produced; and

6. Approximately 1,000 acres of land would be required for plant facilities, including solid waste disposal.

These parameters and requirements were considered to be maximum estimates that would not be exceeded by final plant requirements.

Initially, the entire state of Florida was reviewed to identify "candidate siting zones." Two general siting criteria were employed to identify these zones: (1) adequate water availability, and (2) reasonable transportation and transmission access. Criteria definition is contained in Appendix K.

A system of overlays for a base map of Florida was used to identify these candidate siting zones (Appendix K). Next, these zones were examined in terms of four environmental criteria relating to air quality, prime agricultural land, sensitive areas, and land use. The application of these criteria, plus the requirement that siting locations have reasonable access to the SECI service area, resulted in the identification of search areas in which the next level of investigations could be conducted.

The study of detailed maps and other readily available information resulted in the identification of 53 locations (defined as 36-square-mile areas) within the search areas. The best representative locations were then identified by means of county highway maps, ground water data, and other detailed information This screening process narrowed the choice to the eleven 36-square-mile locations shown in Figure 1 of Appendix K. These 11 siting locations were reevaluted using the siting criteria of water availability, transportation and transmission access, air quality, prime agricultural land, sensitive areas, and fringe growth area locations. A modified Delphi-structured (i.e., group consensus) decision-making process was conducted by specialists within Stanley Consultants to produce quantifiable, detailed criteria specific to SECI's site selection needs. The criteria are described in Appendix K.

Following the development of the weighted criteria, the 11 siting locations were re-evaluated. Cursory site inspections were conducted. The results were then informally presented for review to Florida's Division of State Planning and Department of Environmental Regulation (DER).

This final stage of Phase I resulted in a grouping of the 11 locations into three groups, A through C, with A containing the top-rated locations, B the second, and C the third. These groupings were as follows:

Group A		Group B		Group C	
L-7	Bostwick	L-2	High Springs	L-11	Charlotte Harbor
L-1	Branford	L-5	Lake Rosseau	L-10	Flagler
L-6	Bushnell	L-3	Santa Fe	L-8	Rodman
L-9	Satsuma	L-4	Silver Springs		

Appendix K provides descriptive data for each of these locations.

The Phase I study concluded in April 1977 with the recommendation that the Group A siting locations should be used to identify a preferred and several alternate sites for development of the proposed 1,200-MW generating facility. Following this recommendation, SECI located specific properties within the four candidate locations in Group A.

9.1.2.1.3 Phase II Site Evaluation Studies

Methodology

In June 1977, Dames & Moore was retained by SECI to conduct Phase II of the site selection and evaluation program, preliminary environmental analyses of specific sites from the Group A siting locations:

Putnam (within Stanley's 36-square-mile Bostwick siting location) - SECI's Preferred site.

Suwannee (within Stanley's 36-square-mile Branford siting location).

Sumter (within Stanley's 36-square-mile Bushnell siting location).

Satsuma (within Stanley's 36-square-mile Satsuma siting location).

The Phase II studies were designed to verify the viability of the four sites. The investigations were to accomplish this purpose by:

1. examining each site in a preliminary manner to uncover conditions that would result in unacceptable impacts to the environment, should the proposed 1,200-MW station be built and operated at the site, and

2. determining if such conditions, if present, would constitute a "fatal flaw" in the proposed action; that is, if the condition would result in the unsuccessful completion of licensing actions.

Each site investigation included seven separate areas for study: land use, ground water hydrology, geology/geotechnical, air quality, surface water hydrology, terrestrial biology, and aquatic biology. The site investigations proceededs in steps designed to provide a systematic approach to uncovering critical issues and to explore each issue in sufficient depth to determine the site's viability. The steps were as follows:

1. Preliminary examination of available data to identify potential issues of concern.

2. Preparation of a proposal outlining the issues of concern and the study approaches to explore the issues.

3. Review of the proposal by SECI.

4. A decision by SECI and Dames & Moore as to what issues of concern appeared to be most critical, that is, those issues judged to be most likely to include site development problems.

5. Initial study of most critical issues of concern. Less critical issues were deferred pending the outcome of the initial studies. In the case of sites for which no particular critical issues were identified, investigation into all areas proceeded at once.

6. At the conclusion of the initial studies, if a "fatal flaw" or serious problem was uncovered, the subsequent studies were deferred and a preliminary report was made to SECI so that a decision could be made whether to continue investigation of the site. If the initial studies did not uncover serious problems, the procedure called for completion of the balance of the studies.

7. Preparation of a final report.

In each case, state and local agencies were contacted early in the investigation to identify their concerns and to obtain existing information regarding the sites. Comments from the agencies helped to focus the investigations and to identify potential regulatory difficulties that might be encountered during the permitting and licensing process.

Since the Bostwick Siting Location (L-7) was the best rated site in the Phase I study, it was the first site investigated in Phase II. The report of this investigation, completed in July 1977, indicated no environmental problems at the site that could not be mitigated. Encouraged by this finding, SECI designated this best-rated site as the "preferred" site for the proposed plant, and the remaining three sites were considered as "potential" sites, as required by the Florida Electrical Power Plant Siting Act. As specific properties within the three remaining siting locations were identified, they were likewise subjected to preliminary environmental analyses.

Site Comparison

A comparison of the ecological, hydrological, geotechnical, air quality, and land use characteristics of the four top-rated sites is presented in Table 9.1-1. Although not reflected in this table, the investigations indicate, from both an engineering cost and a "fatal flaw" point of view, the Putnam Site (Bostwick L-7) remains the preferred site for development of the proposed 1,200-MW steam electric generating station. Complete reports of the investigations conducted for each site are on file with SECI.

9.1.2.2 Alternative Fuels

Fuel alternatives for the proposed project are discussed in Section 1.3.

Table 9.1-1

Environmental Comparison of
Four Alternate Sites

SITE	ECOLOGY Advantages	ECOLOGY Disadvantages
PUTNAM (Bostwick L-7)	1. No unique or critical habitat on site. 2. Onsite habitats disturbed by past activities. 3. No "wetlands" as defined by the U.S. Corps of Engineers occur on site.	1. 10 percent of site is wetland. 2. Gopher tortoise, a protected species, is found on site. 3. St. Johns River is inhabited by manatee, an endangered species.
SUWANNEE (Branford L-1)	1. A large portion of the site (about 70 percent) is pasture, crops, or pine plantation. Therefore, the development will cause little change of important habitat on the majority of the site.	1. Part of site (30 percent) is relatively undistubed habitat contiguous to the Santa Fe River. 2. Santa Fe River is a high-quality aquatic resource with an abundant sport fishery.
SUMTER (Bushnell L-6)	1. Highly disturbed by past quarrying activities.	1. None
SATSUMA (Satsume L-9)	1. Much of usable portion of the site has been disturbed by past and present logging/clearing	1. St. Johns River is inhabited by manatee, an endangered species. 2. Wetlands (300 acres) as defined by the U. S. Corps of Engineers occur on site, are relatively undisturbed, and are contiguous to navigable water

Table 9.1-1 (Continued)

SITE	WATER — Advantages	WATER — Disadvantages
PUTNAM	1. Adequate surface water source for cooling-cycle makeup (St. Johns River). 2. Adequate ground water source for plant water (Floridan Aquifer). 3. 80 percent (1,700+ acres) is at relatively high elevation and is not flood prone. 4. Proximity to adequate Point of Discharge (POD) of plant blowdown discharge.	1. Surface water source (St. Johns River) is relatively high in dissolved solids.
SUWANNEE	1. Adequate surface water source (Suwannee River or Santa Fe River, minimum flows 1,530 and 609 cfs, respectively). 2. Adequate ground water source for minor plant water (Floridan Aquifer). 3. Large portion (80 percent) of site is not flood prone. 4. Proximity of adequate receiving waters (minimum flows need to be $\geq$1,056); Suwannee River.	1. Limestone comprising the Floridan Aquifer is either exposed or covered by a relatively thin layer of clean sand. Therefore, Floridan Aquifer would be potentially exposed to leachate from coal/waste storage.
SUMTER	1. Adequate ground water source for minor plant water (Floridan Aquifer). 2. Site appears not to be flood prone.	1. Surface water sources are inadequate for cooling water makeup. Ground water may be adequate, but would result in a major stress on the resource. 2. Marginally adequate Point of Discharge would be the Withlacoochee River, 8.5 miles from site.

Table 9.1-1 (Continued)

SITE	WATER: Advantages	WATER: Disadvantages
SATSUMA	1. Adequate surface water source for plant cooling water makeup (St. Johns River). 2. Adequate ground water source for minor plant water (Floridan Aquifer). 3. 70 percent (700 acres) of site is not flood prone. 4. Proximity to adequate POD (St. Johns River).	1. Surface water source is relatively high in dissolved solids.

Table 9.1-1 (Continued)

SITE	GEOTECHNICAL Advantages	GEOTECHNICAL Disadvantages
PUTNAM	1. Floridan Aquifer (primary source of potable water) protected by a thick, relatively impervious aquaclude, the Hawthorn Formation. 2. No evidence of solution activity in underlying soils. 3. High permeability of surface soils will allow for percolation of sanitary effluents.	1. Surface soils are clean, poorly graded sand to depth of 40 to 50 feet; there are no onsite construction materials except sand (i.e., no limestone, no fine, cohesive soils). 2. High permeability of soils offers limited opportunity for sealing or containment of liquid wastes. 3. Sands, coupled with high water table, may present excavation, earthmoving, or dewatering problems.
SUWANNEE	1. No high water table onsite to interfere with construction activities. 2. Limestone for scrubber system is available locally. 3. Presence of existing quarries for storage of stabilized wastes.	1. Presence of numerous sinkholes and solution features onsite; potential high foundation costs. 2. Little, if any, fine material on or near the site for construction of dikes.
SUMTER	1. Limestone for scrubber system is available locally. 2. Presence of existing quarries for storage of stabilized wastes.	1. Presence of numerous sinkholes and solution features on site; potential high foundation costs.
SATSUMA	1. Floridan Aquifer protected by Hawthorn Formation on main part of site. 2. No surface expression of solution activity on main part of site. 3. High permeability of surface soils will allow good percolation of sanitary wastes. 4. Apparently low water table conditions in higher site elevations.	1. Onsite surface soils are apparently clean sands with high permeability; little opportunity for sealing or containment of liquid wastes. 2. Waste storage potential appears to be limited on main part of site; presence of sinkholes southeast of site may cause potential leachate impacts to Floridan Aquifer if that area is used for waste storage

Table 9.1-1 (Continued)

SITE	AIR QUALITY Advantages	AIR QUALITY Disadvantages
PUTNAM	1. Ambient air quality is good. 2. Site is in a PSD Class II area. 3. Nearest PSD Class I area is Okefenokee National Park, over 100 km distant.	1. Duval County, 43 km from site, is a non-attainment area for particulates. 2. FP&L Palatka station source (13 km) and Hudson Pulp and Paper source (7 km) are competing emission sources; however, these are not situated in a straight line and would not be additive concurrently with proposed station.
SUWANNEE	1. Ambient air quality is excellent. 2. No existing nearby major emission sources. 3. Site is in PSD Class II area. 4. Nearest PSD Class I area is Okefenokee National Park, 80 km distant.	1. None
SUMTER	1. Ambient air quality is good. 2. Site is in a PSD Class II area. 3. Only one moderate-size emission source in area (Dixie Lime Company).	1. Class I PSD area, Chassahowitzka National Wildlife Refuge, is only 50 km distant, and could be impacted by station. 2. Polk County non-attainment area is 50 km from site and could be impacted.
SATSUMA	1. Ambient air quality is good. 2. Site is in a PSD Class II area. 3. Nearest PSD Class I area is Okefenokee National Park, over 100 km distant. 4. Nearest non-attainment area is Duval County, about 63 km distant.	1. FP&L Palatka Station (12 km) and Hudson Pulp and Paper (15 km) are competing emission sources; however, these are not situated in a straight line and would not be additive concurrently with proposed station.

Table 9.1-1 (Continued)

SITE	LAND USE: Advantages	LAND USE: Disadvantages
PUTNAM	1. No high density residential areas are nearby. 2. Adjacent to rail transportation. 3. Adjacent to water transportation--St. Johns River barge channel. 4. About 50 percent of site designated "development." 5. No unique farmland on site.	1. About 50 percent of site designated "conservation/preservation."
SUWANNEE	1. No high density residential areas are nearby. 2. Adjacent to rail transportation. 3. No known conflicting land uses.	1. No access to water transportation.
SUMTER	1. No high density residential areas are nearby. 2. Adjacent to rail transportation. 3. No known conflicting land uses.	1. No access to water transportation.
SATSUMA	1. Adjacent to rail transportation.	1. No access to water transportation. 2. Several nearby fishing resorts. 3. Large nearby residential development.

9.2 ALTERNATIVES TO STATION SYSTEMS DESIGN

9.2.1 Flue Gas Emission Control System

The air emissions control system for the proposed station consists of three parts: (1) flue gas desulfurization (FGD), (2) particulates control, and (3) nitrogen oxides control.

9.2.1.1 Flue Gas Desulfurization

Introduction

To meet existing and proposed federal and state New Source Performance Standards for sulfur dioxide (SO_2) emissions, specifications for the evaluation of alternative FGD systems included 79 percent SO_2 removal efficiency and an emission limitation of at least 1.2 lbs of SO_2 per million British thermal units (lbs/10^6Btu) of heat input. (An FGD system removal efficiency of 79 percent coupled with coal washing at the mine will provide overall sulfur removal of 85 percent.) Since the New Source Performance Standards for the electric utility industry have only been proposed and not promulgated, any change in the final promulgated standards would require reevaluation of the alternatives to assure cost effective regulatory compliance.

Three FGD systems were designated for assessment: non-regenerative limestone scrubbing, non-regenerative lime scrubbing, and various regenerative scrubbing systems. Considerations for choosing the preferred FGD system were:

1. Ability to achieve required removal efficiency,
2. Proven high availability and reliability,
3. Capital and operating costs,
4. Availability and cost of reagent,
5. Engineering design, and
6. Environmental impact potential

Numerous documents, including U. S. Environmental Protection Agency (EPA, 1977b) publications, recently published Draft and Final Environmental Impact Statements EIS's (U.S. Corps of Engineers [COE] 1978a, 1978b; EPA, 1978a, 1978b) discuss the various types of regenerative and non-regenerative FGD systems on the market and evaluate the relative merits of each.

Regenerative Systems

In general, regenerative systems produce a byproduct that is potentially marketable, plus a relatively small amount of waste material. Depending on the particular process, the byproduct material may be elemental sulfur or a compound of sulfur such as sulfuric acid, calcium sulfate, or sodium sulfate. However, the process equipment is generally much more expensive than other scrubber types, and the quality and marketability of the byproduct is uncertain. Furthermore, these systems are presently less widely used, and their operating history has not been well established. Many of these processes are currently not commercially available, as only small pilot-plant experience is documented. Because these systems do not meet the criteria of proven high reliability, because of uncertain market conditions for sale of the byproducts, and because of probably high capital and potentially high operating costs, regenerative systems were eliminated from consideration.

Non-Regenerative Systems

Non-regenerative systems, otherwise known as "throwaway processes", are characterized by the requirement of relatively large quantities of relatively inexpensive reagents that will react with sulfur dioxide in flue gas. These reagents are used once; the reaction forms wet solid waste, which is then disposed of.

The available systems considered for use for the Putnam Site are categorized by the reagents used: limestone, lime, alkaline fly ash, and sodium carbonate. Of these, only limestone and lime systems have proven reliable. Past installations utilizing lime scrubbing have experienced plugging and mechanical problems, and the trend in new unit design is away from lime and toward limestone scrubbing. As of November 1977 there were 32 FGD systems in utility operation, and 100 more in various stages of construction, design, and planning. Of the 32 operating systems, 12 were limestone scrubbers, 13 were lime scrubbers, and 7 used other processes. Of the 100 other systems, 44 were committed to limestone scrubbing, 22 to lime scrubbing, 5 to other process, and 29 had not been selected. Limestone and lime scrubbing systems thus comprise 78 percent of all operating systems and 66 percent of systems in design or under construction (Burns and Roe, 1978).

Other types of non-regenerative systems are not well established and have not performed over a comparable length of time. Therefore, they do not meet the criteria of high availability and proven reliability and were rejected on that basis.

Selection of FGD System

The process for removing Sulfur Dioxide (SO_2) from the flue gas stream will be a wet limestone scrubbing process. The system in combination with washing at the mine is capable of reducing sulfur content by 85% in accordance with the proposed New Source Performance Standards published in the Federal Register, 29 November 1978. The system will contain one complete spare scrubbing module. Limestone will be crushed and blended with water to form the make-up reagent slurry to the scrubbers. A bleed stream of scrubber sludge of approximately 10% - 15% solids will be removed from the absorbed tank and will be pumped to thickeners where the solids content will be increased to approximately 35%. Overflow water will be returned to the scrubbing cycle. Underflow (sludge) from the thickeners will be transported to the sludge stabilization system.

9.2.1.2 Particulates Control

To meet the proposed 0.03 lbs/10^6Btu federal and state New Source Performance Standards for particulate emissions, specifications for particulate control alternatives include at least a 99.6 percent removal efficiency. As revisions to the New Source Performance Standards for particulates are promulgated, control alternatives will be reevaluated in light of these changes to assure cost-effective regulatory compliance.

While there are several methods commonly used to remove particulates from flue gases, electrostatic precipitators are the most widely used and proven method for coal-fired steam electric stations.

Baghouse filters were also evaluated. Baghouse filters offer the same particulate removal efficiency as electrostatic precipitators. Given the type of fuel to be used at the proposed station, however, baghouse filters would be a less economical choice, as they have higher operating costs, particularly related to bag replacement. Further, no baghouse filter system of the size required for the proposed station has been in operation long enough to have established an operation and maintenance history.

A third alternative, combined flue gas/particulate scrubbers, may provide the same removal efficiencies achieved by electrostatic precipitators. However, industry experience to date with such combined scrubber systems has not been good. It is therefore an industry standard, with few exceptions, to separate particulate removal from flue gas desulfurization.

9.2.1.3 Nitrogen Oxides Control

The only proven method of limiting nitrogen oxides (NO_x) emissions is to control the combustion process. Some methods presently used to accomplish NO_x control during combustion are (1) overfire air, (2) flue gas recirculation, and (3) combustion in a reducing atmosphere in lieu of an oxidizing atmosphere. Furnace design, using one or more of the above methods to reduce NO_x emissions, is a requirement imposed on the boiler manufacturer by the utility. The boiler must be guaranteed by the manufacturer to limit NO_x emissions to meet the proposed federal emission limitation for nitrogen dioxide of 0.6 lbs/10^6Btu.

9.2.2 Station Service Water Sources

Three water sources exist at the proposed Putnam site: the Floridan Aquifer, the water table aquifer, and the St. Johns River. As described in Section 3.4, the proposed plant service water source arrangement consists of (1) use of the St. Johns River for the makeup water requirements of the heat rejection system and station services (stack wash, air preheater wash, and boiler fireside wash); and (2) use of the Floridan Aquifer to supply such other station water requirements as fire protection, potable water system, condensate polisher makeup, auxiliary and main boiler makeup, and miscellaneous station uses.

9.2 ALTERNATIVES TO STATION SYSTEMS DESIGN

9.2.1 Flue Gas Emission Control System

The air emissions control system for the proposed station consists of three parts: (1) flue gas desulfurization (FGD), (2) particulates control, and (3) nitrous oxide control.

9.2.1.1 Flue Gas Desulfurization

Introduction

To meet existing and currently anticipated federal and state New Source Performance Standards for sulfur dioxide (SO_2) emissions, specifications for the evaluation of alternative FGD systems included 90 percent SO_2 removal efficiency and an emission limitation of at least 1.2 lbs of SO_2 per million British thermal units (lbs/MBtu) of heat input. Since the New Source Performance Standards for the power industry are currently under revision, and the 90 percent efficiency is a proposed standard, any change in this proposal would require reevaluation of the alternatives to assure cost effective regulatory compliance.

Three FGD systems were designated for assessment: non-regenerative limestone scrubbing, non-regenerative lime scrubbing, and various regenerative scrubbing systems. Considerations for choosing the preferred FGD system were:

1. Ability to achieve 90 percent removal efficiency,
2. Proven high availability and reliability,
3. Capital and operating costs,
4. Availability and cost of reagent,
5. Engineering design, and
6. Environmental impact potential

Numerous documents, including U. S. Environmental Protection Agency (EPA, 1977) publications, recently published Draft and Final Environmental Impact Statements EIS's (U.S. Corps of Engineers [COE] 1978a, 1978b; EPA, 1978a, 1978b) discuss the various types of regenerative and non-regenerative FGD systems on the market and evaluate the relative merits of each.

Regenerative Systems

In general, regenerative systems produce a byproduct that is potentially marketable, plus a relatively small amount of waste material. Depending on the particular process, the byproduct material may be elemental sulfur or a compound of sulfur such as sulfuric acid, calcium sulfate, or sodium sulfate. However, the process equipment is generally much more expensive than other scrubber types, and the quality and marketability of the byproduct is uncertain. Furthermore, these systems are presently less widely used, and their operating history has not been well established. Many of these processes are currently not commercially available, as only small pilot-plant experience is documented. Because these systems do not meet the criteria of proven high reliability, because of uncertain market conditions for sale of the byproducts, and because of probably high capital and potentially high operating costs, regenerative systems were eliminated from consideration.

Non-Regenerative Systems

Non-regenerative systems, otherwise known as "throwaway processes", are characterized by the requirement of relatively large quantities of relatively inexpensive reagents that will react with sulfur dioxide in flue gas. These reagents are used once; the reaction forms wet solid waste, which is then disposed of.

The available systems considered for use for the Putnam Site are categorized by the reagents used: limestone, lime, alkaline fly ash, and sodium carbonate. Of these, only limestone and lime systems have proven reliable. Past installations utilizing lime scrubbing have experienced plugging and mechanical problems, and the trend in new unit design is away from lime and toward limestone scrubbing. As of November 1977 there were 32 FGD systems in utility operation, and 100 more in various stages of construction and design. Of the 32 operating systems, 12 were limestone scrubbers, 13 were lime scrubbers, and 7 used other processes. Of the 100 other systems, 44 were committed to limestone scrubbing, 22 to lime scrubbing, 5 to other process, and 29 had not been selected. Limestone and lime scrubbing systems thus comprise 78 percent of all operating systems and 66 percent of systems in design or under construction (Burns and Roe, 1978).

Other types of non-regenerative systems are not well established and have not performed over a comparable length of time. Therefore, they do not meet the criteria of high availability and proven reliability and were rejected on that basis.

Based on the availability of limestone in Florida, and on the more favorable operational history, limestone scrubbers were selected for Seminole Plant Units No. 1 and No. 2. However, the exact process has not yet been selected for the following reasons:

1. As discussed in Section 9.2.6, several ultimate waste disposal methods are under consideration, but a final decision has not been made. The scrubbing process and the ultimate waste disposal method should be designed as a unit.
2. The U. S. Environmental Protection Agency has not yet promulgated the New Source Performance Standards required by the Clean Air Act, and the scrubber to be selected must satisfy the requirements of these standards.

9.2.1.2 <u>Particulates Control</u>

To meet the currently anticipated 0.03 lbs/MBtu federal and state New Source Performance Standards for particulate emissions, specifications for particulate control alternatives include at least a 99.5 percent removal efficiency. As revisions to the New Source Performance Standards for particulates are promulgated, control alternatives will be reevaluated in light of these changes to assure cost-effective regulatory compliance.

While there are several methods commonly used to remove particulates from flue gases, electrostatic precipitators are the most widely used and proven method for coal-fired steam electric stations.

Baghouse filters were also evaluated. Baghouse filters offer the same particulate removal efficiency as electrostatic precipitators. Given the type of fuel to be used at the proposed station, however, baghouse filters would be a less economical choice, as they have higher operating costs, particularly related to bag replacement. Further, no baghouse filter system of the size required for the proposed station has been in operation long enough to have established an operation and maintenance history.

A third alternative, combined flue gas/particulate scrubbers, may provide the same removal efficiencies achieved by electrostatic precipitators. However, industry experience to date with such combined scrubber systems has not been good. It is therefore an industry standard, with few exceptions, to separate particulate removal from flue gas desulfurization.

9.2.1.3 Nitrous Oxides Control

The only proven method of limiting nitrogen oxides (NO_x) emissions is to control the combustion process. Some methods presently used to accomplish NO_x control during combustion are (1) overfire air, (2) flue gas recirculation, (3) tilting burners, and (4) combustion in a reducing atmosphere in lieu of an oxidizing atmosphere. Furnace design, using one of the above methods to reduce NO_x emissions, is a requirement imposed on the boiler manufacturer by the utility. The boiler must be guaranteed by the manufacturer to limit NO_x emissions to meet anticipated federal emission limitationa for nitrogen dioxide of 0.6 lbs/MBtu.

9.2.2 Station Service Water Sources

Three water sources exist at the proposed Putnam site: the Floridan Aquifer, the water table aquifer, and the St. Johns River. As described in Section 3.4, the proposed plant service water source arrangement consists of (1) use of the St. Johns River for the makeup water requirements of the heat rejection system and station services (stack wash, air preheater wash, and boiler fireside wash); and (2) use of the Floridan Aquifer to supply such other station water requirements as fire protection, potable water system, condensate polisher makeup, auxiliary and main boiler makeup, and miscellaneous station uses.

Three other water source arrangements were considered and rejected:

1. Supplying all water requirements--cooling tower makeup as well as potable and boiler makeup--from wells drilled in the Floridan Aquifer. This alternative was ruled out because it would cause excessive drawdown of the Floridan Aquifer and potentially increase salt water intrusion. The Floridan Aquifer supplies drinking water in the site area.

2. Supplying all water from the St. Johns River. This alternative was ruled out because the water quality of the river is not as good as that of the Floridan Aquifer. Further, the river's water quality is quite variable. These conditions would result in higher equipment and chemical costs and a greater quantity of water treatment wastes.

3. Supply potable and boiler makeup from the shallow water table (non-Floridan) aquifer beneath the site. This alternative was ruled out for the same reasons ruling out Alternative 2: the presence of variable water quality, higher equipment and chemical costs, and greater quantity of water treatment wastes. Further, the ability of the water table aquifer to supply the required water over a sustained period of time is doubtful.

9.2.3 Heat Dissipation System

9.2.3.1 Introduction

Two heat dissipation systems were considered for the proposed station: once-through cooling and cooling towers. In the former case, two alternatives were considered: straight once-through cooling and once-through cooling with topping towers. In the latter case, natural draft towers and mechanical draft towers were the alternatives considered. Each of the alternatives was evaluated under different river conditions; the cooling tower system alternative evaluation included variations in the cycles of concentration and a winter peak case as well as a summer peak case.

The thermal impact of the proposed project on the St. Johns River is important because of the presence of the manatee, an endangered species. Manatee are attracted to warm water areas. Where such an area is created by the thermal effluent of a power station, there is a danger that this warm water area would suddenly be eliminated were the station to completely shut down for any reason. Such a sudden elimination of the warm water area during winter conditions, when the ambient river temperature may be as low as 47 degrees F, could subject the manatee to cold shock.

As the following discussion indicates, once-through cooling methods create a considerably larger and warmer thermal plume than do cooling towers, which have been chosen as the proposed heat dissipation system for the Putnam Station.

The choice of cooling towers was between the two most feasible types for a Florida site, natural and mechanical draft, wet-type towers. The choice, natural draft, was based on total evaulated costs taking into consideration capital and operating costs.

9.2.3.2 <u>Once-Through Cooling System</u>

<u>Once-Through Cooling</u>

The once-through cooling method was evaluated by modeling for the critical river flow condition known as minimum absolute flow (see Sect. 2.3.1 for definition). A description of the model is provided in Appendix C.4. The parameters used in the modeling study are shown in Table 9.2-1.

For the once-through cooling method under the minimum absolute flow condition, extensive thermal impact would be felt throughout almost the entire investigated reach of the river. The 1°F delta-T isotherms (1 degree F above ambient) extended up to approximately 3 miles away in either direction at certain tidal stages. The 3°F delta-T isotherms (3 degrees F above ambient) extended to about 90 percent of the river's cross section; in violation of existing Florida Rules on Pollution of Waters, Chapter 17-3, Florida Administrative Code.

Once-Through Cooling With Topping Tower

This heat dissipation method was shown by the modeling study to have a less extensive impact than the once-through cooling method. The 1°F delta-T isotherms (1 degree F above ambient) extended to less than 2 miles from the point of discharge; the 2°F delta-T isotherms (2 degree F above ambient), at their extreme, extended to less than 0.5 mile from the point of discharge. However, as with once-through cooling without a topping tower, virtually the entire river cross section would be raised above ambient.

As is indicated by Table 9.2-1, both the once-through cooling with topping tower and the straight once-through cooling have very high intake volumes: 1,886 cubic feet per second (cfs) for the former and 1,900 cfs for the latter. These intake volumes would be expected to cause impingement/entrainment problems (see Section 5.2.2.2).

9.2.3.3 Cooling Tower System

Cooling tower types that were evaluated for dissipating heat removed from the turbine cycle are the following:

1. Wet-type mechanical draft cooling towers -- the capital cost of these towers is less than the capital cost of a natural draft tower. However, with rapidly escalating fuel costs over the life of the proposed station, the power requirements of the mechanical draft towers drive the evaluated costs for the mechanical draft towers higher than those for the natural draft towers, which have relatively low operating costs.

2. Natural draft cooling towers -- the capital cost of these towers is high while the operating costs are low.

Both of these tower types represent proven technology. From an environmental point of view, natural draft towers offer the advantages of limited or no incidences of ground-level fogging (or icing in severe conditions); greater dispersion and lower maximum salt deposition rates and ground-level salt concentrations; and lower noise levels. The chief environmental disadvantage is related to the impact of these towers on scenic resources (a typical tower is over 400 feet high and over 400 feet in diameter at the basin; the elevated plume from these structures can often be seen for miles).

The final selection of tower type was strongly influenced by an economic evaluation considering capital and differences in present worth energy costs for water pumping and for operation for the mechanical draft towers. The results of the analysis, along with assumptions used in the analysis, are given in Table 9.2-2.

The other tower type evaluated was the dry tower. There is presently only minimal use of dry cooling towers in the United States. These towers require the use of higher condensing pressure, which requires more steam for the same power output. This increases boiler and auxiliary boiler sizes and costs. Because of the limited operating experience and overriding economic considerations, this alternative was eliminated.

9.2.3.4 Other Alternatives

Spray ponds or cooling lakes were rejected for two reasons. First, the site contains insufficient land area for use of either spray ponds or cooling lakes. The land requirements may be in excess of 1,500 acres for a 1,200 MW station. A second, and more important, reason is that site geological and soil conditions are not suitable for the construction of ponds or lakes because of the absence of impermeable soils in the near-surface layers at the site. Section 2.2 indicates that suitable dike construction soils exist some 100 feet below the surface. A suitable lake would require excessively high site preparation costs, either in excavating to suitable soils or importing suitable soils from distant sources.

9.2.3.5 Sale of Steam

An interest to purchase process steam from the generating station was shown by a neighboring facility. SECI investigated the feasibility of providing process steam to this facility and the effect this might have on the design of the power plant.

The investigation showed the sale of process steam increased the cost and complexity of the power plant steam cycle equipment; increased the demand for boiler makeup water; and, in turn increased the volume of ground water withdrawal at the power plant site. The concept was subsequently abandoned.

9.2.4 Alternative Chemical Waste Treatment System

9.2.4.1 Introduction

The Chemical Waste System described in Section 3.6 provides systems to neutralize strong wastes at the source, separate oil before pumping, collect and equalize the wastes in one of two ash pond areas, then adjust pH and reduce any remaining oil, heavy metals, and suspended matter by coagulation and sedimentation before monitoring and release. Alternatives would include a number of small, labor-intensive batch treatment systems with reduced total reliability.

9.2.4.2 Well Water Pretreatment Wastes

Sludge from the lime softening clarifier (see Section 3.6.2) could be collected locally and treated to remove suspended solids and to adjust pH. However, it is not practical or economical to treat small quantities of waste produced intermittently. Several batch treatment vessels, chemical feeds, and sophisticated pH controls would be required. Furthermore, the overall reliability of small, complex systems is questionable.

Filter backwash water (see Section 3.6.2) could also be collected in a batch treatment system and treated to remove suspended solids and to adjust pH. However, treatment of three batches of backwash water per day would require excessive operator attention and equipment similar to that discussed in the preceding paragraph.

9.2.4.3 Makeup Demineralizer System Wastes

The Activated Carbon Unit backwash water (see Section 3.6.3) will be produced in batches two or three times per week. Batch treatment could be consolidated with batch facilities in the Well Water Pretreatment System. These facilities are, however, remote from the Makeup Demineralizer System, and they have separate operators. Consolidation of treatment would require an additional, expensive wastewater line to the Well Water Pretreatment area, which, furthermore, might be used only two or three times per week. Coordination problems between equipment operators sharing the same batch treatment facility would reduce reliability.

Nonrecoverable demineralizer acid and alkaline wastes are proposed to be batch-neutralized as part of the automatic regeneration procedure (see Section 3.6.3). The waste is to be checked by the demineralizer operator before release to the Central Wastewater Treatment Facility. An alternative would be to dilute the proposed integral neutralizing system and rely on chance mixing and neutralization elsewhere. Neutralizing systems to treat wastes ranging from 2 to 4 percent sulfuric acid to 3 to 4 percent sodium hydroxide, on a continuous flow basis, are complex and unreliable.

9.2.4.4 Boiler Blowdown Wastes

Boiler blowdown (see Section 3.6.5) will contain very small quantities of salts and ammonia resulting in a pH range of 9.0 to 9.6. Infrequently, such as during startup operations, some suspended matter will be present. An alternative to the system described in Section 3.6.5 would be a system that would add 1 or 2 parts per million of acid to a small flowing stream for pH adjustment. Such a system would be complex and unreliable; therefore, it is not proposed.

9.2.4.5 Floor Drain Wastes

Floor drain wastes (see Section 3.6.6), which are produced intermittently, could be collected as they are produced and pumped to an oil-water separator before release. However, pumping of oil/ water mixtures produces emulsions that are difficult to treat, expecially on an infrequent-batch basis. This type of system would be complex and unreliable, and therefore is not proposed.

9.2.4.6 Bottom Ash Sluice Wastewater

Bottom ash sluice wastewater (see Section 3.6.9) could be discharged to the Flue Gas Desulfurization System (FGD) rather than treated in the Central Wastewater Treatment Facility before release. This would be undesirable in that the recirculated sluice water may become saturated with salts that would have an adverse impact on the operation of the FGD system in the form of scaling and plugging of the water spray system.

9.2.4.7 Boiler Chemical Cleaning Wastes

An alternative to the procedure outlined in Section 3.6.14 would be the following. Spent alkaline and acid cleaning solutions might be trucked offsite by the cleaning contractor. This would require disposal in a state-licensed facility, supervised by others. The onsite treatment method is more economical and more reliable.

An organic acid or solvent might be substituted for hydrochloric acid. The spent acid portion of the total waste could then be incinerated in a portable burner. However, this could produce an air pollution problem; further, the alkaline wastes would still require treatment or disposal.

9.2.4.8 Central Wastewater Treatment System

There are no viable alternatives to the proposed final wastewater treatment process. Physical equipment variations are possible, but the process should include pH control, chemical coagulation, flocculation, sedimentation, and monitoring before release.

9.2.5 Sanitary Waste Treatment System

The proposed Sanitary Waste Treatment System consists of a prefabricated, digestion-type sewage treatment plant. The alternative considered was a sewage disposal system including the collection of all sanitary wastes in large holding tanks which would be periodically emptied and transported to offsite treatment facilities by an outside contractor. The proposed system is considered more desirable because it would be under the control of SECI. There are no particular cost or environmental advantages associated with the alternative system.

9.2.6 Solid Waste Disposal System

9.2.6.1 Introduction

Three major kinds of solid waste will be produced by the proposed station: dry fly ash, wet bottom ash, and sludge from the flue gas desulfurization (FGD) system (SO_2 limestone scrubber).

Fly ash is proposed to be removed from the precipitator hoppers by a dry pneumatic system and deposited in concrete silos. The dry ash will be available for offsite sale and re-use. Unsold ash will be added to the scrubber sludge. Bottom ash will be collectd in a wet hopper located beneath the boiler and removed by sluicing directly to dewatering bins. Scrubber sludge is proposed to be pumped from a thickener to a chemical processing plant. Solid wastes would be deposited in the northern portion of the site (Figure 3.1-1).

Four methods for ultimate disposal of solid wastes were considered. These methods were (1) wet ash and sludge to unlined ponds, (2) wet ash and sludge to lined ponds, (3) sludge dewatering and mixing with ash to produce stabilized cake, and (4) the use of chemical stabilizers to improve the handling characteristics of the stabilized cake. In addition, sale of fly and bottom ash as an alternative to onsite disposal was investigated by SECI.

The makeup water requirements for the FGD system depend on the method chosen for sludge disposal. A wet-sludge-to-pond system would include provisions to reuse decanted water from the pond as the sludge settles. Assuming seepage losses from the pond are minimized, the estimated makeup water requirements were estimated to be 2000 gpm. If seepage losses from the pond are large, the makeup water requirements will increase accordingly since less decanted water will be available for reuse. If a sludge stabilization or fixation method is used, the makeup water requirements are estimated to be 1200 gpm. As will be discussed, the required amount of makeup water will affect the environmental impact of the system.

9.2.6.2 Method No. 1, Wet Ash and Sludge to Unlined Ponds

This method would include a dewatering process to produce a mixture of scrubber sludge and fly ash at about 30 percent solids (70 percent water). The mixture would be placed in an unlined pond(s) in the northern portion of the site. Bottom ash would be disposed in a separate unlined pond(s). The makeup water requirements are estimated to be 2000 gpm plus any seepage losses from the pond system. The makeup water would be supplied by cooling tower blowdown (Figure 3.4-1).

Leachate from products of coal combustion is expected to contain trace elements in varying quantities. Disposal of such products (ash, scrubber sludge) in unlined ponds may be the most economical alternative available to SECI. The primary disadvantage of this method of disposal is potential impacts to ground water quality. Ground water investigations conducted by Dames & Moore (Section 2.3.2) have indicated that the principal ground water aquifer in the Putnam Site region, the Floridan Aquifer, is protected from potential impacts from surface storage of wastes by a confining layer known as the Hawthorn Formation. These investigations have also, however, indicated the presence of a second, shallow ground water body, termed the water table aquifer, that is not so protected. This aquifer exists in the upper layers of highly permeable sands on the site and receives its principal recharge from surface percolation.

The soil characteristics at the Putnam Site are such that any drainage through, or leachate from, solid wastes will freely leave an unlined pond, move through the soil, and enter the water table aquifer (see Section 5.5). Dames and Moore is of the opinion that, under existing conditions in the northern part of the site, water from the water table aquifer enters the swamp and the small unnamed ditch north of the site. This ditch discharges to Cedar Creek that eventually discharges to the St. Johns River. Therefore, impacts to the water table aquifer have the potential of extending to the small ditch and possibly to Cedar Creek and to the St. Johns River.

9.2.6.3 Method No. 2, Wet Ash and Sludge to Lined Ponds

This method would be identical to Method No. 1 except that the ponds would be lined by impermeable (or relatively impermeable) natural (clayey soil) or man-made (fabric membrane) materials. The purpose of the lining would be to protect the water table aquifer from leachate impacts.

Lining the disposal pond base with clayey materials may substantially reduce pond seepage and increase the attenuation of trace elements in the leachate. This alternative is more costly than the unlined pond alternative because clayey materials are not available onsite and would have to be transported to the site from considerable distances.

Lining the pond base with an impermeable membrane would prevent leachate seepage. This type of lining material would also greatly increase pond costs. Other types of lining material under consideration are bentonite, sludge and ash fixed with a chemical stabilizer, and asphalt concrete.

One effect of providing lining material to the ponds is that more water would be available for recirculation in the FGD system (less water would be lost through seepage). The result would be a reduced requirement for FGD makeup which would be obtained from cooling tower blowdown, and an increase in discharge and blowdown impacts to the St. Johns River. The difference in blowdown discharge flows cannot be accurately estimated with the information at hand, but would be equal to the difference in seepage rates for unlined and lined ponds and would depend on the nature of the lining material and the configuration of the pond system.

The environmental tradeoff of pond lining would be potential impacts of seepage to the water table aquifer versus increased potential impacts of blowdown to the St. Johns River.

9.2.6.4 Method No. 3, Stabilized Cake

This method would involve a process whereby scrubber sludge would be dewatered and mixed with fly ash and bottom ash to produce a semi-solid stabilized cake containing 50 to 60 percent solids. The resulting material would be easier to handle and would be reduced in volume compared to Methods No. 1 and No. 2. Makeup water requirements would also be reduced because more water would be recovered from the material. It is estimated that the volume of waste material would be reduced by 40 to 50 percent and that makeup water requirements would be reduced to 1200 gpm. The waste material would be land-filled in the northern portion of the site.

Among the disadvantages of this method is its cost since a separate solid waste processing plant is required. The increased cost would include both capital and operation.

Another disadvantage of this process is the reduced requirement for system makeup water which would be obtained from cooling tower blowdown.

Thus, similar to the effect of providing pond lining (see Section 9.2.6.3), using this process would result in increased blowdown discharges to the St. Johns River. It is estimated that this process would require about 1200 gpm compared to 2000 gpm required for a wet sludge system. The difference, 800 gpm (or 1.78 cfs) would be equal to the increase in blowdown to the river. The result would be that 3.79 cfs would be discharged to the river if this method is used compared to 2.0 cfs if a wet-sludge-pond system is used, an increase of about 90 percent.

9.2.6.5 Method No. 4, Chemical Fixation

This method would involve a process almost identical to that for Method No. 3. The difference would be that chemical fixation agents would be added to the ash and sludge mixture to produce a stabilized solid material with the following characteristics: (1) compressive strength of 300 to 500 pounds per square inch, (2) low permeability, and (3) high chemical stability.

The material would be landfilled in the northern portion of the site. Because of the low permeability of the material, no lining material is likely to be required. This would tend to offset the higher cost of the process (operational costs would be increased over Method No. 3 because of the necessity of purchasing fixation chemicals).

An advantage of Method No. 4 is that the landfill material can be covered with native soil and planted with native vegetation. The end result would be the land could later be used for any one of a variety of purposes such as open space and timber production.

Relative impacts with respect to quantity of blowdown to the St. Johns River would be identical to that of Method No. 3 since the expected process water makeup is the same as for Method No. 3, 1200 gpm.

9.2.6.6 Choice of Ultimate Disposal Method

In October, 1978, an economic and engineering analysis of flue gas desulfurization systems was completed. The wet limestone process was shown to be the most feasible. On the basis of this selection, Seminole performed a site-specific, economic analysis of disposal alternatives:

Method No. 1, Method No. 2, and a combination of Methods No. 3 and 4. Factors included, as applicable, were: average capital cost of equipment and erection, present worth of combined energy and capability costs, estimated cost of pond excavation and fill, average evaluated additive cost, estimated cost of lining, present worth of operating labor, present worth of land fill equipment, and present worth of maintenance requirements. Not evaluated, but subjectively identified as associated costs were ground water monitoring, and short term and long term mitigative and maintenance measures that may be required if unconfined leachates were shown to pose a problem to public health and welfare.

The results of the evaluation showed that the combined Methods No. 3 and 4 was the most economical and most environmentally protective alternative. Studies have shown that the chemically stabilized cake yields a monolithic, nearly-impermeable mass which will not reliquify, channel, or permit permeation or runoff to any appreciable degree. The costs of the combination of Methods No. 3 and 4 resulted in a 2 percent savings over Method No. 1 and a 3 percent savings over Method No. 2. Additionally, the disposal area is effectively reduced from 460 acres to about 300 acres. This reduction results from the ability to use the stabilized sludge as material for the formation of dikes and lining. On this basis, Seminole is proposing to use a stabilized-cake, sludge-ash disposal procedure.

9.2.7 Intake Structures

9.2.7.1 Introduction

Six intake structure designs were evaluated for the proposed station. A biological evaluation of the alternative structures has been performed. The U.S. Environmental Protection Agency guidance document (1977a) was used in the evaluation, along with other pertinent field data and literature.

Of the screening systems proposed for the alternative structures, only fine-mesh screening can keep out the smaller life stages of the smallest fish present in the site area. A net mesh size of about 0.5 millimeter (mm) is used to collect eggs and larvae of most fish species. Such an opening size on a screening device would ensure almost total protection of fish eggs and larvae from entrainment. Such an opening size is not, however, likely to be the most practical considering its potential for plugging (fouling).

In addition to a small opening size, a low intake velocity of less than 0.5 feet per second (fps) through the screen is necessary to prevent impingement and retention of smaller fish on the screen. Almost all fish, including larvae, impinged at less than 0.5 fps will be able to free themselves from entrapment.

It may not be feasible to protect all life stages of a given species from entrainment because of plugging and fouling problems associated with extremely fine-mesh screens. Also, from a biological point of view, entrainment of the earlier life stages of a species may be an acceptable impact because of the nature of the reproductive cycle. Aquatic biological studies going back 20 years have shown that the removal of early-life-stage fish is less damaging to the overall population of a species than removal of more mature fish (McFadden, 1977; W. Van Winkle, 1977; Copeland, Hodgson, and Berket, 1975). The removal of some young individuals when natural mortality is still compensatory is at least partially balanced by increased survival and/or growth of the remainder. This is not an unexpected phenomenon, when one considers the naturally high mortality rate of newly hatched fish, which may exceed 99.9 percent for many species.

The final selection of a screen opening size and intake velocity for the proposed station intake will be based on an evaluation of the expected biological impacts and the engineering and cost feasibility of the intake structure required to accommodate screens of various sizes.

The six intake alternatives that were considered are:

Scheme 1 - Modified conventional intake with standard traveling screens. The modifications for fish protection include "flush mounting" of the screens and the provision of fish escape passages through the outside walls of the structure.

Scheme 2 - The same general configuration as Scheme 1, but with the traveling screen itself modified with the Surry-type, dual-spray fish recovery system.

Scheme 3 - Perforated (or wedge-wire) pipe offshore intake, with pump structure on shore.

Scheme 4 - Perforated (or wedge-wire) pipe shoreline intake, utilizing multiple removable screen units.

Scheme 5 - Radial well system (Ranney collectors).

Scheme 6 - Cylindrical, wedge-wire shoreline intake, utilizing multiple removable screen units.

A location key plan for the proposed intakes is shown on Figure 9.2-1.

9.2.7.2 Scheme 1 - Conventional Intake with Flush-Mounted Traveling Screens

A plan and section of the Scheme 1 intake structure are presented in Figure 9.2-2. This structure can have either one or two screens.

If only one screen is employed, the only modification that would be made to the "conventional" traveling screen intake design would be a fish escape passage provided in both outside walls of the structure. The screen baskets could also be modified so that the side plates do not protrude forward of the screen face. It is believed that such a modification would allow small fish to swim unimpeded to the right or left of the immediate screen face.

If two screens are employed, the supporting wall between the screens would also stop at the screen face, giving a clear passage for fish across the entire face of both screens to the escape ports in the outside walls. A dredged channel to deep water would be required.

The advantages of this intake design are:

1. it is a proven intake type that uses technology known to be reliable, and

2. the shoreline location of the intake structure would make it less visible to residents along the river. If necessary, the structure can be covered with a frame or block building.

The disadvantage of this scheme is that, of all the alternate screens, this is least likely to mitigate potential entrainment impacts that could occur at the Putnam Site. This evaluation assumes a relatively large (3/8 inch or 9.5 mm) screen opening and an intake velocity of less than 0.5 fps (to comply with U.S. Environmental Protection Agency guidelines). With this low intake velocity, large fish in good condition will, for the most part, be able to avoid impingement. Entrainment impacts on small organisms would not be mitigated. Impacts to the aquatic biota associated with channel dredging would occur during intake construction and channel maintenance.

9.2.7.3 Scheme 2 - Conventional Intake with Surry-Type Screen

This intake, shown on Figure 9.2-3, would be structurally identical with Scheme 1, including the fish passages. The only difference would be in the details of the traveling screen, which would be modified as follows:

1. Water- and fish-holding buckets would replace the conventional lifting lips on each 2-foot-high screen panel.

2. Two spray-and-trough systems would be provided instead of one. The first encountered by the moving screen would be a gentle spray or deluge which would discharge fish into a fish recovery flume. The second would be a conventional high-pressure spray system blasting debris into a debris flume. The fish recovery flume would carry the fish back to the river. This screen must operate continuously when performing its fish recovery function to keep to a minimum the time that impinged fish must remain trapped on the screen face.

While this type of design is a recognized conventional intake type, it has several disadvantages:

1. it is more complicated than the Scheme 1 design; and
2. it has higher initial and maintenance costs than Scheme 1.

This scheme is believed to be only slightly better, from a biological point of view, than Scheme 1. If the screen openings are relatively large (9.5 mm), the potential entrainment impacts of the intake would not be mitigated by this design. With low velocities (less than 0.5 fps) maintained through the screen openings, the fish recovery system would serve little use because large fish in good condition would, for the most part, be able to avoid impingement. Impacts associated with construction and maintenance dredging would still be present.

9.2.7.4 Scheme 3 - Perforated (or Wedge-Wire) Pipe Offshore Intake

This intake system, shown on Figure 9.2-4 would consist of an offshore screen unit, a gravity pipe leading to shore, and a pump structure at the shoreline (or set back, as may be desirable for aesthetic reasons).

The offshore intake unit would consist of one or more perforated (or wedge-wire) cylindrical pipe sections. The wedge-wire winding screen would have the standard 9.5 mm opening. A cleaning platform to allow brush-scrubbing of the face of pipe screens is also included in this design. Routine cleaning would normally be done by a backwash of either compressed air, water, or a combination of the two.

Advantages of this scheme are the following:

1. Assuming sufficient water depth is encountered at reasonable distances offshore, neither confined channels to trap fish nor construction/maintenance dredging are required,

2. Many of these intakes are in service and have performed well from a reliability standpoint,

3. Mechanical design is simplified by the elimination of traveling screens, and

Disadvantages of this system are:

1. Most intakes of this type have been placed in fairly fast - moving water whose current assists in keeping the screen clean. Performance in relatively quiet water such as exists at the Putnam Site is not known,

2. The screen units must be placed in relatively deep water, well offshore. Visible protective barriers that may affect the scenic quality of the river must be installed to protect both the screens and passing boats,

3. Mechanical design is complicated by the addition of an air and/or water backwash system, and

4. Mechanical cleaning by brush may be required to prevent fouling. If so, the offshore location would make it extremely difficult to achieve brush scrubbing because of access difficulties.

9.2.7.5 Scheme 4 - Perforated (or Wedge-Wire) Pipe Shoreline Intake

This type of intake structure, shown on Figure 9.2-5 would be located at the shoreline in the same manner as Schemes 1 and 2. A dredged channel would carry water to shore. Multiple, readily removable screen units utilizing extremely small (1 to 2 mm) openings would be provided. These would be mounted on a wall. Screen units would be removed by overhead hoists and carried to a cleaning deck for scrubbing. Appropriate valving would be provided to permit isolation of individual units for in-place backwashing and for complete removal. From a biological point of view, this is the second most desirable intake design as indicated in Section 9.2.7.8.

This type of intake is a recent development. It has no service history beyond that of a test facility of the Delmarva Utility Company. The major reason for using such a design, rather than the offshore type of perforated pipe intake, would be to permit normal, periodic removal of the screen units to brush-clean biological growth from both the outside and inside of the screen units. Thus, they are advantageous only when biological growth is expected. Such growth has not been a problem to date in fresh water, but can be a serious problem in salt water. It is not known whether biological growth would be a problem at the Putnam Site.

9.2.7.6 Scheme 5 - Radial Well System (Ranney Collector)

The radial well, shown on Figure 9.2-6, is a horizontal version of the vertical water well. Horizontal collector pipes are jacked out of a pump caisson into the surrounding aquifer. The inflow capacity of these pipes is developed in a manner similar to vertical wells.

Preliminary information regarding the subsurface material at the site indicates that a radial well system installed at the site may have the following characteristics:

1. Two 16-foot inner diameter (19-foot outer diameter) caisson units spaced as far as 1,500 to 2,000 feet apart. Two riverfront properties would therefore be required.

2. Six radial collector pipes for each caisson; each pipe would be 16 inches in diameter by 250 feet long.

This intake can only be used where a suitable aquifer is available.

The following are the advantages associated with this type of intake scheme.

1. As indicated in Section 9.2.7.8, the radial well system is the most desirable from a biological point of view. Water is drawn in from the bed of the river at nearly imperceptible velocities.

2. The radial well system causes minimum disruption to the environment during construction. The pump caisson is lowered into the ground without the necessity of cofferdams or dredging. The horizontal collector pipes are jacked out under the river without disturbing the riverbed.

3. Radial wells have been in service about 40 years and have an excellent record of performance where favorable geologic conditions exist.

Disadvantages of this scheme are as follows:

1. Occasionally, the radial well system must be redeveloped as a maintenance procedure after some period of operation.

2. This type of intake is suitable only where favorable geologic conditions exist (i.e., an aquifer with high transmissivity and a hydraulic connection to the river).

9.2.7.7 Scheme 6 - Cylindrical Wedge-Wire Screen Intake

This scheme would employ a simple, semi-circular layout shown in Figure 9.2-7. The screen would consist of eight cylindrical wedgewire screens units.

The screen structure will be located near the shoreline to allow access by maintenance personnel. A crane will be provided so that screen units can be lifted out for cleaning by water pressure hoses and brush scrubbing. This would be accomplished by cutting off flow through a screen unit by closing its sluice gate before lifting it out.

The screen surface area will be designed to achieve a through-screen velocity of 0.2 feet per second (fps) with clean screens. Screens will be cleaned when fouling reduced the screen opening area to the point that through-screen velocities reach about 0.4 fps.

At the centerline of each screen unit will be an embedded air back-wash pipe. An air compressor equipped with a flexible air line will be provided. This will allow each screen unit to be cleaned in place by following these steps. First, the sluice gate for the unit to be air cleaned will be closed. Second, the flexible air line will be attached to the unit's air backwash pipe. Third, compressed air will be forced through the unit in the reversed direction from normal flow. This procedure will reduce the required frequency for mechanical removal and brush cleaning.

The final selection of screen opening size is expected to be within the range of 1 to 2 mm, and will be the smallest feasible opening size that will not cause excessive fouling (Section 5.2.2.2).

The advantages of this intake scheme are as follows:

1. Low capital costs.
2. Few anticipated operational problems since it is mechanically simple.

Disadvantages of the scheme are as follows:

1. A dredged intake channel is required. Thus, some construction impacts can be expected. Also, impacts of maintenance dredging can be anticipated.
2. The design concept is relatively new and untried.

9.2.7.8 Environmental Ranking of Intake Schemes

Based on the aquatic ecology characteristics of the St. Johns River in the Putnam Site area, the six intake schemes were ranked according to their desirability. The following list begins with the most desirable intake scheme:

Scheme 5 - Radial Well Intake. This is most desirable because virtually no aquatic impacts are expected.

Schemes 4 and 6 - Perforated (or wedge-wire) pipe or cylindrical wedge-wire screen units utilizing the smallest feasible screen opening size and through-screen velocities less than 0.5 fps. These two schemes are considered equal in biological protection and will mitigate against entrainment impacts to the maximum extent practicable.

Scheme 3 - Perforated (or wedge-wire) pipe offshore intake with 9.5 mm screen openings and through-screen velocities of 0.5 fps or less. Because ambient river velocities are slightly higher offshort (as compared to onshore) and because of the positioning of the screen openings relative to currents, some entrainment mitigation may be realized compared to an onshore structure that utilizes screen opening sizes of equal size.

Scheme 2 - Conventional intake with Surry-type fish recovery system and standard 9.5-mm mesh screen. While the fish recovery system may save larger fish, smaller species and early-life-stage fish will be adversely impacted by entrainment.

Scheme 1 - Conventional intake with standard 9.5-mm mesh screen. This is the least desirable intake since little mitigation of potential impacts of impingement and entrainment is offered.

9.2.7.9 Choice of Intake Design

Scheme 6 was chosen for this project. The other schemes were rejected for the reasons explained below.

Intake Schemes Eliminated from Consideration

Scheme 1 was rejected because of unacceptable biological impacts.

Scheme 2 was rejected for the same reason as Scheme 1.

Scheme 3 was rejected because of probable difficulty in maintaining and cleaning of screens, and because of expected unacceptable entrainment impacts.

Scheme 4 was rejected in favor of Scheme 6 because of higher relative construction costs.

Scheme 5 was rejected because of the existance of unfavorable geologic conditions. As seen in Table 9.2-3, the presence of fine materials (silts and plastic clays) preclude the existance of a suitable aquifer with hydraulic connections to the river.

Description of Selected Intake

The selected intake (Scheme 6) is shown in Figure 9.2-7. The screen units will be the wedge-wire type screens manufactured by the Johnson Division of U. O. P., Inc. They have been successfully used to mitigate against entrainment by virtue of their small openings and surface boundary effects and against impingement by their uniform low through-screen velocities. The finally selected screen opening size will be 1 or 2 mm as determined by a screen test.

Intake Screen Test

To determine the final design of the shoreline screen structure (Scheme 6), an in situ test described in Section 5.2.2.2 is planned for the Spring and Summer of 1979. The screen test will lead to the final selection of screen opening size.

9.2.8 Discharge Structure

A single discharge pipeline will be provided to carry cooling tower blowdown and discharges from the Central Wastewater Treatment System and sanitary system to the St. Johns River. Two basic alternatives were considered. The difference between them relates to location of the discharge point with respect to the shoreline rather than type of discharge structure. The choice of location depends on the final location of the intake structure.

Preliminary model studies indicated that a separation of 150 feet is necessary between the points of intake and discharge to prevent excessive recirculation of discharged water to the intake. Since it is desirable to limit the consumption of land area for pipeline corridors, it was decided to utilize a single, narrow corridor for both the intake and discharge pipelines. In order to achieve desirable separation of the intake/discharge points, the following alternatives were considered:

Nearshore Discharge - This would be used if the intake is located offshore. In order to provide sufficient water depth at the discharge point, it may be necessary to provide a dredged channel from the discharge point to deep water. The channel would be angled away from the intake structure so that discharged wastewater would be directed away from the intake.

Offshore Discharge - This is the selected alternative since the intake will be either radial well or near shore. If a shoreline intake (Scheme 4 or 6) is used, the discharge point will be located at least 150 feet from the entrance to a dredged intake channel and far enough offshore to encounter water of appropriate depth.

The type of discharge structure is described in Section 3.5.3.

Table 9.2-1

Parameters Used in Estuarine Modeling Study of Thermal Discharge to the St. Johns River for Once-Through Cooling

Parameter	Once-Through Cooling	Once-Through With Topping Tower
Discharge Rate (cfs)	1900	1886
Discharge Temperature (°F)	101	92
Ambient River Temperature (°F)	87	87

Table 9.2-2

Summary of Results of an Economic Analysis of Natural Versus Mechanical Draft, Wet-Type Cooling Towers.

Assumptions:

Number of towers	2
Heat Load	5.94×10^9 Btu/hr.
Circulating Water Flow	600,000 gpm
Approach	10 °F
Range (ΔT)	19.8 °F

ITEM	NATURAL DRAFT	MECHANICAL DRAFT
Pump Head, ft.	43.9	42
ΔPump Head, ft.	1.9	Base
ΔPump hp	306	Base
Fan hp	None	3,816
Total Δ Hp	306	3,816
Total Δ Energy (kW)	228	2,922
Total Capital Cost	$21,000,000	$16,688,000
Present Worth of Energy*	$ 866,400	$11,103,600
Total Evaluated Cost	$21,866,400	$27,791,600

*Present Worth of Energy is based on $3800 per kilowatt (kW). This figure is based on the capitalized and annualized cost of providing the energy and is consistant with the economic evaluations in SECI's electric power needs study.

Table 9.2-3

Description of Soils from Log
of Bore Hole Located in
the Preferred Pipeline Corridor
(Ground Elevation at Boring = 14.33 ft)

Depth (feet)	Soil Description
0 - 4	Dark gray fine sand
4 - 19.5	Light brown clay and silt, medium plastic
19.5 - 31.5	Gray clay, very highly plactic
31.5 - 46	Soft dark gray clay
46 - 51.5	Fine sand, trace fine silt with shell fragments

Source: Burns and Roe, Inc.

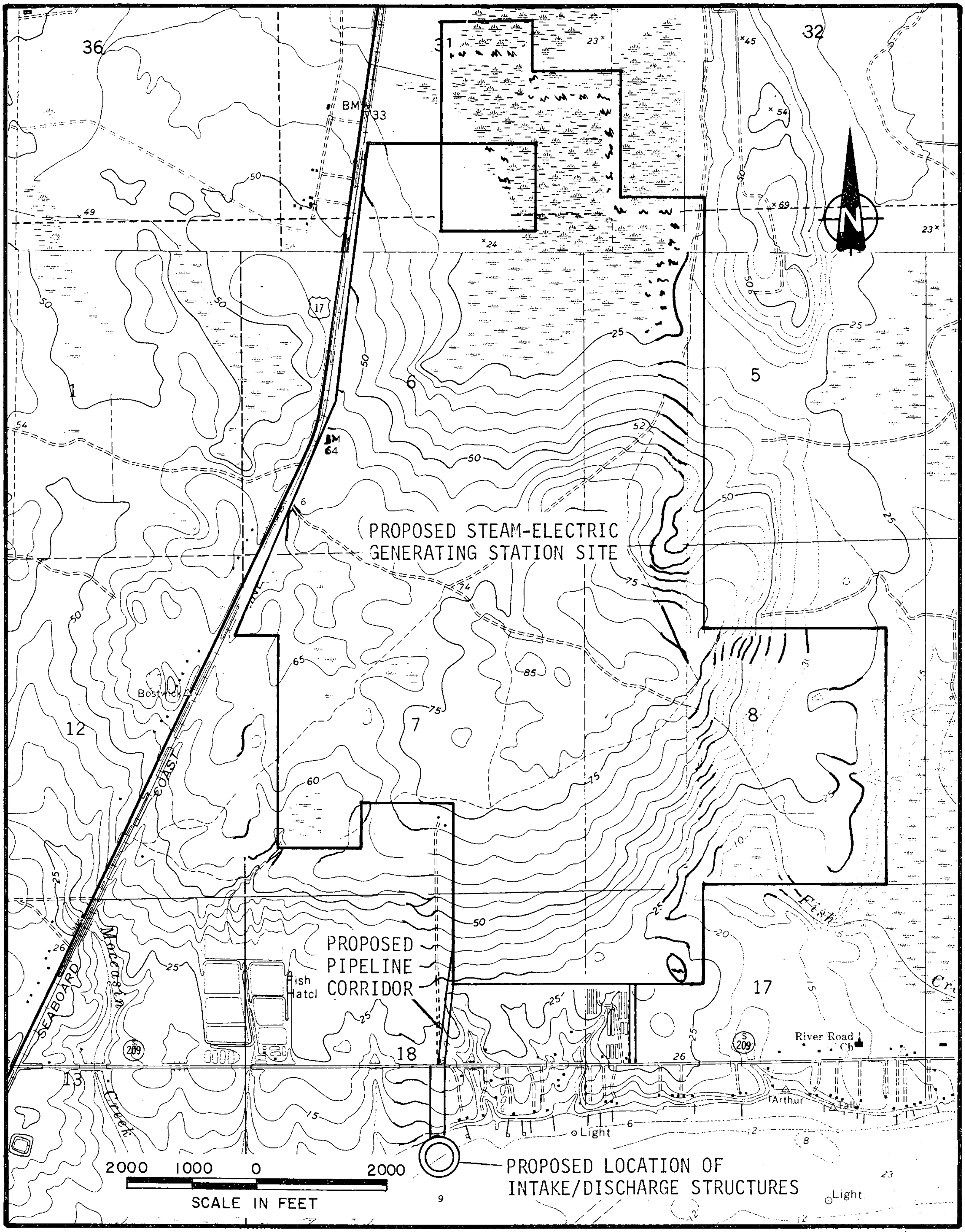


Figure 9.2-1. Location of Proposed Intake/Discharge Structures.

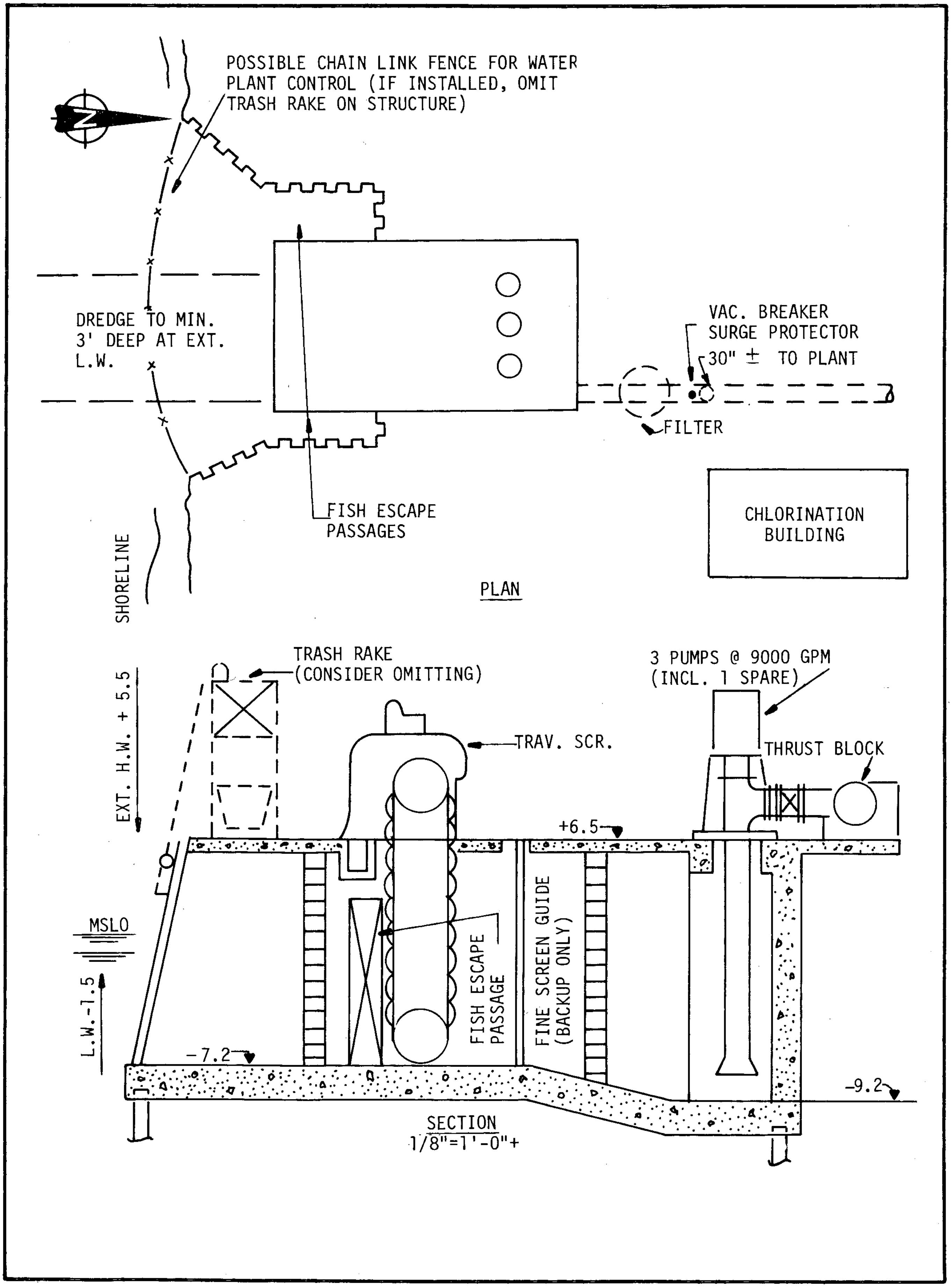
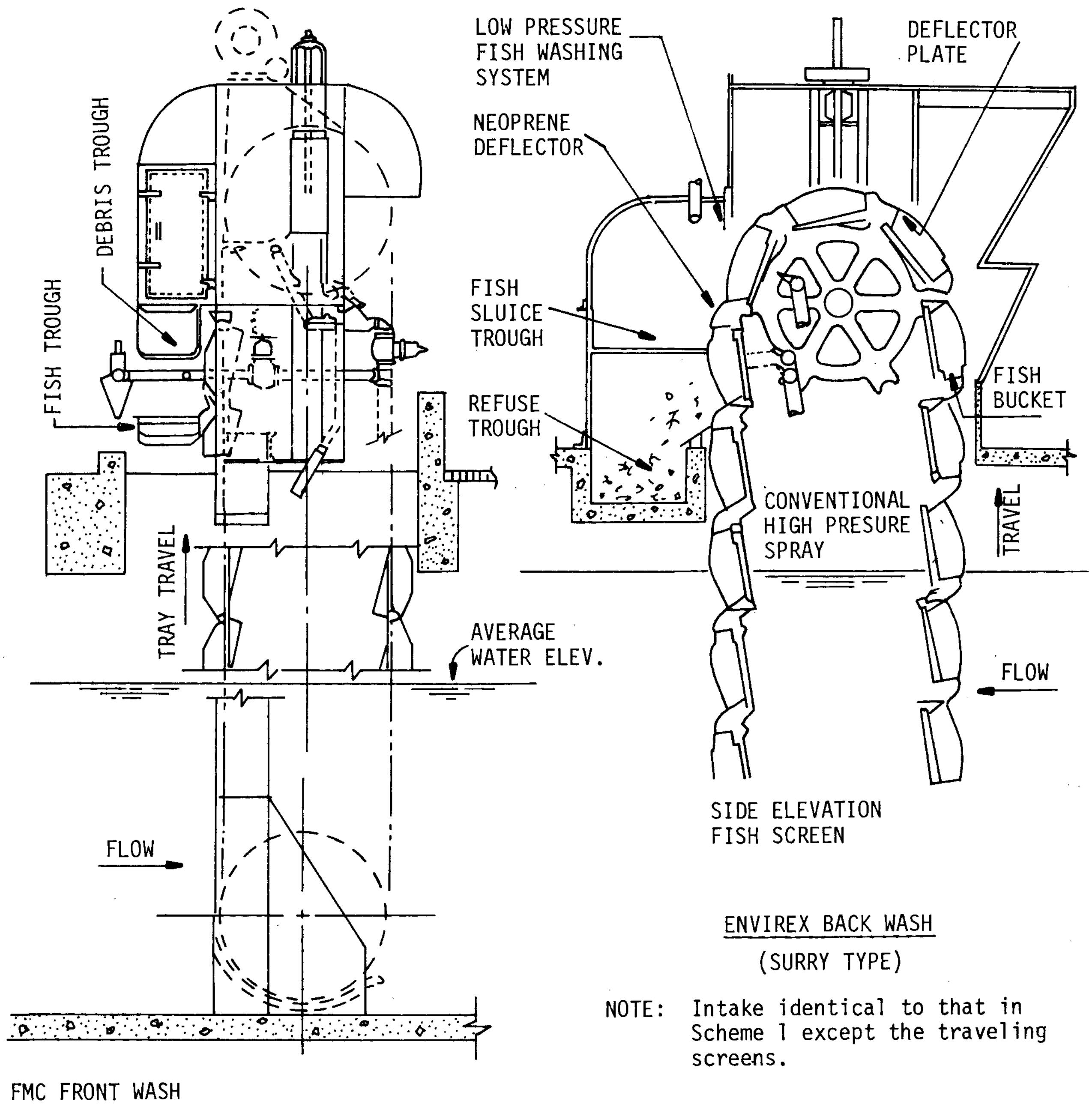


Figure 9.2-2. Scheme 1-Conventional Intake with Flush-Mounted Traveling Screen.



NOTE: Intake identical to that in Scheme 1 except the traveling screens.

TYP. FISH RECOVERY SCREENS

Figure 9.2-3 Scheme 2 - Conventional Intake With Surry - Type Fish Recovery System

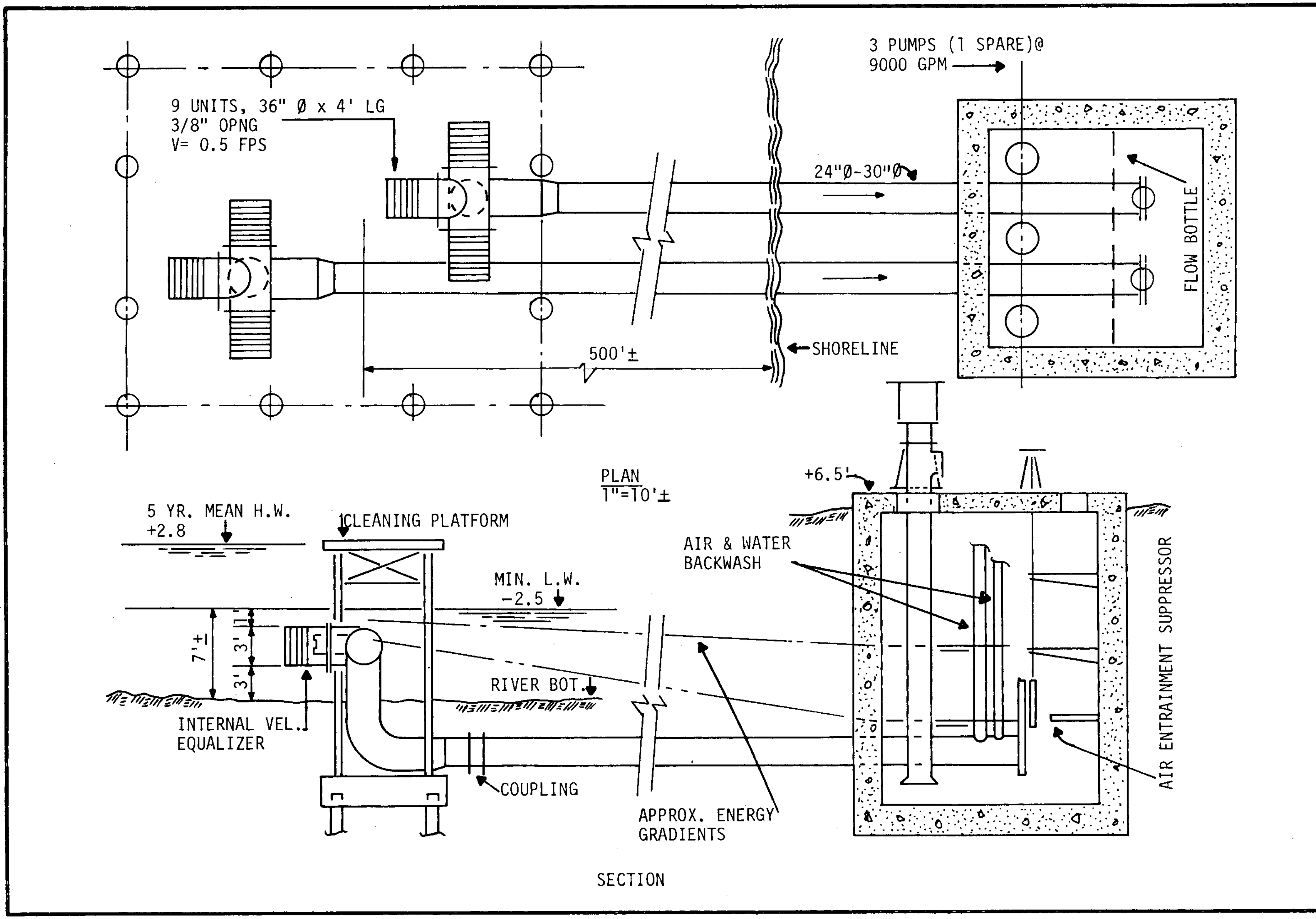


Figure 9.2-4. Scheme 3 - Perforated (or Wedge-Wire) Pipe Offshore Intake.

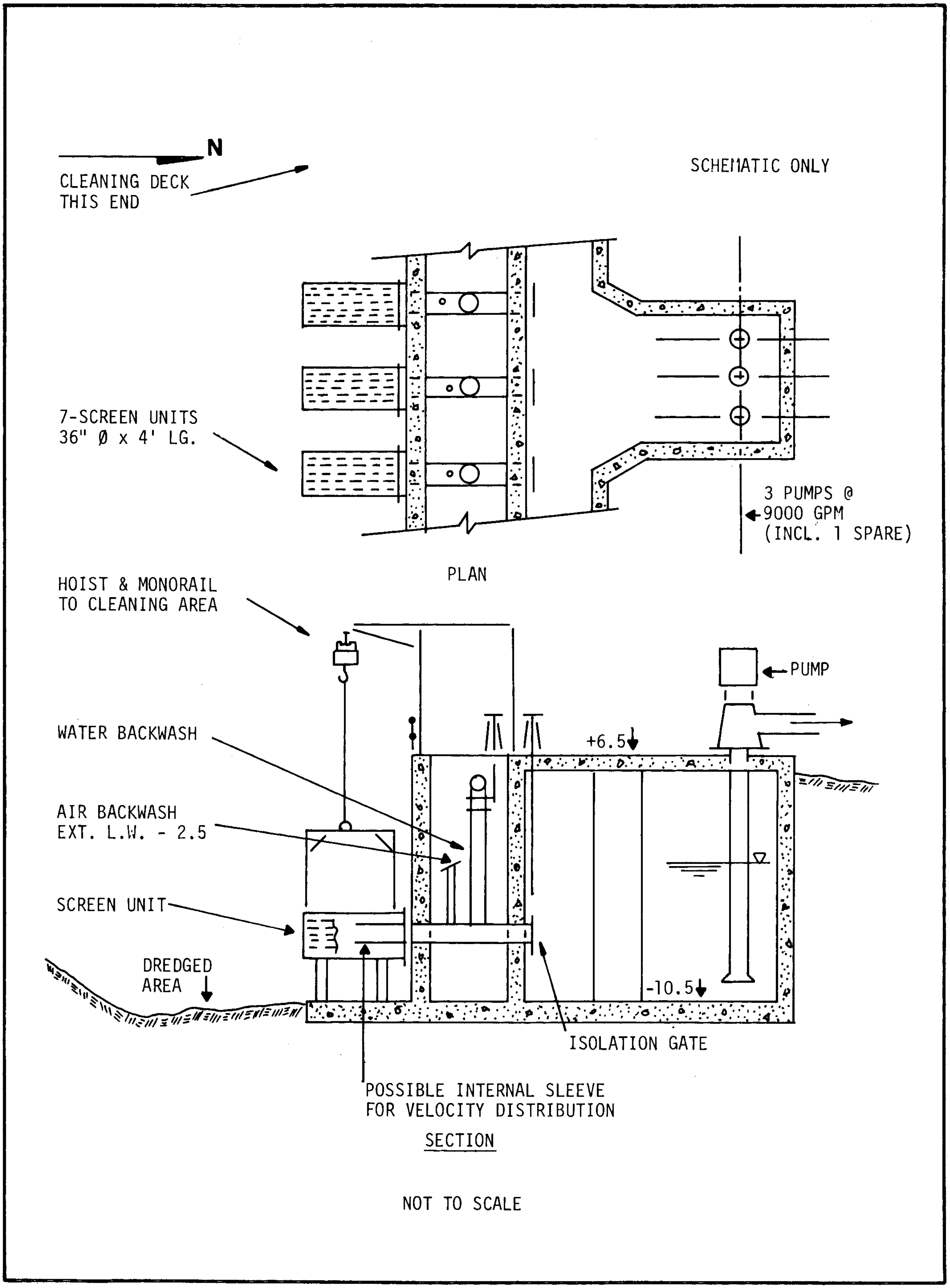
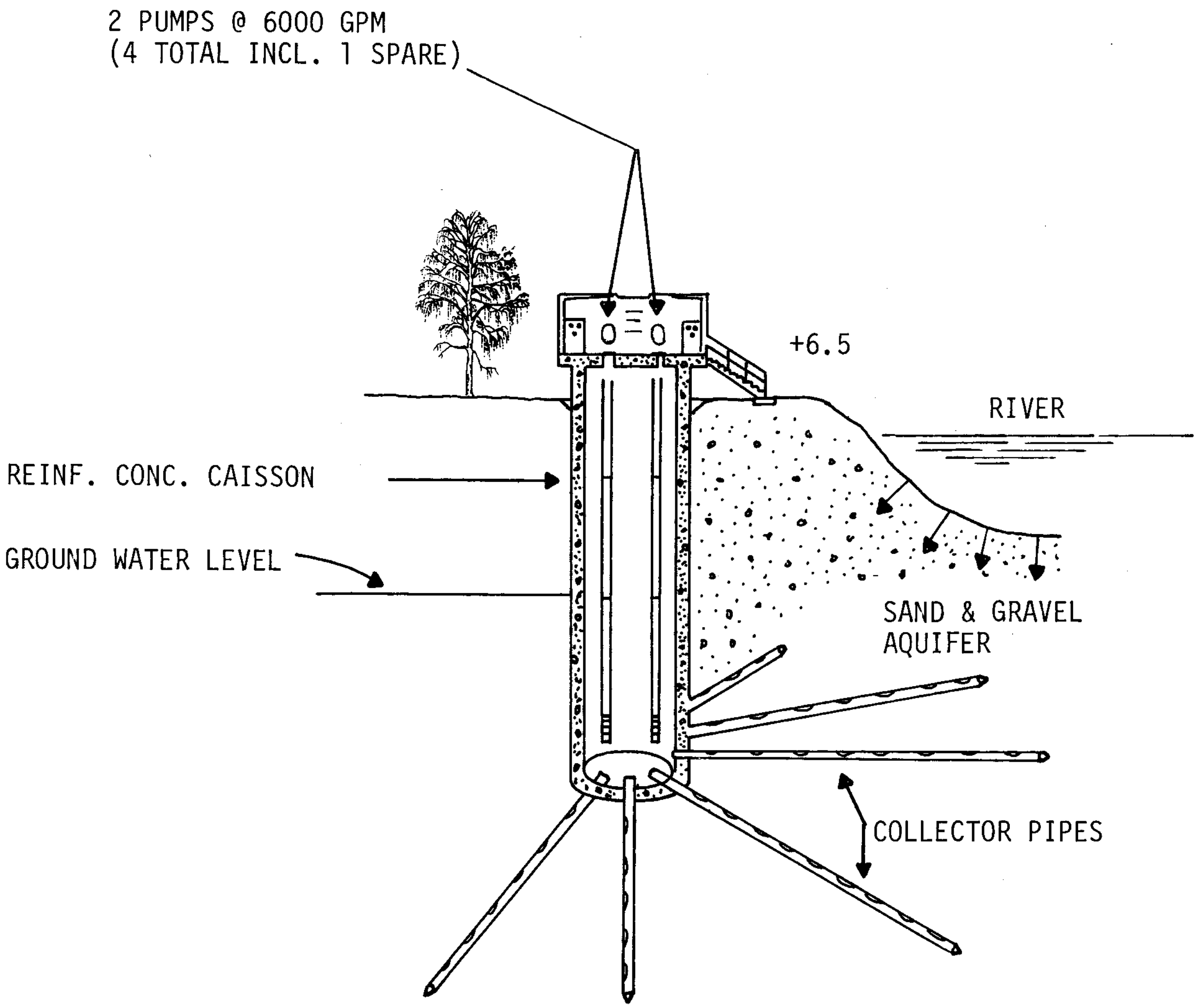


Figure 9.2-5. Scheme 4 - Perforated (or Wedge-Wire) Shoreline Intake.

FOR SEMINOLE ASSUME:

2 CAISSONS - 16' I.D., 19' ϕ.D.
6 HORIZ. SCR. PIPES PER CAISSON - 16" 0 x 250' LG



RADIAL WELL INTAKE

(RANNEY COLLECTOR)

Figure 9.2-6. Scheme 5 - Radial Well System.

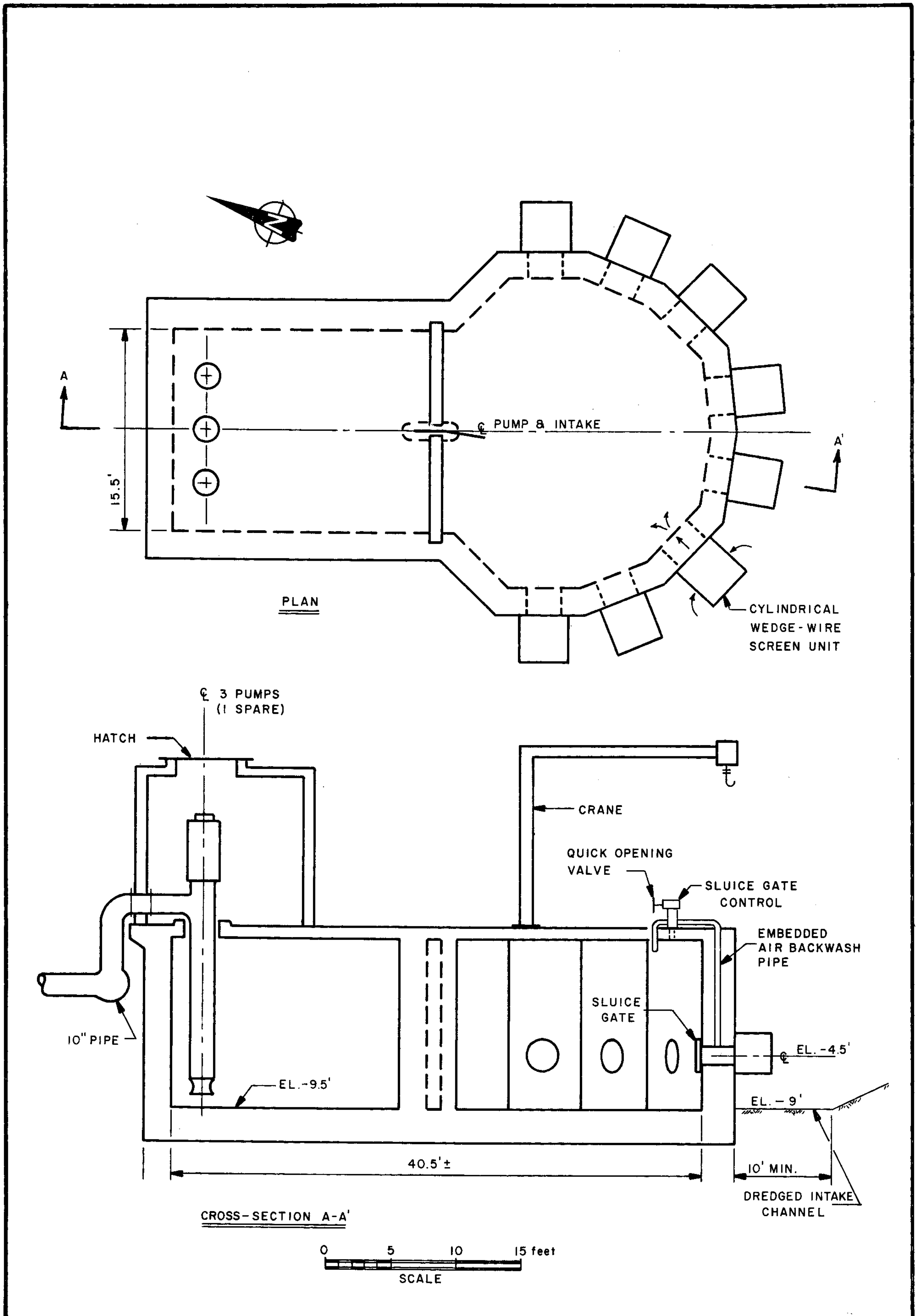


Figure 9.2-7. Scheme 6 - Cylindrical Wedge-Wire Screen Intake.

9.3 ALTERNATIVES TO SITE UTILIZATION

9.3.1 Environmental Site Layout Guidelines

Recognizing the importance of integrating environmental knowledge into the engineering design process, SECI initiated a series of conferences between the environmental consultant, Dames & Moore, and the architect/ engineering consultant, Burns and Roe, Inc. (BRI). The conferences were an important part of the interaction between parties structured to achieve the goal of developing a facility design that fully reflects site-specific environmental conditions and state and federal environmental regulatory compliance requirements.

Among the specific objectives of this interaction was to develop a facility layout that will optimize site utilization with respect to the site's environmental characteristics as well as engineering design requirements. To achieve this objective, Dames & Moore developed a series of recommentations that were formalized as "Environmental Site Layout Guidelines," and are presented in this section. The final layout of major station facilities (Figure 3.1-1) is based, in part, on these guidelines.

The Environmental Site Layout Guidelines are presented along with the rationale for their development. The zones (A through D) referred to in the following discussion are shown on Figure 9.3-1. These zones were identified from studies of the site's environmental characteristics.

Ash and Sludge Disposal Should be Confined to Zone A

The following items present the rationale for confining ash and sludge disposal to Zone A:

1. In Zone A, ground water flow is predictable and is in one direction (downslope toward the north). See Section 2.3.2.

2. Few residents are located downslope in the direction of ground water movement (Figure 2.8-4).

3. More fine material exists in surface soils within the lowland area in Zone A, compared to other parts of the site (Section 2.2.7). This fine material would help to mitigate subsurface movement of leachate from waste materials.

4 Compared to other parts of the site, fewer site preparation activities (in the form of dike construction, cut-off trenches, etc.) would be required to confine wastes, if this becomes necessary. Therefore, less environmental impact and lower costs would result.

The recommendation to use Zone A containing the lowland at the northern extension of the site for the indefinite storage of coal-combustion waste materials considered several favorable and unfavorable factors. Factors unfavorable to this proposed use of the lowland included:

1. The lowland is designated a "preservation" area in the Coastal Zone Management Atlas (Figure 2.8-2).

2. The lowland is designated as a flood-prone area in the USGS Flood-Prone Atlas (Section 2.3.1).

Factors that tend to favor the utilization of the lowland included:

1. The lowland is not contiguous to navigable waters (Section 2.3.1).

2. The lowland has apparently been extensively disturbed by past logging activities (Section 2.7.1).

3. The lowland is only periodically inundated; it is thus unlikely to be an important aquatic resource (Section 2.7.1).

4. The lowland is not a unique or critical habitat; many thousands of acres of this type of habitat exist in Florida (Section 2.7.1).

The Most Desirable Location for Coal Storage is in Zone A; The Second-Best Area is Zone B

Because of potential runoff impacts from coal, the rationale given for the ash and sludge disposal recommendation also applies to coal storage in Zone A. Zone B is also acceptable, but not as good as Zone A. Zone B contains fine surface soils that would help to contain or control leachate and runoff, but the direction of ground water flow is less certain in Zone B than in Zone A.

Avoid Placing Leachate-Contributing Facilities on the South Slopes of the Site

Migrating leachate from facilities on the south slopes of the site might reach wetlands contiguous to the St. Johns River. Most residences in the site vicinity are located south of the site on the bank of the St. Johns River. To preclude the potential of contamination of domestic wells, sludge and ash disposal facilities should not be located on the south slopes of the site.

Heavy Structures Should be Located on Flat Areas; Zone C is Most Desirable; Zone B is Second Best

Construction of heavy structures on flat ground would result in less earthwork, less chance of differential settlement, less construction impact, and lower costs. Zone C represents the best flat ground on the site. Zone B is also a flat area. However, there is evidence that standing water has existed in that area. Therefore, there is a greater risk of solution activity in underlying materials. Zone B is also considered second best because some organic soils exist there (Section 2.2). Construction in Zones B and C would make maximum utilization of the area designated "development" in the Coastal Zone Management Atlas Figure 2.8-2).

Maintain Distance Between Cooling Towers and Other Features

A separation of 2,000 feet or greater is desirable between cooling towers and local highways. This will reduce the potential for fog development, especially if low-profile mechanical draft cooling towers are used.

If high-profile, natural draft cooling towers are used, the distance between the towers and the flue-gas chimneys must be at least equal to or greater than three times the height of the towers. This distance is necessary to prevent wind-wake effects from disturbing flue-gas plume development.

An adequate separation between cooling towers and the switchyard, and between the coal storage area and the switchyard, should be maintained in order to prevent possibility of corrosion and flashover. In addition, placing the switchyard on the west side of the site to minimize transmission line length, and to avoid crossing other structures, was also recommended.

Maintain 300-Foot-Wide Buffer Zones Around Site, Particularly Along West Side of Site Near U.S. Route 17

A 300-foot-wide buffer zone with trees would achieve an attenuation of 10 decibels of construction- and operation-generated noise. In addition, a buffer zone would provide a visual screening of construction and operation activities and facilities.

The buffer zone should include the entire south slope in order to maintain erosion protection as well as noise attenuation and visual screening.

9.3.2 Pipeline Corridors

9.3.2.1 Introduction

Pipeline corridors for transporting plant effluent and cooling tower makeup betwen the plant and the river were identified on the basis of the following factors:

1. Proximity to the site
2. Existing residential structures

3. Location of the navigational channel in the St. Johns River - this channel should be a sufficient distance offshore that no interference with barge or boat traffic would result from intake and pipeline placement.

The studies conducted to evaluate Corridors A, B, and C (Figure 9.3-2) included a terrestrial ecology reconnaissance, a complete aquatic sampling program, a bathymetry survey, and an archeological reconnaissance.

9.3.2.2 Environmental Comparison of the Pipeline Corridors

The results of the comparative evaluation of the pipeline corridor alternatives are displayed in Table 9.3-1. On the basis of economic, terrestrial ecological, land use, and archaeological advantages, Corridor A appears to be the best choice. The most important consideration is the potential impact on aquatic resources. Based on the results of the aquatic sampling program that found markedly smaller numbers of fish and other nekton species and individuals at Corridor A, it was selected as the best location for the intake structure (Section 5.2.2.2).

Table 9.3-1

Generic Environmental Comparison
Alternative Pipeline Corridors

	ECOLOGY	
	Advantages	Disadvantages
CORRIDOR A	1. The shortest route; disruption would be kept to a minimum. 2. Aquatic species numbers and diversity are markedly lower than at other corridors. 3. No encroachment on wetlands. 4. Almost no presently undisturbed habitats would be affected.	1. Some hardwood forest species would be disturbed along shoreline.
CORRIDOR B	1. None	1. One of the longest routes; would disturb a relatively large area during construction. 2. Aquatic species numbers and diversity were markedly higher than Corridor A (about the same as Corridor C). 3. Some minor wetlands may be disturbed. 4. Luxuriant growths of hardwood forest species east of State Route S209; these would be disturbed by construction.
CORRIDOR C	1. None	1. 1 through 4. Same as Corridor B.

REVISED 3/15/79

Table 9.3-1 (Continued)

	LAND USE-SOCIOECONOMICS	
	Advantages	Disadvantages
CORRIDOR A	1. Only three residences are within 1,000 feet of the intake location (they are 600 feet, 700 feet, and 900 feet distant). 2. Shoreline is 2,500 feet from barge channel. 3. Corridor length from powerhouse to shoreline is 7,300 feet.	1. Corridor crosses 1,200 feet of land not under option by SECI.
CORRIDOR B	1. Nearest residence (to intake) would be over 1,000 feet distant 2. Shoreline is 2,000 feet from barge channel.	1. Corridor length from powerhouse to shoreline: 19,300 feet. 2. Corridor crosses 14,300 feet of land not under option by SECI. 3. Two archaeological sites (middens) that may be considered eligible for inclusion in the National Register of Historic Places lie within corridor (Appendix J).
CORRIDOR C	1. Nearest residence about 2,000 feet distant. 2. Shoreline is 3,700 feet from barge channel.	1. Corridor length from powerhouse to shoreline: about 19,200 feet. 2. Corridor crosses 14,200 feet of land not under option by SECI.

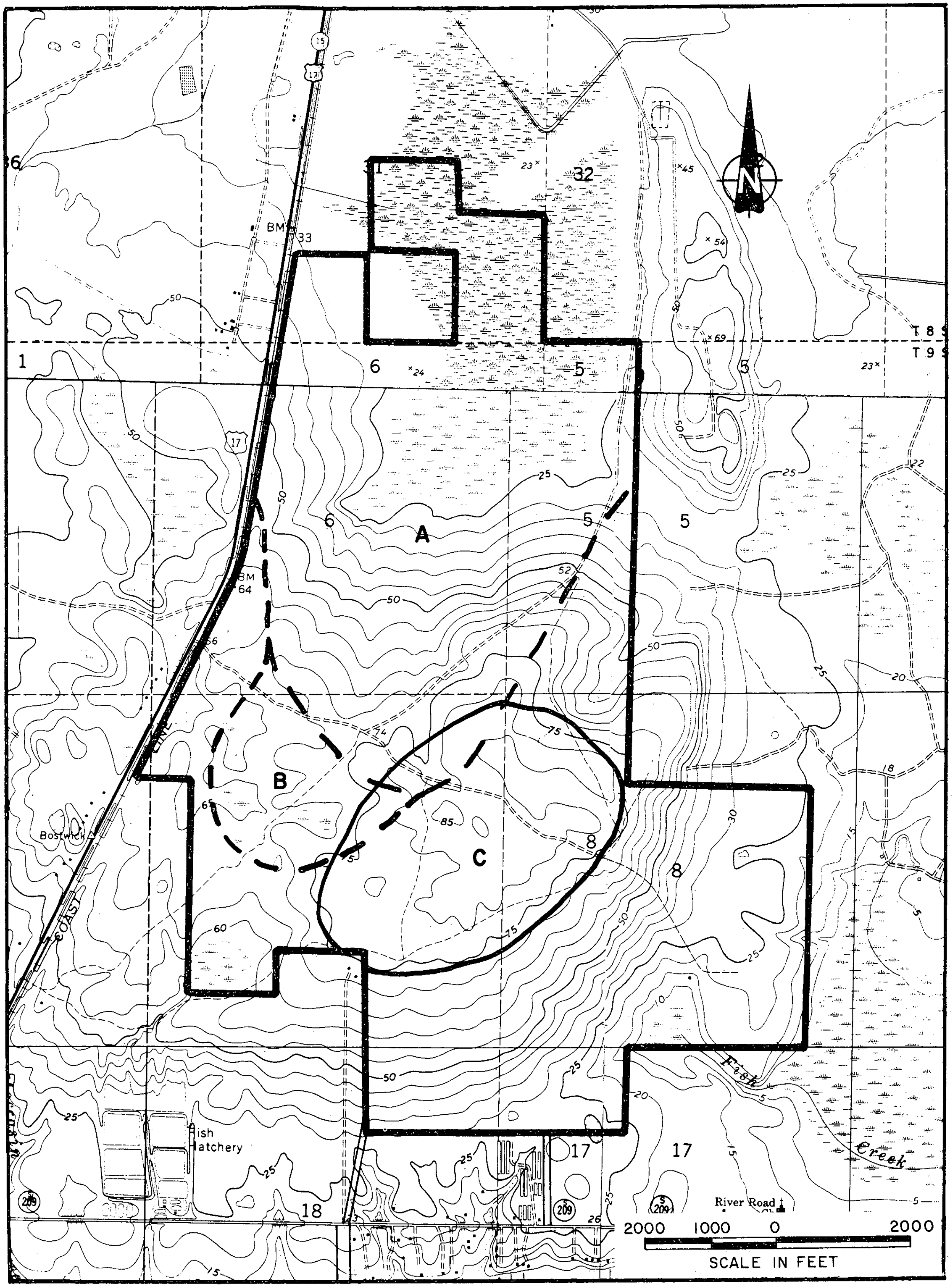
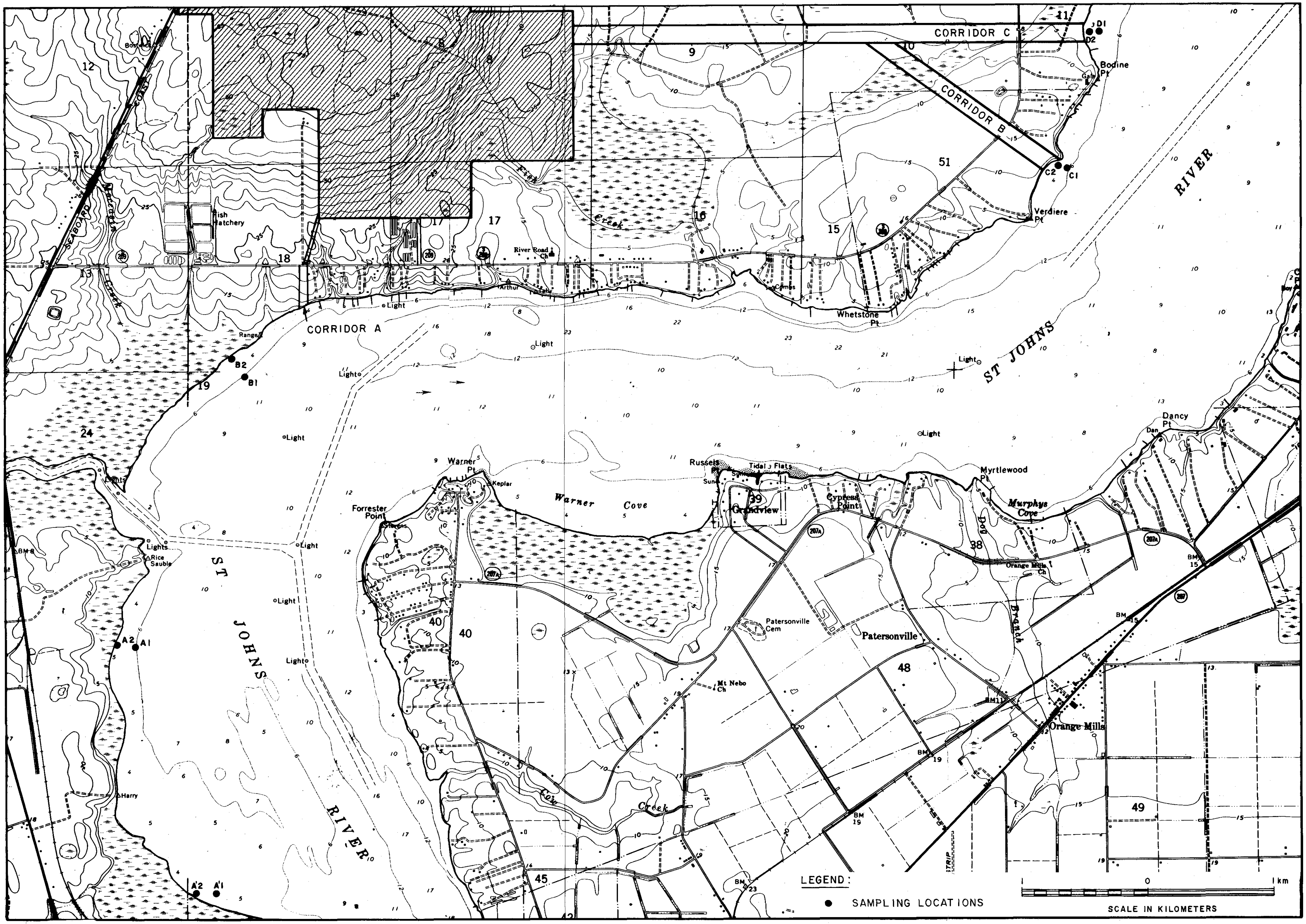


Figure 9.3-1. Site Environmental Zone Map.



REVISED 3/15/79

Figure 9.3-2. Location of Aquatic Sampling Stations and Tentative Pipeline Corridors.

9.4 REFERENCES

Burns and Roe, Incorporated, June 28, 1978, Preliminary report: flue gas desulfurization system study, phase 1 for Seminole Electric Cooperative, Inc., Seminole Plant Units No. 1 (and 2).

Copeland, Hodgson, and Berlect, 1975, Entrainment and entrainment mortality at the Brunswick Nuclear Power Plant. Part 1 - report on entrainment and entrainment mortality of zooplankton and larvae and infringement and movement of fish. Report to Carolina Power & Light Company, Raleigh, N.C.

U.S. Army Engineer District, Louisville, 1978a, Final environmental impact statement: East Bend station units 1 and 2. Louisville, Kentucky.

__________, 1978b, Draft environmental impact statement: Patriot generating station, Louisville, Kentucky.

U.S. Environmental Protection Agency, 1978a, Draft environmental impact statement, Ghent generating station, units 3 and 4. Region IV, Atlanta, Georgia.

__________, 1978b, Draft environmental impact statement, Trimble County generating station. Region IV, Atlanta, Georgia.

__________, 1977a, Guidance for evaluating the adverse impact of cooling water intake structure on the aquatic environment, Section 316(b) Public Law 92-500, draft. Washington, D.C.

__________, 1977b, Flue gas desulfurization in power plants. Status Report, Division of Stationary Source Enforcement, Office of Enforcement.

VanWinkle, W., 1977, Proceedings: conference on assessing the effects of power plant induced mortality on fish populations. Oak Ridge National Laboratory, Oak Ridge, Tennessee.

10.0
ASSOCIATED TRANSMISSION LINES

TABLE OF CONTENTS

CHAPTER 10.0

ASSOCIATED TRANSMISSION FACILITIES

TABLE OF CONTENTS (Continued)

LIST OF TABLES

LIST OF FIGURES

10.0 ASSOCIATED TRANSMISSION FACILITIES

10.1 INTRODUCTION AND PURPOSE

The purpose of this study is to identify one-mile-wide corridors to environmentally and economically accommodate 230 KV transmission lines linking the Seminole Electric Cooperative, Inc. (SECI) steam-electric generating station to the Florida bulk electric power grid.

A "corridor envelope" approach was selected as the most feasible and effective process for evaluating transmission route alternatives. The one-mile corridor width was selected as a practical scale for generally evaluating route alternatives, while preserving the flexibility for locating and acquiring right-of-way (ROW) easements.

The approach allows extensive use of readily available information: topographic maps, aerial photography (1:80,000 and 1:24,000 scales), planning reports, land use maps, highway planning maps, and other published data supplemented by overflights reconnaissance.

The corridor envelope approach provides a systematic, methodological approach through which (1) alternatives may be compared, (2) land use and environmental problems identified and avoided as possible and (3) specific work selection decisions may be made on the basis of clearly defined criteria.

The implementation goals in the corridor identification are:

- To maximize the environmental and social benefits associated with the transmission lines.
- To minimize the environmental impacts of constructing and maintaining the transmission lines.
- To minimize the cost of constructing and maintaining the transmission lines.

Criteria were developed and systematically applied to identify alternative corridors within the study area. These corridors were subjected to a general environmental assessment. "Preferred" corridors were selected on the basis of the results of the collective assessment of the corridor alternatives (Figure 10-1).

10.2 ELECTRICAL ANALYSIS AND ALTERNATIVES

SECI conducted a loadflow analysis of its existing transmission system, future State transmission system, and plant needs. The analysis identified a variety of locations and voltage alternatives.

10.2.1 Future Transmission Facilities

As the loads increase in the SECI member systems, additional transmission facilities will be needed to connect new substations either to existing SECI transmission or the State grid. Generally, substations are constructed for one or more of three reasons: capacity, voltage, and/or reliability. The SECI member systems constantly monitor their load growth to detect areas in which (1) existing facilities will become insufficient (facilities may become overloaded), (2) voltage will be too low, and/or (3) the reliability of service is inadequate.

10.2.2 Associated Plant Transmission

SECI must plan and design its transmission facilities in coordination with other utilities in Florida. The data base available for SECI's studies, developed by the Florida Electric Power Coordinating Group (FCG), is almost one year old and not as "fine tuned" as necessary. SECI could and did develop transmission alternatives based on knowledge of the State bulk transmission grid, but could not confirm the validity of these alternatives without the cooperation of neighboring utilities. A joint meeting, held in October, 1977, with representatives from Florida Power & Light Company (FP&L), Florida Power Corporation (FPC), and the Jacksonville Electric Authority (JEA) was arranged to explain SECI's intentions and solicit cooperation. SECI's initial transmission alternatives were presented, along with a request for an updated base case for computer studies. The participants agreed to jointly study the technical requirements of transmission associated with the plant, and offered additional alternatives for SECI's consideration. The group arrived at the criteria and methods to be used for the study and agreed on interchange schedules against which to test the alternatives.

The 1987 FCG Data Base Case was chosen as the basis for this study, because it is the first year that all generation projected for Northeast Florida through the 1980's is scheduled to be in service. To update this case, participating companies submitted updates of their systems to Seminole for computer merging into a base case load flow. The resultant load flow is the base for the comparison of alternatives under investigation.

SECI analyzed load flows of the various transmission and interchange alternatives using the Philadelphia Electric Company (PECO) power flow program. Single contingency line outages were analyzed using the PECO super position factors program. Copies of all output from these programs were given to each study participant for review and comment. Several joint meetings have been held to review the results of the computer work and receive additional suggestions, comments, and feedback.

The raw computer data for the transmission alternatives were given to each participant for his detailed review and study. The participants most directly affected by the study (FP&L and FPC), have agreed in principal with SECI to the tie-points proposed for the associated transmission. Both utilities have described modifications to their systems that will be required because of the impact of the associated transmission. JEA is not significantly affected electrically by the proposed transmission.

10.2.3 <u>Associated Transmission Electrical Alternatives</u>

The following transmission alternatives were evaluated in the joint study:

1. 230 KV double circuits from Seminole Plant to Putnam (Route 1) and from the Plant to Columbia, with single 230 KV circuits from Columbia to Suwannee and Fort White (Route 3).

2. 230 KV double circuits from Seminole Plant to Putnam (Route 1) and to Fort White.

3. 230 KV double circuits from Seminole Plant to Putnam (Route 1) and from the Plant to Silver Springs (Route 2).

4. 230 KV quadruple circuits from Seminole Plant to Putnam (Route 1), with 500 KV single circuits to Central Florida and Lake Poinsett.

5. 230 KV double circuit from Seminole Plant to Putnam (Route 1) and a 500 KV circuit to Fort White (portion of Route 3).

6. 230 KV double circuits from Seminole Plant to Silver Springs (Route 2) and from Plant to Columbia with single 230 KV circuits from Columbia to Fort White and Suwannee (Route 3).

7. 230 KV quadruple circuits to Putnam (Route 1) with 500 KV single circuits to Windermere and Lake Poinsett.

8. Variations on number 1 and number 2, with minor line and bus changes.

All alternatives assumed that a 1200 MW plant, jointly owned by FP&L and JEA, would be located at a site several miles north of the Seminole Plant. An alternative site location of the FP&L/JEA plant in Duval County was also considered. The transmission for this alternative would include a 230 KV double circuit to Columbia and the busing on existing FP&L Putnam-to-Duval 230 KV line at Seminole Plant. Accordingly, it was given a brief examination.

For all alternatives, three possible interchange schedules were considered: (1) all 1200 MW from Seminole Plant to FPC's system, (2) all 1200 MW to FP&L's system, (3) and a 50/50 split of generation exchange between the FPC and FP&L systems. The study participants felt that these extreme cases would provide the "worst case" analysis. 230 KV is predominant in these alternatives because it is the common voltage used in the State bulk power grid by all utilities in the State, and four 230 KV circuits with 1590 MCM ACSR conductor can provide the necessary capacity to transport the 1200 MW of the Seminole Plant into the State grid and provide single contingency reliability. Single contingency analysis identified potentially overloaded lines. The 500 KV option included in alternatives 4, 5, and 7 above was dropped from further consideration, because 500 KV facilities are not planned to be in reasonable proximity of the plant location.

Alternative 2 was eliminated because of electrical problems.

10.2.4 Study Results

Alternative number 3, 230 KV double circuits from Seminole Plant to Putnam (Route 1) and from Seminole Plant to Silver Springs (Route 2), is preferred by SECI. The choice of Putnam and Silver Springs as the tie-points to the State grid was based on several factors: (1) enhances the reliability of the bulk power system, (2) the increase in total system losses for the bulk transmission grid was the lowest of the alternatives studied, and (3) this alternative requires the fewest miles of transmission construction. This transmission alternative can be broken down into two Phases, A & B. Phase A will be associated with Seminole Unit No. 1, and Phase B with Seminole Unit No. 2.

Phase A:

Phase A is a double circuit 230 KV line from the Seminole Plant to FPC's Silver Springs Substation. The in-service date of July 1982, corresponds with the construction schedule requirement for high voltage for equipment checkout. FPC has agreed in principle to this tie, detailing substation additions and modifications required at Silver Springs. Additionally, SECI intends to serve a portion of its load in the FPC control area in the first years of the Plant's operation.

Phase B:

Phase B is a double circuit 230 KV line to FP&L's Putnam Station concurrently with the construction of Seminole Unit No. 2. FP&L has proposed modification of its transmission system south of Putnam as being necessary. These modifications and additions are now under study. Putnam was selected as the FP&L tie-point for several reasons. It is a transmission hub with five 230 KV lines into the

State grid. It is a probable location of a 500/230 KV substation some years in the future. Physically, it is a short distance from the Seminole Plant. Electrically, it is very near a large SECI load of Clay Electric Cooperative; and it provides flexibility for future power displacement and supply arrangements to increase the reliability of service to SECI's members.

In addition to the alternatives in Phase A and Phase B above, a third alternative was considered viable, but less attractive than the Plant-to-Putnam route. The environmental assessment of possible corridors for this route was undertaken to provide a backup possibility. Route three consists of two 230 KV circuits from the Seminole Plant to Columbia, then single 230 KV lines from Columbia to Fort White and Suwannee. This alternative is considered less attractive than Plant-to-Putnam for the following reasons: the transmission losses are higher, the total economic and environmental impact is greater because of the increased line length, the ROW for this route may conflict with future 500 KV lines connecting Florida and Georgia, and FPC may require extensive transmission additions in the event of additional generation at the Suwannee site.

10.3 EXISTING TRANSMISSION FACILITIES

SECI and its member cooperatives own and operate a combined total of approximately 650 miles of 138, 115, and 69 KV transmission. Typically, much of this transmission is radial from a tap or breaker on the State bulk transmission grid to a member-owned substation. The majority of this transmission is in northeast Florida and belongs to Clay Electric Cooperative, Inc., or is in southwest Florida and belongs to Lee County Electric Cooperative, Inc. SECI owns approximately 31 miles of 69 KV line from Cedar Key to Otter Creek and then on to Bronson, in Levy County, Florida. In addition to these two lines, SECI has eight other 69 and 115 KV lines in various stages of design and construction for a total of approximately 75 miles. SECI is also supplied by the Florida bulk power grid. The owners of this grid most affected by associated plant transmission are JEA, FP&L, and FPC.

10.3.1 SECI Transmission Facilities

Figure 10-2 shows the study area defined by the interconnect points and the electric utility lines belonging to Clay Electric Cooperative, the member company of SECI which has the most transmission coverage in the study area. As shown on Figure 10-2, most of these are small 69 KV lines, which follow highways and which have a great many angles. In the area of the three routes, Clay Electric has a few existing lines:

A. Route 1 - Site-to-Putnam

Clay Electric does not have existing transmission lines.

B. Route 2 - Site-to-Silver Springs

A small section of transmission line, owned by Clay Electric Cooperative, is the 115 KV line from Fort McCoy Station to Highway 20 near the Intersection of Highway 20 and Highway 315.

C. Route 3 - Site-to-Columbia

Clay Electric has a number of small transmission lines along this route. As shown on Figure 10-2, a 69 KV Clay Electric line goes from the site to Keystone Heights and then proceeds in a northwesterly direction to near Lake Sampson. At this point, called TP-8, the Clay Electric 69 KV branches in three different directions. One branch proceeds north, around Lake Sampson, crosses Highway 100 and connects to the existing FP&L 115 KV transmission line. Another branch goes south from TP-8 to the Waldo Substation just southwest of the town of Waldo, and the third route goes from TP-8 to the Brooker Substation. From the Brooker Substation, the line follows Highway 18 to Worthington Springs. The third branch proceeds from Worthington Springs north to the Bland Substation which is south of Lake City. This line makes many turns in this area and crosses I-75 twice. From the Bland Substation, the line joins the FP&L 115 KV line, traverses Lake City and terminates in the Columbia Substation in the northwest section of Lake City.

These lines are of particular interest because they provide existing ROWs that may be used. The ROWs belong to a SECI member utility and their use would minimize visual, ecological, erosional, and legal problems associated with acquisition. However, the number of angles and the small size of these lines require that they be examined in greater detail.

10.3.2 Other Transmission Facilities

Figure 10-3 shows the electric utility lines for JEA, FP&L and FPC. The key transmission lines are:

- FP&L's 240 KV line from the Robinwood substation in Jacksonville to the Volusia substation near Daytona Beach. This line originates at a generating station near East Palatka.

- FP&L's 240 KV line from the Duval substation to the Putnam substation near East Palatka.
- FPC's 240 KV line from the Suwannee substation to the Silver Springs substation near Ocala.
- FPC's twin 115 KV line from the Jasper substation through the Fort White substation to the Brooksville substation.

These transmission lines are key in that they provide interconnection lines for the Seminole Plant.

The existing transmission system also provides lengths of ROW which may be used as practical by the proposed lines. These include:

Route 1 - Site-to-Putnam
FP&L's 240 KV line from north of Palatka to the Putnam substation.

Route 2 - Site-to-Silver Springs
FPC's 240 KV line from Highway 40 at Ocala to the Silver Springs substation.

Route 3 - Site-to-Columbia
FP&L's 240 KV line from the Clay Electric 60 KV line (Figure 10-2) to Keystone Heights.

Site-to-Fort White
No transmission lines which may be of use.

Site-to-Suwannee
No transmission lines which may be of use.

10.4 CORRIDOR SELECTION AND IDENTIFICATION

The impacts generally associated with a transmission line are:

° Construction Impacts

- Clearing of woodlands or shrubs.
- Noise and dust.
- Erosion due to removal of surface vegetation.
- Influx of construction labor.
- Visibility.

° Operation Impacts

- Removal of ROW from habitat and other land uses.
- Visibility of tower and line.
- Noise from line.
- Maintenance of ROW clearance (either mechanically or chemically).
- Access to lands due to corridor.
- Radio and TV interference.

While these impacts cannot be avoided, they can be mitigated by:

1. Carefully selecting the corridor, and
2. Using good engineering design, and construction practices.

Existing transmission ROW was designated for use where possible to minimize disruption. Exclusion criteria defining areas particularly susceptible to serious impacts were mapped. Unless there was an existing transmission line corridor, these areas were avoided. Finally, limited use areas were identified. These are not exclusion areas but areas generally designated as unsuitable for transmission lines. Use of these areas would be based upon available suitable alternatives.

10.4.1 Exclusion Mapping Criteria

The exclusion mapping criteria were:

° Small towns were avoided. A one-mile buffer zone was assigned to preclude the relocation problems of a new ROW through towns. The one-mile radius provides a buffer zone with regard to noise and visual impact. However, use of an existing transmission line through a town was considered acceptable.

° Lakes were excluded from consideration to avoid impacts on migratory birds, and alterations to lake bottoms, and to minimize construction costs.

- ° Federal, State and local parks were avoided because they were considered to be legally committed lands, and are very likely to be of high recreational and biological value.
- ° State prisons, hospitals and other similar land uses were avoided.
- ° Historic places as listed in the National Register of Historic Places were avoided.
- ° Areas previously identified as sensitive habitat for rare and endangered species were avoided. Sensitive habitat is generally identified by the U. S. Army Corps of Engineers and the Florida State Game and Fresh Water Fish Commission. Such areas are of unique biological value.
- ° Areas designated for game refuge were avoided (game refuge is not to be confused with a Wildlife Management Area). Game refuges provide shelter for game species (species stocking). In addition, intensive management is often practiced in an effort to increase species populations. Wildlife Management Areas are open to hunting.
- ° Airports were avoided. A transmission line can pose a hazard to air traffic. A one mile buffer zone was chosen as adequate distance.

Areas corresponding to the existence of constraints were drawn on 7-1/2 minute topographic maps to initially exclude all constraint areas from consideration. However, under certain conditions the exclusion criteria were adjusted to minimize the social and environmental impacts of the transmission line, and the costs of its construction and operation. In line with these goals, use of existing transmission lines may compromise some of the constraint mapping criteria. This was the case where exclusion areas included existing transmission line ROW.

It is difficult to deal with problems of noise, radio/TV interference, relocation of residences, or visibility when working with a one-mile wide transmission corridor, as these are specific and not considered to be the chief general impacts of line construction. However, the intent of the exclusion criteria is to minimize visual impact or interference by avoiding population concentrations, thereby minimizing impact on numbers of people. Therefore, unless a transmission line already passes through a town or urban area, it is desirable to avoid the town. In cases where an existing corridor is used, care should be taken, for example, to make the tower structures as unobtrusive as possible.

10.4.2 Identification of Limited Use Areas

Limited use areas were evaluated with respect to their suitability for use as transmission line ROW, not as an exclusion to use.

Three sets of criteria included were socioeconomic, environmental, and engineering. The criteria are:

Socioeconomic Criteria

Limited use socioeconomic areas are:

- Planned open space
- Planned residential areas (permanent residential areas are more sensitive than seasonal residential areas)
- Urban areas
- Wildlife Management Areas
- Intersections of major highways

Designations for socioeconomic were derived from master plans for the county and region, and from the Florida Department of Transportation (DOT).

Suitable locations for transmission lines are areas planned for heavy or light industrial needs, some commercial areas, agricultural or pasture lands and woodlands which have not been designated as biologically sensitive. Agricultural lands are considered more suitable for transmission line development than forested lands because the land has already been cleared and the transmission line does not take the land out of agricultural production. However, it may result in some problems in terms of access or crop dusting and cultivation patterns. Further, transmission lines in open agricultural land may be more visible than when in woodlands.

Environmental Criteria

Areas considered environmentally less suitable for transmission line routing include:

- Extensive wetland areas
- Areas of known importance to sport or commercial game species (this has an overlap with the Wildlife Management Areas outlined in the land use sections)
- The areas which could serve as suitable habitat for rare and endangered species.
- Open water where an overhead power line could pose a hazard to migratory water fowl.

Aerial photography, state and local data and professional judgments were used to identify sensitive biological areas.

Woodlands are considered to be of higher ecological value than other plant communities and less desirable for a transmission ROW. The use of agricultural lands or pasture lands for a transmission system produces fewer ecological impacts.

Engineering Criteria

Areas considered less suitable for constructing and operating a transmission line include:

- river crossings
- sinkhole areas or depressions
- areas requiring spans of more than 1500 feet
- marshes and swamps
- mining pits

In Florida, marsh and sinkhole areas are relatively common and not easily avoided. To minimize the occurrence of such areas in the transmission corridors, these areas were identified using 7-1/2 minute topographic maps and aerial photography at a scale of 1:24,000.

10.4.3 Identification of Potential Corridors

The above criteria serve two purposes: First, they identify areas which may have environmental, socioeconomic, or engineering problems; second, they allow the identification of a corridor that minimizes such problems. Using 7-1/2 minute topographic data, 1:80,000 and 1:24,000 aerial photography, and other information, the areas proscribed by the socioeconomic, environmental, and engineering criteria were drawn on 7-1/2 minute topographic maps. Several alternative corridors for each route were then located directly upon the topographic maps. Corridors were identified by:

1. Following existing transmission line ROW where possible.
2. Avoiding restricted areas, unless an existing transmission line already crossed such an area.
3. Avoiding, where possible, limited use areas, unless an existing transmission line already crossed such an area.
4. Avoiding numerous turns and spans of over 1500 feet.
5. Using the most direct routes available.

In cases in which a limited use area could not be avoided using the most direct corridor, an alternative was identified. This procedure resulted in a number of potential corridors for each route.

In general, the most efficient and, in some cases, least expensive means of running a transmission line is to follow an existing route. The reduction in costs for clearing ROW and for creating access roads or culverts over creeks and wetlands is significant; however, the realities of a 230 KV transmission line versus a 69 KV transmission line are such that many existing corridors using a 69 KV line have more turns and bends in them than is practicable for a 230 KV line. Further, a 69 KV line can follow a highway without disrupting residences along the road; it may be very difficult for a 230 KV transmission line to be as unobtrusive. These, then, are practical limitations in using existing corridors for least-cost routing.

10.4.3.1 Description of Route 1 - Site to Putnam, Potential Corridors

As shown in Figure 10-4, the transmission line exits the Plant and proceeds south just east of U.S. Route 17 to an existing FP&L 240 KV transmission line north of Palatka. Corridor AB'BC turns east, and crosses the St. Johns River using the existing corridor. The corridor then parallels the FP&L transmission corridor to the Putnam substation. The corridor goes around East Palatka. Using the existing crossing requires going through part of Rice Creek, a marsh area.

There is an alternative as shown in Figure 10-4. In alternative ABC, the transmission line exits the Plant and proceeds southeast directly across the St. Johns and eventually joins the existing FP&L transmission line. This is the least cost corridor. However, this least cost corridor will impact residential development along the northwestern bank of the St. Johns River, and it may also impact a local recreation area on the southeast bank of the St. Johns River. Once it is across the river, however, it crosses farmland before it connects with the existing FP&L transmission line.

10.4.3.2 Description of Route 2 - Site to Silver Springs, Potential Corridors

As indicated in Figure 10-5, Route 2 has several alternatives. The alternatives will be discussed in various segments and compared in Section 10.4.4.

Segment AB

Segment AB exits at the site and proceeds in a southwest direction to State Route S20. Along this route, it must avoid Palatka and the Kay-Larkin Airport by going to the west of the airport. This route, however, takes it through a Wildlife Management Area owned by Hudson Pulp and Paper Company. The paper company is in the process of harvesting portions of this tree farm. To the east of this route is a considerable amount of development associated with the town of Palatka. Just after the transmission line comes out of the Plant, it must go across Rice Creek Swamp, which is considered to be a sensitive wildlife habitat. This swamp should be crossed at its narrowest point to minimize possible disruption of the swamp.

Segment BC

Segment BC proceeds in a southwesterly direction from Highway 20. It crosses Seaboard Coast Line Railroad. This area is fairly uninhabited; however, it does have some woodland. The route crosses Rice Creek and parts of Camp Branch at the narrowest points to minimize the potential disruption. It may be possible to follow the existing Seaboard Coast Line Railroad over the swampy areas. The corridor then proceeds to the small town of Orange Springs and crosses the stream of Orange Springs. Northeast of Orange Springs is a small area of what appears to be karst topography. Directly south of the transmission line is Lake Oklawaha which borders the Ocala National Forest. This area has been identified as a sensitive biological area as well as a protected area. The transmission line does not cross it; however, it does come within five miles of this area.

Segment BD

Segment BD follows a FP&L 69 KV transmission line along State Route S20 to Hawthorne, Florida. The transmission line is adjacent to the highway. The corridor traverses Interlachen, an area which is rapidly developing. State Route S20 is a main highway for traffic traveling between Gainesville and Palatka. As a result there are numerous homes close to the highway.

The corridor turns south at Hawthorne and follows U.S. Route 301 south to the FPC 240 KV transmission line. The corridor crosses marsh and wetlands at Lochloosa, crosses Orange Lake, and traverses Citra and Sparr, two small towns which have been identified as growth centers by the Marion County Comprehensive Plan. Orange Lake is a popular lake for sport fishing.

Segment CD

Segment CD parallels State Route S318; however, it stays north to the highway so as to provide a buffer between the highway and the transmission line. Woodlands may screen the transmission line from the highway. Just before reaching U. S. Route 301, the proposed corridor veers south to stay east of Old Highway 301 and crosses Old Highway 301 just north of State Route S316. This route goes through a mostly cleared area and eventually enters an area that is under pressure to develop.

Segment CE

Segment CE progresses southwest to a point west of Fort McCoy. The corridor is mostly forest and is part of Hudson Pulp and Paper Company's Wildlife Management Area. From Fort McCoy the corridor proceeds south-southwest to the Silver Springs substation. The corridor passes east of the Silver Springs "tourist attraction" and crosses the Silver River.

Segment DE

Segment DE follows the FPC 240 KV transmission line. This corridor crosses State Route S40, which links Silver Springs to Ocala. From State Route S200 to the Silver Springs substation the area is under heavy residential development.

10.4.3.3 Description of Route 3 - Potential Corridors

As shown in Figure 10-6, there are three parts of Route 3 - Site-to-Columbia, Columbia-to-Fort White, and Columbia-to-Suwannee. These parts are discussed by segment.

10.4.3.3.1 Site-to-Columbia

The proposed transmission line from the site to the Columbia substation in Lake City follows a number of potential alternatives as outlined in Figure 10-6.

Segment AB

Segment AB is standard for all routes in that it exits the Plant and follows the existing Clay Electric 69 KV transmission corridor west. In general, it is through woodlands; however, there appear to be a number of dirt roads as well as the existing corridor in the area. The dirt roads could be utilized if variations on this particular segment's basic route are required.

Segment BE

There are three basic variations in Segment BE. There is the BE corridor, the northern corridor; there is the BCDE corridor, the middle corridor; and the BDE corridor, the southern corridor. Portion DE is common to Portions BCDE and BDE.

Portion BE: The BE portion is a new corridor. Basically it continues in a straight line from the AB segment north to a point just southeast of State Route S21, where it turns west, and joins the Clay Electric 69 KV transmission line just north of Keystone Airpark. This route goes north of Church's Lake, George's Lake, and Sam Hill Lake. It goes through the southern portion of the Camp Blanding Wildlife Management area and avoids numerous lakes and marshy areas to the south. This corridor is identified as being the most direct corridor for this section for the reason that it has fewer turns and is slightly shorter. This corridor goes through very little swampy area. From the 7-1/2 minute topographic maps and from the aerial photography it appears that tower foundations within the corridor would be reasonably free of karst topography. Further, the transmission corridor avoids developed areas, Gold Head Branch State Park, Magnolia State Park, the community of Keystone, Keystone Airpark and many other sensitive factors (Figure 10-6).

Portion BCD: The portion BCD follows existing FP&L transmission line corridor northwest to point C, and then west to point D. The corridor does not appear to be biologically sensitive until the Smith Lake area at which point the transmission corridor must weave through a number of small lakes, with Smith Lake to the north and a continuation of Smith Lake to the south (Smith Lake, however, is not crossed). On the west bank of Smith Lake is an area identified by the DOT as a developing area. The transmission corridor follows an existing line through this area and the access roads and culverts appear on aerial photography to be already in place.

Portion BD: The southern alternative continues to follow the Clay Electric 69 KV line west. This line follows the Georgia Southern and Florida Railroad for 7 miles, and State Route S100 for 7 miles. In addition, the existing line traverses Florahome, a small community. Just beyond Florahome, the corridor turns northwest to point D. There is evidence of scattered residential development along State Route S100.

Portion DE: This portion of the corridor follows FP&L's 240 KV transmission line to a point just east of State Route S100 and north of Keystone Heights. South of Keystone Airpark the proposed corridor crosses open land and joins the Clay Elecric 69 KV transmission and proceeds north. This corridor traverses an area identified as developing. The corridor passes south of Crystal Lake and Magnolia Lake, but north of Lake Bedford and Brooklyn Lake. This entire area is under development pressure associated with Keystone Heights. West of Lake Bedford, the corridor crosses State Route S40.

Segment EF

Segment EF goes from the Keystone Airpark to just beyond U.S. Route 301 at which point the transmission line branches into three directions, north, south, and west. The southern line is not followed. Segment EF is about half agricultural land and half woodlands. Some of the woodlands are swampy in nature. No major roads are paralleled and the line goes within one mile of the small town of Hampton; however, it goes through the very northern edge of Hampton and could use existing transmission line corridor.

Segment FHI

Segment FHI starts at the substation near the intersection of State Route S227 and the Southern Railroad. The corridor follows Clay Electric 69 KV line north, wrapping around Lake Sampson, and interconnecting with the FP&L 115 KV line which follows State Route S100. The corridor then parallels State Route S100 and the FP&L transmission line to the town of Lake Butler. In the process, the transmission corridor goes across a swampy area associated with New River, skirts a number of potential sinkhole areas, and crosses woodlands before reaching Lake Butler.

At the city of Lake Butler, the corridor passes to the south and west of the city limits, rejoining the existing FP&L corridor northwest of the city. From there the corridor proceeds northwest to Lake City. This section of the corridor was selected after consultation with representatives from the city of Lake Butler and represents a modification to the original corridor location. It follows an existing FP&L corridor which is offset from Route 100 in some places by as much as a mile. Significant factors that the corridor crosses are: 1) a portion of the Lake Butler Wildlife Refuge which belongs to Rayonier, Inc. and Owens-Illinois, 2) a narrow section of Swift Creek Swamp, and 3) Olustee Creek. Skirting to the north of the small community, Lulu, it goes through a number of very small sinkhole areas. Ultimately it approaches Lake City from the south by way of the Lake City Municipal Airport. It crosses State Route S100 and makes a number of 90 degree turns as it progresses through the town of Lake City to the Columbia substation on the northwest side of Lake City. The corridor parallels the existing FP&L corridor in traversing Lake City. Section FHI is a very direct line and uses the existing corridor. It does traverse the town of Lake City; however, any of the lines that are going to use the Columbia substation must also go through the town of Lake City.

Segment FGI

Segment FGI follows an existing Clay Electric Cooperative 69 KV transmission corridor. This corridor stays to the south of Lake Sampson and goes directly west through a swampy area east of Brooker. This area has a large number of potential sinkholes. The existing Clay Electric corridor proceeds to the north of Brooker where it crosses State Route S235. The corridor continues west until it reaches State Route S18. The highway connects Brooker to Worthington Springs. The transmission corridor follows the highway and uses the same New River crossing as the highway. At Worthington Springs, the transmission corridor turns north to Highway 18 where it turns west. The town of Worthington Springs is developing, and the DOT has indicated that there are sections of

Worthington Springs which may continue to grow. Following the Clay Electric line through Worthington Springs, the corridor follows a gas pipeline route in a west-northwest direction to a point about 2-1/2 miles east of Interstate 75. The transmission line departs the pipeline corridor and proceeds on a more northwesterly course to a point near U.S. Route 41 just north of Ellisville. At this point, the transmission corridor branches west off Interstate Route 75 and begins a wandering route on the west side of I-75, re-crosses I-75 going in a northerly direction, and finally enters an area near Bethel Church. In this particular area, the transmission line corridor for Clay Electric becomes very winding. Ultimately the transmission line joins FPC's transmission line just south of the Lake City Municipal Airport. From this point, the corridor progresses through Lake City using the FPC transmission corridor to the Columbia substation.

10.4.3.3.2 Columbia-to-Fort White

Segment HGK

At a point approximately 6 to 7 miles southeast of Lake City near the Town of Lulu, one circuit of the 230 KV transmission line proceeds in a southwesterly direction to the Fort White Substation, northwest of the town of Fort White. The transmission corridor is very straight, and it crosses several small areas of sinkhole concentrations, U.S. Route 441 near the community of Mirtis, Interstate 75 at approximately a 80 to 90 degree angle, and it progresses down through an area of gently rolling countryside, farmland, and woodlands. When it nears the Fort White substation, it follows the Seaboard Coast Line Railroad and Highway 27 for a short distance as to skirt the Ichetucknee Springs State Park. The transmission corridor does not cross the Santa Fe River or Ichetucknee Springs.

Segment JK

Segment JK exits Lake City to the west, and proceeds to a point just west of Lake Jeffrey. It crosses I-75, then proceeds south directly to the transmission corridors west of the Ichetucknee Springs State Park. The transmission corridor joins one of the existing FPC transmission corridors going east to cross Ichetucknee Springs and proceeds into the Fort White substation. Its route takes it across State Route S247, State Route S252, and several areas that seem to have concentrations of sinkholes. Generally, the area is rolling countryside as well as woodlands and agricultural land.

10.4.3.3.3 Columbia-to-Suwannee

Segment IJLMN

This segment exits the Columbia Substation in Lake City and parallels State Route S250 for 1-1/2 miles. It proceeds in a northwest direction toward Live Oak. In the process it crosses I-75, several marshy areas, and areas of apparent sinkhole concentration. Just west of the University of Florida Suwannee Valley Experiment Station, the corridor crosses I-10. It then proceeds west, north of Live Oak and South of the Suwannee Mine. From Live Oak the corridor proceeds west, crossing I-10 again, to the Suwannee substation.

Segment ILMN

This is an alternative to segment IJLMN. It exits the Columbia substation to the north-northwest, follows U.S. 41 for 5 miles to an existing FP&L 69 KV line. The corridor follows this transmission northwest for approximately 5 miles, and then proceeds directly west following the existing transmission line for approximately 12 miles. In this length, the corridor crosses I-10, several marshes, and areas of apparent sinkhole concentrations. The corridor heads north for 4 miles to State Route S136. At this point the corridor leaves the FP&L 69 KV transmission line and proceeds west to the Suwannee Substation. The 14-mile corridor is new ROW, and it parallels I-10 to some extent. The corridor crosses a number of marshy and swampy areas as well as several areas of sinkhole concentrations. To link to the Suwannee substation, the corridor must cross U.S. Route 90 just south of Suwannee State Park.

10.4.4 Selection of Preferred Corridors

All the potential corridors accomplish the same purpose; they would connect the Seminole Generating Plant to the Florida bulk electrical distribution system. However, some of these corridors cost less and have fewer environmental problems than others. To identify the preferred corridors, each alternative was examined for environmental, socioeconomic and cost characteristics. These parameters are shown in Table 10-1.

10.4.4.1 Route 1 - Site-to-Putnam

As shown in Table 10-1, there are relatively minor differences between the two alternatives. Alternative ABC is slightly shorter than alternative AB'BC; however, AB'BC uses more existing transmission line corridor. The key factor in selecting a preferred corridor for Route 1 is the crossing of the St. Johns River. Alternative AB'BC uses the existing FP&L transmission line crossing. Although separate towers may have to be constructed to handle the proposed line, the visual and biological impacts of using the existing crossing should be less severe than those entailed in creating a new crossing. Further, examination of aerial photography indicates fewer residences near the AB'BC crossing than the ABC alternative crossing. The preferred corridor, then, is AB'BC.

10.4.4.2 Route 2 - Site-to-Silver Springs

The preferred corridor for the Site-to-Silver Springs route is a variation of corridor ABCE. Figure 10-7 indicates the preferred corridor. Alternatives ABDE and ABCDE were rejected because:

- They are longer.
- They have more angles
- Alternative ABDE follows U.S. 301 and Highway 20 for 28 miles
- They cross more heavily populated areas
- They cross areas identified as suitable for development by the Marion County Comprehensive Plan

These factors work strongly against the two rejected corridors. However, corridor ABCE is much more forested than the other two corridors (Table 10-1). The potential biological impact is higher than for corridor ABCDE. Further, corridor ABCE crosses the Silver River (Figure 10-5), which is heavily used by the Silver Springs tourist attraction. The potential impact, real or perceived, of the transmission line on the attraction was considered prohibitive.

The preferred corridor is an alteration of corridor ABCE. The alterations increase the corridor's mileage somewhat, but retain the routing through a sparsely populated area. The alterations are:

a. Use an existing Clay Electric transmission corridor from Orange Springs to Fort McCoy (approximately 12 miles)

b. Route the corridor north of the Silver Springs resort and use FPC's 240 KV transmission line corridor to cross eastern Ocala (approximately 5 miles)

These alterations reduce the biological impact of the corridor and also avoid the Silver River crossing.

10.4.4.3 Route 3

Route 3 actually involves three corridors: Site-to-Columbia, Columbia-to-Fort White, and Columbia-to-Suwannee.

Site-to-Columbia

This segment of Route 3 is the most complicated as shown in Table 10-1. Most of the alternatives utilize existing corridors for considerable distances; however, the corridors are long (76 to 84 miles) and the cost of constructing and operating the line may be high. To minimize the cost and environmental impacts, alternative ABCDEFHI is preferred. It is one of the shortest, it utilizes existing tranamission line, it has the fewest major angles, and it crosses relatively little marsh or swamp. Alternative ABEFHI, which involves a rather long stretch of new corridor, is a close second. Creation of new corridor is not desirable at this time. Overflights confirm the advantages of corridor ABCDEFHI; however, an acceptable corridor through the community of Lake Butler must be found. The preferred corridor follows an existing transmission line through Lake Butler. Potentially, use of the existing corridor minimizes impacts; however, it has not yet been determined whether the existing corridor can be used.

Site-to-Fort White

The preferred corridor is HGK because it does not cross Ichetucknee Springs. Otherwise, there is little difference between the corridors.

Site-to-Suwannee

Alternative IJLMN is preferred. It is shorter and has fewer angles.

10.4.4.4 Preferred Combination of Routes

SECI has identified use of Route 1 and Route 2 as the electrically preferred routing combination (Section 10.2.4). If possible, this combination is also preferred from an environmental, socioeconomic, and cost standpoint. Basically, Route 3 requires the most new ROW, is the longest, crosses two towns, and crosses the most highways. Although Route 3 is a viable alternative it is not preferred to Route 2. The Route 1 and Route 2 combination should be used if possible.

10.5 ENVIRONMENTAL OVERVIEW OF PREFERRED CORRIDORS

The preferred corridors (Figure 10-8) each have potential impacts which may not be avoided. This section is to provide an overview of what these impacts may be, and provide a summary of the environmental characteristics of the preferred corridors. Appendix M provides maps of the corridors.

10.5.1 Land Use

The three preferred corridors cross a variety of land uses. The most prevalent uses are woodlands, agricultural lands, and marsh. There are a number of small residential areas either crossed by or close to the corridors. Table 10-2 provides a land use inventory in terms of miles of transmission lines crossing various land uses. Assuming a 150-foot wide ROW, one mile of transmission line would require approximately 18 acres of land, Route 1 would require 252 acres; Route 2, 990 acres; and Route 3, 2,430 acres. The land required would be unavailable for most uses other than agriculture or open space. A transmission line will remove no land from agricultural use except for the area required for the tower bases. However, the transmission lines may limit access by crop dusting aircraft.

Developed areas provide difficulties in transmission line routing because of the line's visibility and noise. Table 10-3 shows the communities likely to be influenced. If a transmission line is adjacent to a community, the primary impact may be visibility. Generally, the three corridors are far enough from people for noise to be a minor factor. If a corridor goes through a community, it may be necessary to relocate residents. Such an impact may be reduced by using suitable existing transmission ROWs. There are existing transmission lines through Lake Butler, Lake City, Orange Springs, Fort McCoy, and Ocala. It has not yet been established that these existing transmission line ROWs can accommodate 230 KV transmission line. If necessary, Fort McCoy, Orange Springs, and Lake Butler may be avoided by rerouting the line - additional cost and environmental impact will be incurred because these routes would require new ROW. Ocala and Lake City cannot be avoided because of the location of the interconnection substations.

Sensitive land uses in the vicinity of the proposed corridors are shown in Table 10-4. Wildlife Management Areas are crossed by the corridors. In each case the area is owned by a paper or paper product company (Hudson Pulp and Paper Company; Rayonier) which is using the land to grow trees for commercial purposes. The preferred corridors can use existing transmission lines to cross the Wildlife Management Areas in each case except for Hudson Pulp and Paper Company's Wildlife Management Area east of Palatka (this is the northern Hudson Pulp & Paper Company Management area). The major land use impact through these areas is the removal of the ROW from production.

Another land use concern is the highway crossings for each of the routes. Crossings are often important because of the number of travelers who see the transmission lines at the crossings. Table 10-5 presents the number of times highways are crossed by the proposed corridors. Generally, the longer the corridor the more highway crossings it will have.

The corridors do not contain any known historic sites as listed in the National Register of Historic Sites. However, sites considered by local or state groups as being of historic interest have not been investigated.

10.5.2 Terrestrial Biology

The study utilized existing information (topographic maps, published reports, and aerial photography) and overflights to examine the preferred corridors. No attempt was made to examine specific flora and fauna within the corridors. However, it is possible to provide an overview of the habitat and wildlife which may be impacted by the proposed transmission lines. Table 10-2 provides an inventory of the amount of forest and wetlands likely to be crossed by the corridors. The major plant communities likely to be encountered by the corridors are the Pine Flatwood, the Sandhill Community, the Sand Pine-Rosemary Scrub, the Freshwater Marsh, and the Hardwood and Cypress Swamp.

Description

The Pine Flatwoods contain many of the animals associated with Florida. It is a sub-climax community which is perpetuated by occasional fires. For a discussion of the animals associated with this community see Section 2.7.1.

A large portion of the Florida Flatwoods is being managed for the production of pine pulpwood or sawtimber. This form of management calls for the removal of any tree species that might compete with pine for nutrients or growing space. Likewise all ground cover is discouraged; the ultimate result being a stand of pure pine timber. Fire is the primary tool in removing pine competition. Pines are somewhat fire resistant due to their thick, insulating bark, whereas other native plants are readily killed by fire. The monoculture resulting from this practice is unattractive to most wildlife species because of the lack of plant diversity that would offer higher-quality food sources. Also, the frequent burning (usually every three to five years) destroys any wildlife habitat which may exist. Pine stands that are not intensely managed and only infrequently burned can be quite beneficial to wildlife in the early years before the pines reach an age at which their thick canopies eliminate sunlight from the forest floor. Generally, the first seven years of the pine plantation's life are quite productive years for wildlife.

The Sandhill Community is vegetated with a longleaf pine-turkey oak overstory. This community type is disappearing in Florida due to development. Several wildlife species associated with the Sandhill Community are becoming scarce as more and more of this habitat is removed. These wildlife species include the gopher tortoise, eastern indigo snake, short-tailed snake, Florida gopher frog, Florida scrub jay and Florida mouse. All of these species, with the exception of the short-tailed snake, are listed as threatened species by Florida. The short-tailed snake is an endangered species in Florida and the indigo snake is listed as a threatened species by the U. S. Fish and Wildlife Service.

A distinctive plant community that in general appearance resembles the pine-scrub oak forests is the Sand Pine-Rosemary Scrub. This community is well developed in central areas of the State, as well as in other isolated places, and is characterized by a number of interesting and unique wild flowers.

Shallow ponds and backwaters of river margins are usually the beginnings of freshwater marshes. Herbaceous vegetation begins to encroach on the shallow open water producing marshland. Marshlands are treeless expanses, often with dense growth of herbaceous plants such as cattails, grasses, and sedges. In marsh pools, where the water is deeper, water lilies, pond weeds and other plants become established.

Marshes are quite important to aquatic birds, especially migratory species. Numerous resident and migratory herons, ibises, and egrets may be found here as well as the Florida sandhill crane (State listed as threatened) and wood stork (State listed as endangered). The round-tailed muskrat, a State "species of special concern," is found in maidencane marshes.

Swamp, a wetland covered with trees and shrubs, is usually developed from a marsh as sediment and plant remains gradually reduce the depth and frequency of flooding. Typically wet and occasionally flooded, swamp forests often persist for a long time, especially when they are associated with streams that periodically overflow.

A multitude of animals occur in the swamp habitat because of the abundance of food, water, heavy cover and a general lack of influence from man. The abundance of water makes the swamp very attractive to the more aquatic species such as frogs, salamanders, turtles, water snakes, the American alligator (an endangered species), and various wading birds such as great blue herons, great egrets, night herons, wood ducks, and Florida ducks.

Impacts on Flora

Various activities involved in the construction of transmission systems have an effect on vegetation. Direct impacts through displacement, removal, or damage during construction change the form, composition, and density of vegetation communities. In heavily wooded areas, the clearing of lines of sight for surveys involves cutting brush, branches and trees. ROW clearing removes all trees and brush on and next to the ROW that could interfere with the safe operation of the transmission line.

Movement of construction equipment is expected to mix, churn, rut and compact topsoil, reducing infiltration both of rainfall and surface runoff. Increased runoff velocity and reduced infiltration are expected to result in soil erosion. Further impacts to vegetation result from excavating for tower sites and substations where the vegetative cover is completely removed.

Forested areas will sustain the greatest impacts among the upland systems. Soil stabilization, nutrient retention, and moderation of environmental factors such as wind and runoff are characteristic of mature forests. When the tree canopy is removed, sunlight penetrates to the now-cleared forest floor, encouraging colonization by herbaceous and shrubby plants. Mature forest is then replaced by a condition approximately an earlier successional stage; the benefits of the forest are lost as it is cleared. However, earlier successional communities do have a higher ratio of food production to utilization than do adjacent forest communities.

Loss of topsoil and compaction of soil are expected to reduce soil productivity. Grasses and other annuals and perennials are expected to establish themselves within a year after construction is completed. Natural soil erosion control will increase gradually as ground cover is re-established.

Wetlands (marshes and swamps) are the habitats most vulnerable to construction activities. Wetland characteristics are to a large degree determined by depth and pattern of water circulation. The building of access roads will fill areas of wetland, causing the immediate area to change to a grass or old field community as well as disrupting surface water flow. Borrow pits may create areas of deep stagnant water. Erosion products from the building of the access road will accelerate the filling process. The opening of a corridor in wooded wetlands may cause increased wind damage to the shallow-rooted wetland forest.

Impacts on Fauna

Wildlife populations are generally associated with specific habitat types. When these habitat types are altered or removed, the wildlife occurring in the affected area is forced to go elsewhere to satisfy its habitat requirements.

The establishment of a transmission line across agricultural land will have very little effect on wildlife. Effects of construction noise and activity will be about the same as those occurring during normal farming operations. The more motile species, such as birds, may be disturbed and leave the area temporarily, but they should resume normal activities once construction has been completed. The transmission towers may serve as new resting places for such species as blackbirds, vultures, swallows, and flycatchers in this open habitat. Hawks, owls, and shrikes will also perch on support towers, from which they will search for prey in the surrounding fields.

The impact of ROW establishment on the forested sections of the alignment may be more substantial due to the clearing necessary in these habitats. All tall vegetation must be removed and controlled within the ROW in order to avoid interference with the power lines. This action introduces a new and not necessarily adverse habitat to the forested area. Once the forest overstory has been removed, grasses, forbs, and shrubs will become established in the ROW. In the case of overstory removal in moist areas, aquatic plants such as sedges, rushes, and hydrophytes will occur. The establishment of this corridor would create an "edge effect," which is defined as the tendency for increased variety and density of floral and faunal species at community junctions. This field-like habitat and its resultant edge would act much like natural forest openings, which have been demonstrated to be very important to wildlife. Numerous rodents, rabbits, ground-nesting birds, songbirds, raptors, and reptiles would find useful habitat within the maintained ROW.

Adverse impacts may occur where the ROW is built up for access, resulting in restriction or diversion of surface water flow. This could result in the loss of downstream vegetation deprived of necessary water. This effect can be minimized by attempting to avoid disrupting the natural surface water flow, alternate means of ROW construction, and maintenance by other than conventional land vehicles.

Endangered or Threatened Plants and Wildlife

Presently, no floral species federally listed as endangered and threatened are known to occur in Florida. However, many species are on State lists and on Federal proposed endangered and threatened plant lists. Most of these plants are found in very specific localities according to soil type, surface water conditions, successional status and adjacent plant associations.

Several species of wildlife are currently faced with the possibility of extinction. The U.S. Fish and Wildlife Service has published a list of these species as has the Florida Game and Fresh Water Fish Commission. The following is the State endangered and threatened species list with notations made of those species (also listed by the Fish and Wildlife Service). Only those which might reasonably be expected to occur in the section of Florida under study for this report are presented.

Endangered Species - species which are in danger of extinction throughout all or a significant portion of its range in Florida:

*American Alligator (Alligator mississippiensis)
Short-tailed Snake (Stilosoma extenuatum)
Wood Stork (Mycteria americana)
*Ivory-billed Woodpecker (Campephilus principalis)
*American Peregrine Falcon (Falco peregrinus anatum)
*Red-cockaded Woodpecker (Picoides borealis hylonomus)
*Bachman's Warbler (Vermivora bachmanii)
*Kirtland's Warbler (Dendroica kirtlandii)
Florida Grasshopper Sparrow (Ammondramus savannarum floridanus)
*Gray Bat (Myotis grisescens)
*Florida Panther (Felis concolor coryi)

*Listed as an endangered species by U. S. Fish and Wildlife Service.

Threatened Species - species which may become endangered species within the forseeable future in all or a significant portion of its range in Florida:

Florida Gopher Frog (Rana areolata aesopus)
Sand Skink (Neoseps reynoldsi)
*Eastern Indigo Snake (Drymarchon corais couperi)
Osprey (Pandion haliaetus)
Southeastern Kestrel (Falco sparvelius paulus)
Florida Scrub Jay (Aphelocoma coerulescens coerulescens)
*Bald Eagle (Haliaeetus leucocephalus)
Audubon's Caracara (Caracara cheriway auduboni)

Great White Heron (Ardea herodius occidentalis)
*Arctic Peregrine Falcon (Falco peregrinus turdrius)
Florida Sandhill Crane (Grus canadensis pratensis)
Florida Mouse (Peromyscus floridanus)
*West Indian Manatee (Trichechus manatus latirostris)
Florida Black Bear (Ursus americanus floridanus) Except in Baker and Columbia Counties and in the Apalachicola National Forest.

*Listed as a threatened species by U. S. Fish and Wildlife Service.

10.5.3 Aquatic Biology

A transmission line influences aquatic resources in several ways. During construction, excavation and other activities of tower construction in a river may increase turbidity in the immediate area. This temporary increase in turbidity, however, may be balanced by an increase in available nutrients downstream. The area of the river bottom actually used by the tower base is, of course, no longer available habitat for bottom-dwelling species, but the surfaces of the tower bases or the shelter they may provide may be attractive to other species. Runoff from clearing and construction could result in increased debris, turbidity, and sedimentation unless appropriate erosion-control measures are used. The only significant impact after construction would be due to any runoff containing herbicides used to maintain ROW clearance. Certain herbicides may affect aquatic organisms.

Table 10-6 presents the water bodies which may be influenced by the corridors. In most cases the creeks or rivers are crossed; however, with the exception of the St. Johns River the creeks or rivers can be crossed with a single 1500-foot span. It may be necessary to place towers in the St. Johns River. Use of the existing FP&L corridor will not eliminate the new towers, but it will mean that the impact will be confined to an area which has already been impacted.

Seminole did investigate the alternative of a submerged river crossing and found that in addition to a ten-to-one first cost differential between a submerged versus an overhead river crossing, there were environmental concerns such as the possibility of an oil loss to the river in the order of 10,000 gallons if, in the case of a submerged crossing, a pipe failure occured. Seminole requires that the transmission lines carrying power from this plant be very reliable. 230 kV pipe type cable which is submerged has proven to be much less reliable when compared to an overhead line based on discussions with utilities who have installed this type of equipment, i.e., Con Edison. Seminole also found that the operation and maintenance of a submerged cable would be much more costly on a per mile basis. As a result of these factors, Seminole has had Dames & Moore consider overhead crossings only.

The lakes identified are partially within the one-mile wide corridors; however, there is room within the corridors to avoid crossing the lakes. Route 3, for instance, has a number of lakes within its corridor. All of these lakes may be avoided by using existing transmission line ROW.

10.5.4 Soil and Erosion Potential

Soil associations in the vicinity of the corridor alignments are depicted on Figure 10-9. Those soil associations traversed by the corridor are listed and described on Table 10-7 with their relative agricultural capability, flooding susceptibility, and ease of erodibility. Each soil association consists of one or more major soil components and at least one minor soil. Soil associations designated as "Subject to Flooding" in Table 10-7 consist of areas dominated by poorly to very poorly drained soils. Four soil associations have been identified as being easily erodible. Soil associations in which at least 50 percent of the soil components were easily erodible were considered.

Agricultural capability classes are developed to reflect the suitability of soils to production of most field crops. Table 10-7 tabulates the capability class.

The impact of transmission facilities construction on soils will consist primarily of the effects of necessary clearing and stripping operations. Clearing will be required along the transmission line ROW, along access roads, at the substation, and at each tower site. Clear stripping will be required along access roads, at the proposed substations and at each tower site in order to remove major stumps and root systems within these areas.

Impact on soils from transmission line construction occurs largely from increased runoff associated with removal of vegetative cover and alteration of surface water runoff patterns and velocity. Clearing, stripping, and grading operations will result in removal/disturbance of top soil and mixing of various soil layers, thereby reducing soil fertility and exposing soil to the erosive elements of wind and water. Construction equipment movement is expected to mix, churn, rut and compact top soil, reducing infiltration of rainfall and surface runoff. This increase in the amount and velocity of runoff is expected to result in soil erosion. Sheet and gully erosion can be expected to occur, resulting in the loss or removal of top soil with formation of rills and gullies. Loss of top soil and soil compaction are expected to reduce soil productivity due either to physical removal of nutrients or by allowing nutrients to leach out.

Those soil associations along the corridor that are expected to be highly susceptible to erosion are identified in Table 10-7. Highly erodible soils are characterized primarily by their grain size characteristics, their inability to accept surface runoff and rainfall, the general steep terrain in which these soils lie, and their relative inability to regenerate ground cover due to lack of nutrients.

10.5.5 Socioeconomics

The study area is close to Jacksonville, Orlando, Daytona Beach, St. Augustine, and, to some extent, Tampa. These areas are metropolitan centers and contain a wide range of construction labor. Within the study area are Gainesville, Ocala, Lake City, and Palatka, all of which may supply construction labor and transient housing and services.

The socioeconomic impacts of constructing the proposed transmission line are not serious. The number of persons employed in building a line, 30 to 50, is not large enough to result in a regional economic or social impact. Further, the construction crew is present only a short time in any one place while constructing the line. What may be impacts in terms of socioeconomics are: (a) traffic interference; (b) noise or dust; and (c) construction camps

The impacts associated with the three corridors are very specific local impacts - construction camps, highway crossings, and noise/aesthetic impacts. Construction camps will be located to minimize any local disruption; further, techniques such as watering will be used to reduce the impacts of construction-generated dust.

The major construction impact is likely to be the crossing of highways. Construction equipment will have to detour traffic temporarily until the transmission line is constructed. Such delays are not long; however, they will cause some inconvenience. Further, it can be expected, that the larger more heavily traveled the highway, the more significant the impact. Table 10-5 gives the major highway crossings for each corridor.

Another impact could occur if all the materials, steel, wire, etc., were purchased locally; however, it is more likely that such materials would be purchased outside the study region. Further, the proximity of Jacksonville, Daytona Beach, Gainesville, St. Augustine, and Orlando will allow construction labor to commute from these urban centers.

10.6 MITIGATION OF POTENTIAL IMPACTS

The identification of the preferred corridors was performed in a manner designed to minimize impacts by avoiding areas sensitive to them. Some impacts, however, cannot be avoided. There are two ways of further reducing impact: 1) identifying the exact ROW; and 2) mitigative design, construction or maintenance activities.

10.6.1 Identification of Right-Of-Way (ROW)

Transmission line routing criteria established in Environmental Criteria for Electric Transmission Systems (United States Departments of Agriculture and Interior), and additional criteria developed to address specific characteristics of the area will be used. These criteria are:

1) Existing transmission line ROWs will be used wherever practical.

   Comment: Rebuilding and upgrading of existing lines, or new ROW contiguous and parallel to existing ROW, are considered preferable to entirely separate new clearing and construction. This will minimize both the human (visual/aesthetic) and ecological (minimal clearing and disruption of communities) impacts of the new lines.

2) Parks, monuments, scenic, recreational or historic areas will be avoided.

   Comment: The corridors do avoid most parks, monuments, and historic areas. Local and State officials will be interviewed to identify areas of scenic or historic interest that may not now be identified in available publications.

3) Steep slopes and heavily timbered areas will be avoided where possible, as will highways and shelter belts.

4) Highway crossings at intersections will be avoided.

5) Highways, rivers, and streams will be crossed at 90° where possible.

   Comment: In most cases ROW can cross at 90°. However the 90° angle may not be possible in all cases, particularly when using existing or parallel ROW.

6) Open expanses of water and marshland will be avoided.

Comment: In Florida, some marsh and swampland will be unavoidable. However, both the length and number of such crossings have been minimized with the routing of the corridors. While some sectors of the corridors are more sensitive than others, use of existing ROW wherever possible will minimize impacts.

7) When possible, towers will be located to make use of any screening afforded by existing topography and vegetation.

Comment: Except for new ROW paralleling existing ROW next to a highway, there should be no problem in screening the transmission line in open country. However, there may be unavoidable crossings of some small towns, and in such cases screening of the transmission line may not be possible. The problem is, therefore, to minimize the visual impact of the line by special pole designs, by establishing joint uses of ROW with railroads or pipelines, or by other mitigative measures.

8) In cases in which new transmission lines cannot avoid scenic forest or timber areas, the clearing for the ROW should be deflected occasionally.

Comment: Occasional deflections or "bends" in the cleared ROW will help to mask the line by eliminating seemingly endless straight stretches across such areas.

9) Areas of archaeological importance will be avoided.

Comment: Prior to identification of ROWs these corridors will be presented to the state archaeologist so that archaeologically valuable areas may be identified and avoided.

10) Areas of endangered or threatened species will be avoided.

Comment: Prior to selection of a final ROW, the ROW will be examined for endangered and threatened species.

These techniques must be differentiated from those related specifically to design and construction of the transmission line. These criteria are designed to avoid problems during the corridor selection phase; they cannot be expected to correct problems.

10.6.2 Mitigative Procedures

The REA Guidelines on Transmission Line Routing were considered in the corridor routing study. SECI has stated that these Guidelines will be employed during construction of the rights-of-way as practicable.

Unavoidable impacts are associated with the construction and maintenance of transmission lines. Mitigative measures are impact-minimizing procedures that can be introduced during the design, construction, or maintenance programs.

10.6.2.1 Tower Design

Various tower designs which, combined with appropriate coloring, make the towers more attractive in a given setting. In areas of particular visual sensitivity, such as a corridor through a community or a corridor adjacent to a highway, attention will be given to tower, line, and ROW design to reduce their visual intrusion.

10.6.2.2 Access Roads

Existing public roads will provide basic access to the transmission corridors. The corridor itself will provide access to the interior portions of the line. In non-swampy areas, the soil may be stable enough to support maintenance equipment, thus a road may not have to be built. In marshy areas, it may be necessary to build roads within the corridor or ROW. Such roads would be earth and rock, with culverts to allow drainage. The actual necessity of such road construction cannot be established at this point in the study; road construction would be avoided wherever practical. Access roads will not cross rivers. It should be pointed out that most of the transmission lines being paralleled are already provided with access roads.

The closest distance to which any identified corridor is situated with respect to any lands designated on the Florida map for Roadless and Undeveloped Area Evaluation II (RARE II) was determined by the Environmental Licensing Group, Inc. (ELG), a consultant retained by SECI. ELG reported that the closest any portion of the project occurs with respect to these areas is about 85 miles. This is the perpendicular distance between a segment of transmission corridor Number 2 and the western most extent of Little Lake George, south of Palatka. Therefore, based on this determination, access roads developed for basic access to proposed transmission lines should not effect any RARE II lands.

10.6.2.3 Construction Procedures

In order to minimize the unavoidable impacts of transmission line construction and maintenance, the following procedures will be adhered to:

A. Construction camps, storage areas, and temporary buildings required in the performance of construction activities will be located to minimize disturbance of the community. Work areas will be furnished with sanitary facilities as needed and such areas will be kept in a neat, clean, and sanitary condition at all times.

B. Initial clearing will be conducted using mowing and brush-cutting tractors and/or by hand cutting as necessary. Larger vegetation will be clear cut to a minimum six inches height. Grass cover will be left intact.

C. Erosion directly traceable to construction activities could occur as a result of one or a combination of the following factors: clearing of vegetation from unstable soils, changes in surface water drainage patterns, and movement of construction vehicles resulting in the natural soil surface being broken and unconsolidated soils being exposed.

   Control measures will be employed as required by site specific conditions. Examples of such controls are: control of runoff; use of sediment traps; and alert construction personnel to the potential for erosion in areas in which the transmission line crosses erodible soils.

   Soil will not be pushed into stream or river channels. Upon completion of construction, damaged areas will be filled, terraced, and/or planted to control existing and eliminate future erosion.

D. Precautions will be taken to prevent construction wastes from entering streams. Such materials as wood, litter, steel cuttings, wire, oil, grease, and domestic wastes will be stockpiled or stored in predesignated areas and periodically transported to appropriate disposal sites. Unmarketable timber and other vegetative growth will be windrowed, or chipped and used as mulch for erosion control purposes on the ROWs. Some environmental benefits which accrue are: an increase in the number of nesting and foraging sites for small animals, retardation of soil erosion, return of chemically bound nutrients to the soil, and building and binding of topsoil as organics decompose slowly in place.

E. The Florida State Game and Fresh Water Fish Commission will be informed of the presence of any endangered or threatened animals encountered during clearing for and construction of the transmission line. Similarly, SECI will take extra care in areas of possible archaeological importance, and the State archaeologist will be notified immediately if any artifacts are uncovered.

10.6.2.4 Right-of-Way Maintenance

During its operation phase, SECI will operate and maintain its transmission lines, and lines' ROW by the following activities:

- ° Periodic inspection on foot or by vehicle.
- ° Aerial inspection as needed.
- ° Emergency patrol by vehicle and/or aircraft in the event of damage to line by severe weather, etc.
- ° Clearing of brush in low-ground areas as necessary.
- ° Clearing of dry areas of upland brush with mowing machinery as necessary.
- ° Aerial application of herbicides under carefully controlled conditions as required in areas in which soil remains too wet for a low vegetation height to be maintained by mechanical means.

10.7 REFERENCES

Bass, D. G. and Hitt, U. G., 1973, Sport fishery ecology of the Suwannee and Santa Fe Rivers, Florida. Florida Game & Fresh Water Fish Commission, Lake City, Florida.

Carvell, 1973, Bramble & Byrnes, 1973, from Environmental Impact Statement, Dickey-Lincoln School Lakes Transmission Project. Maine, New Hampshire and Vermont, U. S. Department of Energy (1978).

Comprehensive Plan Document, Marion County, Florida, February 1978.

Department of Army, Corps of Engineers, Jacksonville, Florida (1977), Cross Florida Barge Canal Restudy Report.

East Kentucky Power Cooperative, 1975, Environmental analysis 345 KV transmission lines for Spurlock Station - Unit 2.

Environmental criteria for electrical transmission lines. United States Department of Interior and United States Department of Agriculture. Superintendent of Documents, U. S. Government Printing Office, Washington, D.C.

Federal Register, April 26, 1978, Endangered species, Vol. 43. No. 81. Department of Interior, Fish and Wildlife Service.

Florida Department of Administration, Division of State Planning, Bureau of Comprehensive Planning, "The Florida general soils atlas for regional planning districts III & IV" and Marion County, July, 1975.

Gillespie, David M., 1975, The value and vulnerability of fresh water ecosystems. Chapter 4 of the value and vulnerability of coastal resources, Georgia Department of Natural Resources.

Kurz, Herman and Godfrey, R. K., 1976, Trees of northern Florida. Omni Press Inc., Sarasota, Florida.

Urh, Thelma, Palatka Wildlife Coordinator, Hudson Pulp and Paper Company, Personal communication.

Monk, C. D., 1965, Southern mixed hardwood forest northcentral Florida. Ecological Monograph No. 35, p. 335-354.

State of Florida, 1978, Rock contour maps for Suwannee and St. Johns District. Bureay of Geology, unpublished.data.

Sweeney, John W., and Henry, Charles W. Jr., 1974, The mineral industry of Florida. State of Florida, Department of Natural Resources, Bureau of Geology, Information Circular No. 90, 1977.

U. S. Department of Commerce, National Oceanic and Atmospheric Administration, "Earthquake history of the United States," Publication 41-1, Revised Edition (Through 1970), 1973.

Vernon, R. O., and Puri, H. S., geologic map of Florida. U. S. Department of the Interior, Geologial Survey, Map Series No. 18, 1965.

White, William A., "The Geomorphology of the Florida Peninsula," State of Florida, Department of Natural Resources, Bureau of Geology, Geological Bulletin No. 51, 1970.

TABLE 10-1

SUMMARY OF POTENTIAL CORRIDOR CHARACTERISTICS

	Route 1		Route 2			Route 3									
	Site to Putnam		Site to Silver Springs			Site to Columbia						Columbia to Suwannee		Columbia to Ft. White	
	ABBC	ABC	ABDE	ABCDE	ABCE	ABDEFGI	ABDEFHI	ABCDEFGI	ABCDEFHI	ABEFGI	ABEFHI	ILMN	IJLMN	IJK	HGK
Socioeconomics															
Undeveloped Land (miles)															
0-25 Percent	6	6	30	26	39	36	56	32	52	30	44	6	11	12	6
25-100 Percent	8	6	34	32	16	44	28	42	26	48	32	34	26	9	14
Parks, Wildlife Refuges, etc.															
0-25 Percent	14	12	62	56	45	80	84	84	78	72	70	40	37	21	18
25-100 Percent	-	-	2	2	10	-	-	-	-	6	6	-	-	-	2
Parallel Facilities (miles)															
Transmission Lines	9	4	44	8	1/2	78	74	81	78	47	44	16	-	1	1
Pipelines	-	-	-	-	-	7	-	7	-	7	-	-	-	-	-
Railroads	2	-	21	4	4	8	4	5	1	4	-	-	-	-	-
Highways	2	2	33	-	-	9	16	10	13	7	10	-	-	-	-
Crossings															
Major Roads	2	1	3	3	3	7	7	7	7	8	8	8	5	6	2
Secondary Roads	10	6	74	49	30	58	48	60	80	56	46	30	29	19	18
Railroads	1	-	5	4	2	5	5	5	5	5	5	4	3	3	1
Transmission Lines	-	-	1	1	1	4	-	-	-	-	-	-	2	1	0
Telephone Lines	1	1	-	-	-	2	2	4	2	3	1	2	-	1	0
Pipelines	-	-	-	-	-	5	1	5	1	5	1	-	-	1	1
Engineering															
Length (miles)	14	12	64	58	55	80	84	84	78	78	76	40	37	21	20
Depressions and sinkholes (miles)															
0-25 Percent	14	12	54	50	55	80	84	84	78	78	76	36	35	11	12
25-100 Percent	-	-	10	8	-	-	-	-	-	-	-	4	2	10	8
Number of River Crossings	1	1	-	-	1	-	1	-	1	-	1	-	-	1	-
Number of Stream Crossings	3	1	7	16	12	26	21	24	19	36	29	3	4	-	-
Number of Angles															
0-19°	2	1	11	4	7	6	6	7	5	17	15	5	4	2	2
20-44°	1	1	10	10	6	17	15	14	12	13	11	3	4	1	0
45-90°	8	8	12	7	4	26	13	26	13	36	23	4	0	2	1
Environmental															
Miles of Forest	4	4	18	27	47	40	27	31	49	40	44	16	13	11	9
Miles of Marsh	4	-	23	3	3	9	10	8	11	10	11	2	1	3	-
Miles of Open Water	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 10-2

Land Use Inventory in Miles [1]

	Agriculture	Commercial Forest	Non-Commercial Forest	Residential	Commercial or Industrial	Wetland	Other	Total	Acres
Route 1									
Site to Putnam	5	--	4	<1	<1	4	<1[2]	14	252
Route 2									
Site to Silver Springs	9	16	19	2	<1	8	--	55	990
Route 3									
Site to Columbia	13	13	35	4	1	11	--	77	1,386
Columbia to Suwannee	14	--	19	1	1	<1	--	36	648
Columbia to Fort White	9	--	11	<1	--	<1	--	22	396
								135	2,430

[1] Mileage is based on the center line of each route.

[2] Open water (St. Johns River)

[3] 18 acres per mile (@150' average width).

Source of land use information: Land Use Department Analysis Maps, United States Geological Survey in coordination with the Florida Department of Planning Tallahassee, Florida.

Table 10-3

Developed Areas Influenced by Preferred Corridors

	Comment
Route 1 - Site-to-Putnam	
East Palatka (1,446)	Adjacent
Palatka (9,310)	Adjacent
Route 2 - Site-to-Silver Springs	
Fort McCoy	Crossed
Ocala (22,583)	Crossed (Eastern part of community)
Orange Springs	Crossed
Palatka (9,310)	Adjacent
Route 3 - Site-to-Columbia	
Keystone Heights	Adjacent
Lake Butler (1,598)	Crossed
Lake City (10,575)	Crossed
Site-to-Suwannee	
Live Oak (6,830)	Adjacent

Table 10-4

Sensitive Land Uses in Vicinity of
The Preferred Corridors

	Routes 1	Routes 2	Routes 3
State Parks			
Gold Head Branch	--	--	Adjacent[a]
Magnolia	--	--	Adjacent
Ichetucknee Springs	--	--	Adjacent
Suwannee	--	--	Adjacent
Wildlife Management Areas			
Hudson Pulp & Paper Co. - north	--	2[b]	--
Hudson Pulp & Paper Co. - south	--	24[b]	--
Lake Butler	--	--	26[b]
Camp Blanding	--	--	Adjacent
Scenic Rivers[c]			
Suwannee	--	--	Adjacent
Ichetucknee	--	--	Adjacent
National Forests			
Ocala	--	Adjacent	--
Osceola	--	--	Adjacent

[a] "Adjacent" means that the preferred corridor is within several miles of the boundary of the sensitive area, but the corridor does not cross the area.

[b] Miles of Wildlife Management area in corridor.

[c] Under consideration, but not yet officially designated as scenic rivers.

Table 10-5

Number of Highway Crossings
by the Preferred Crossings

Highways	Routes 1	2	3
Interstate 10	--	--	1
Interstate 75	--	--	2
U.S. Route 17	1	1	1
U.S. Route 27	--	--	1
U.S. Route 41	--	--	2
U.S. Route 90	--	--	1
U.S. Route 129	--	--	1
U.S. Route 301	--	--	1
U.S. Route 441	--	--	2
State Route S20	--	1	--
State Route S21	--	1	1
State Route S40	--	--	--
State Route S47	--	--	1
State Route S100	--	--	4
State Route S136	--	--	1
State Route S207	1	--	--
State Route S250	--	--	1
State Route S315	--	1	--
Secondary and Tertiary Highway Crossings	10	30	130

Table 10-6

Water Bodies In or Near The Preferred Corridors

Corridor	Water Body	Drainage System	Comment
Route 1	St. Johns River	St. Johns River	Crossed
Route 2	Etonia Creek	St. Johns River	Crossed
	Rice Creek	St. Johns River	Crossed
	Sweetwater Creek	Oklawaha River	Crossed
	Alligator Creek	Oklawaha River	Crossed
	Poley Branch	Oklawaha River	Crossed
	Deep Creek	Oklawaha River	Crossed
	Bruntbridge Brook	Oklawaha River	Crossed
	Little Orange Creek	Oklawaha River	Crossed
	Orange Creek	Oklawaha River	Crossed
	Hewitt Lakes		In corridor
	Silver Lake		In corridor
	Grass Lake		In corridor
	Albrefton Lake		In corridor
Route 3	McKinney Brook	New River	Crossed
	Richard Creek	New River	Crossed
	New River	Santa Fe River	Crossed
	Swift Creek	Santa Fe River	Crossed
	Olustee Creek	Santa Fe River	Crossed
	Rock Creek	Suwannee River	Crossed
	Lake Bedford		In corridor
	Cystal Lake		In corridor
	Brooklyn Lake		In corridor
	Lake Sumpson		In corridor
	Lake Butler		In corridor
	Long Lake		In corridor
	Smith Lake		In corridor
	Magnolia Lake		In corridor
	Georges Lake		In corridor

Table 10-7

Description of Soil Associations within the Proposed Corridor Limits

	Soil Associations[1]	Descriptions	Designated Soils Subject to Flooding	Easily Erodible Soils[2]	Agricultural Capability Class[2]
1.	Blanton (High)-Lakeland	Nearly level to sloping excessively drained soils sandy throughout.	No	No	IV
2.	Arredondo-Kanapaha	Nearly level to sloping, well drained soils, sand throughout and somewhat poorly drained soils with thick sandy layers over loamy subsoil.	No	No	III
3.	Blanton (Low)	Nearly level to gently sloping moderately well drained soils sandy throughout.	No	No	III
4.	Blanton (Low) Susquehanna-Bowie	Nearly level to gently sloping, moderately well drained soils, sandy throughout and somewhat poorly or well drained soils, with thin sandy layers over clayey or loamy subsoil.	No	No	III
5.	Susquehanna-Bowie	Nearly level to gently sloping, somewhat poorly or well drained soils with thin sand layers over clayey or loamy subsoil.	No	No	II
6.	Leon-Plummer	Nearly level, poorly drained sandy soils with weakly cemented sandy subsoil and poorly drained sandy soils with loamy subsoil.	No	No	IV

Table 10-7 (Continued)

	Soil Associations[1]	Descriptions	Designated Soils Subject to Flooding	Easily Erodible Soils[2]	Agricultural Capability Class[2]
7.	Alluvial land - Swamp	Nearly level, poorly and very poorly drained soils subject to prolonged flooding.	Yes	No	VII
8.	Blankton-Kalmia-Swamp	Nearly level, moderately well drained soils, sandy throughout and well drained soils with thin sandy layers over loamy subsoil, and low wet swampy areas.	No	No	VII
10.	Mascotte-Leon-Surrency	Nearly level, poorly drained sandy soils with a weakly cemented sandy layer underlain by loamy subsoil and poorly drained sandy soils with weakly cemented sand subsoil and very poorly drained sandy soils with loamy subsoil.	No	Yes	IV
11.	Alpin-Blanton	Nearly level to sloping excessively drained soils with very thick sandy layers over thin loamy sand or sandy loam lamella, and moderately well drained soils with very thick sandy layers over loamy subsoil.	No	No	IV
12.	Freshwater swamp	Nearly level very poorly drained soils subject to prolonged flooding.	Yes	No	VII

Table 10-7 (Continued)

	Soil Associations[1]	Descriptions	Designated Soils Subject to Flooding	Easily Erodible Soils[2]	Agricultural Capability Class[2]
14.	Chipley-Albany-Rutlege	Nearly level to gently sloping moderately well drained soils, sandy throughout and somewhat poorly drained soils with very thick sandy layers over loamy subsoil and very poorly drained soils, sandy throughout.	No	Yes	III
15.	Archer-Chiefland	Nearly level to sloping, well drained sandy soils with clayey or loamy subsoil, underlain by limestone.	No	No	II
16.	Leefield-Mascotte-Albany	Nearly level, somewhat poorly drained sandy soils with loamy subsoil and poorly drained sandy soils with a weakly cemented subsoil and somewhat poorly drained soils with thick sandy layers over loamy subsoil.	No	Yes	III
19.	Stilson-Pelham-Mascotte	Nearly level, moderately well and poorly drained sandy soils with loamy subsoil and poorly drained sandy soils with a weakly cemented sandy subsoil layer underlain by loamy subsoil.	No	Yes	II

Table 10-7 (Continued)

Soil Associations[1]	Descriptions	Designated Soils Subject to Flooding	Easily Erodible Soils[2]	Agricultural Capability Class[2]
22. Brighton	Nearly level, very poorly drained organic soils in low marshy areas surrounded by mineral soils.	Yes	No	III
24. Kanapaha-Chipley-Scranton	Nearly level to gently sloping, poorly drained soils with very thick sandy layers over loamy subsoil and moderately well drained soils sandy throughout and somewhat poorly drained sandy soils with thick black surfaces.	No	No	III
25. Osier-Rustlege-Leon	Nearly level, poorly and very poorly drained soils, sandy throughout and poorly drained sandy soils with weakly cemented sandy subsoil.	Yes	No	V
26. Tavares-Myakka-Basinger	Nearly level to gently sloping, moderately well drained soils, sandy throughout and poorly drained sandy soils with weakly cemented sandy subsoil, and poorly drained soils, sandy throughout.	No	No	III
28. Candler-Apopka	Nearly level to strongly sloping, excessively drained soils with very thick sandy layers over thin loamy or sandy loam lamella and well drained soils with very thick sandy layers over loamy subsoil.	No	No	IV

Table 10-7 (Continued)

	Soil Associations[1]	Descriptions	Designated Soils Subject to Flooding	Easily Erodible Soils[2]	Agricultural Capability Class[2]
30.	Myakka-Wauchula-Placid	Nearly level poorly drained sandy soils with weakly cemented sandy subsoil and poorly drained sandy soils with a weakly cemented sandy subsoil layer underlain by loamy subsoil and very poorly drained soils, sandy throughout.	No	No	III
34.	Arredondo-Gainesville	Nearly level to sloping well drained soils with very thick sandy layers over loamy subsoil and well drained soils sandy throughout.	No	No	III
36.	Sparr-Lochloosa-Tavares	Nearly level to sloping somewhat poorly drained soils with very thick or thick sandy layers over loamy subsoil and moderately well drained soils sandy throughout.	No	No	III
37.	Lynne-Pomona-Pompano	Nearly level, poorly drained sandy soils with a weakly cemented sandy subsoil layer underlain by loamy or clayey subsoil and poorly drained soils sandy throughout.	No	No	IV
38.	Eureka-Paisley-Eaton	Nearly level, poorly drained soils with thin sandy layers over loamy subsoil and poorly drained sandy soils with clayey subsoils.	No	No	III

Table 10-7 (Continued)

[1]Numbers refer to those shown in Figure 10-9.

[2]At least 50 percent of the soil components within the association are considered easily erodible (or have the designated agricultural capability class).

Source: The Florida General Soils Atlas for Regional Planning Districts III and IV, (and Marion County), Florida Department of Administration, Division of State Planning, Bureau of Comprehensive Planning, July, 1975.

Note: Capability Classes are designated by Roman numerals I through VIII, indicating progressively greater limitations and narrower choices for practical use, defined as follows:

Class I soils have few limitations that restrict their use.

Class II soils have moderate limitations that reduce the choice of plants, or that require moderate conservation practices.

Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.

Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.

Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes.

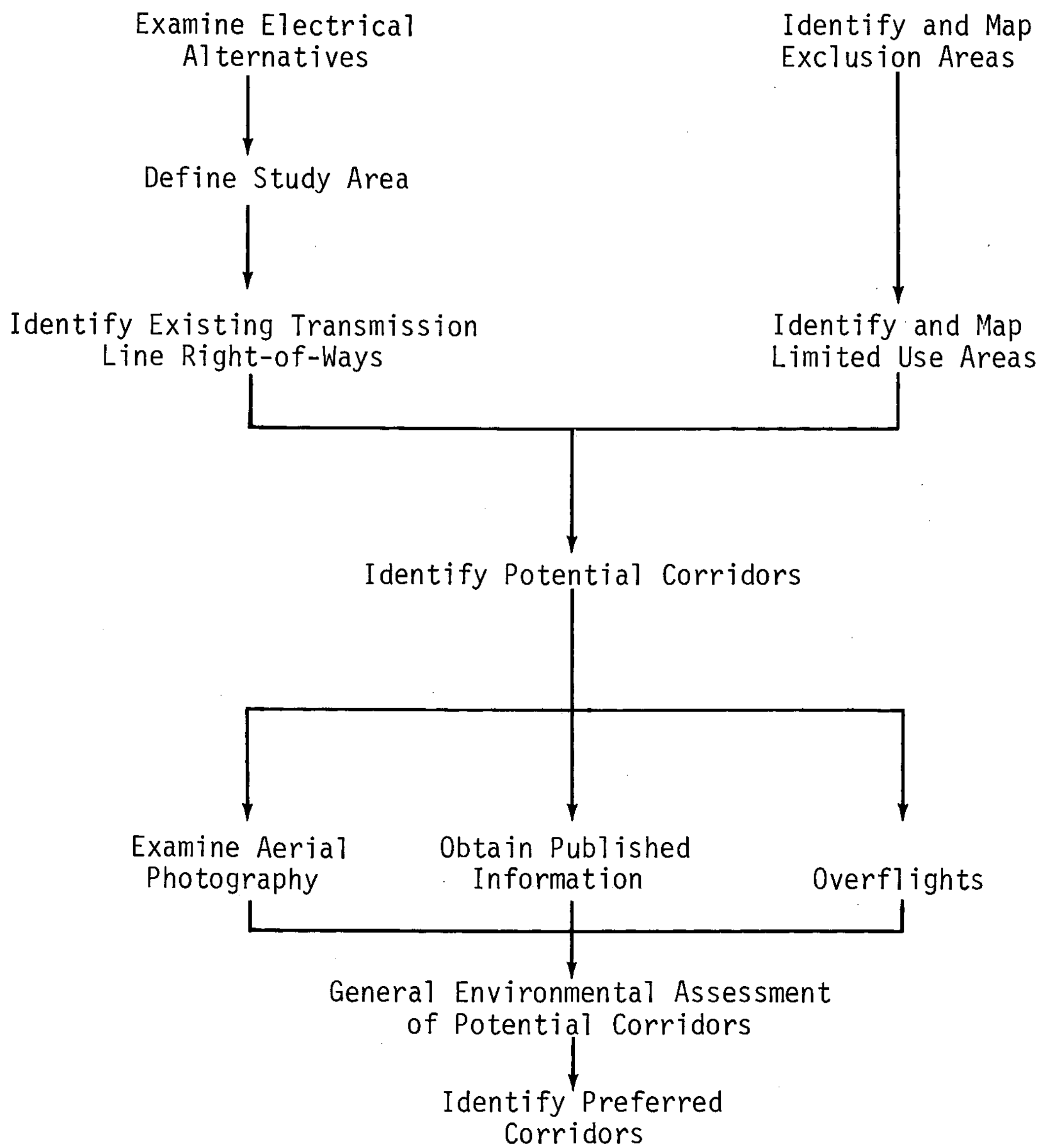
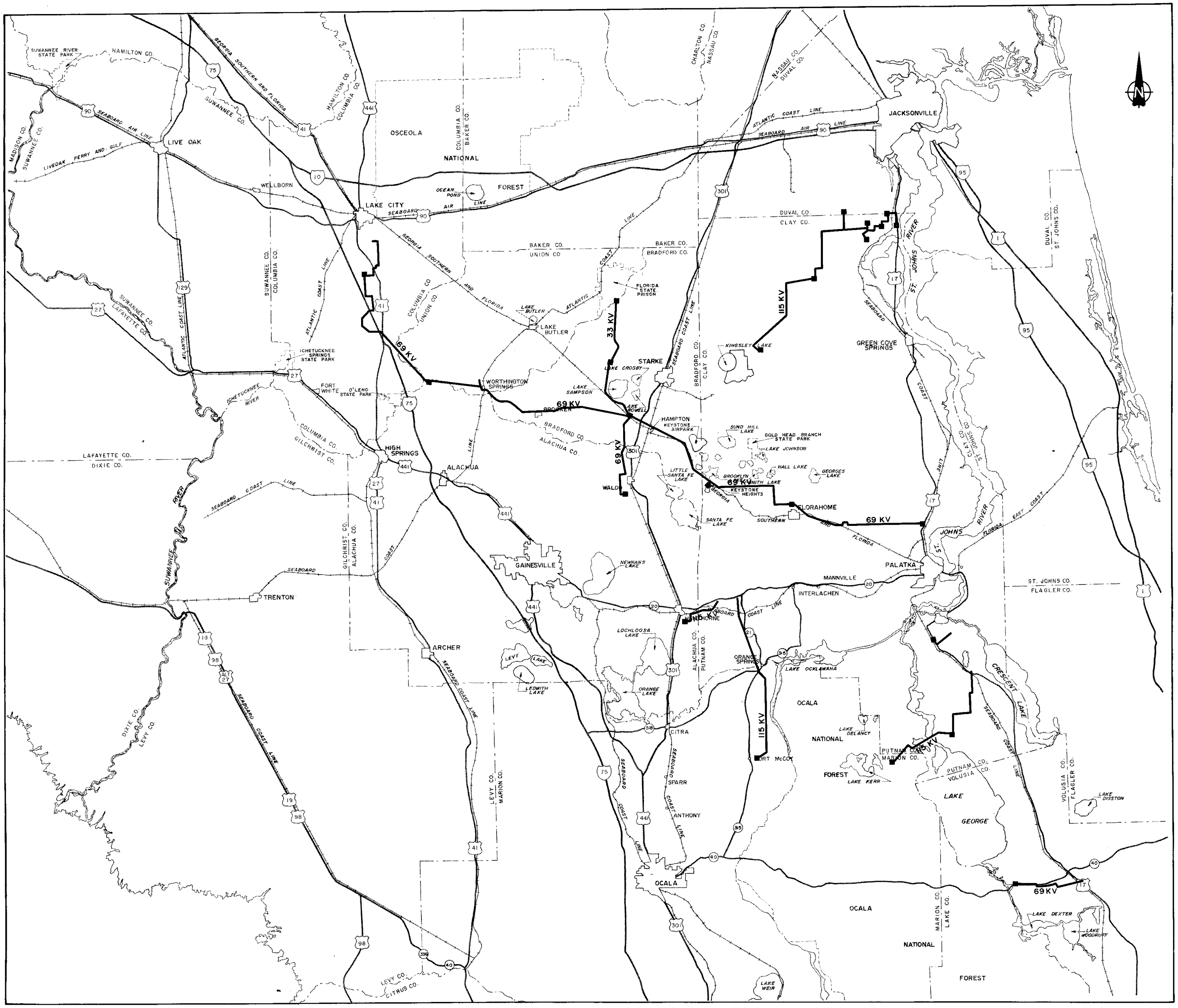


Figure 10-1. Systematic Corridor Selection Process.



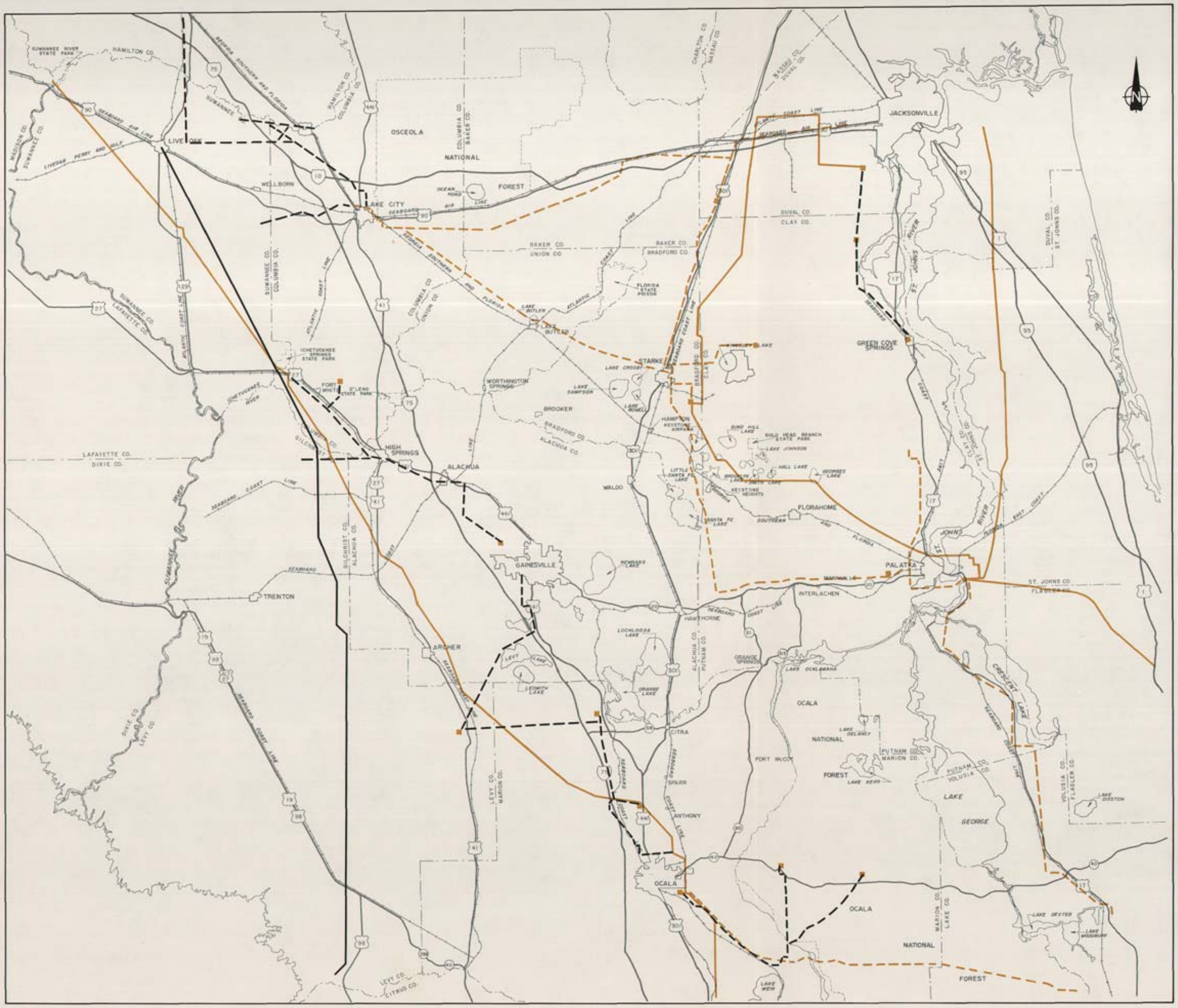
LEGEND:

■ SUBSTATION

5 0 5 10 15 20

SCALE IN MILES

SYSTEM TRANSMISSION MAP
CLAY ELECTRIC COOPERATIVE, INC.
FIGURE 10-2



LEGEND:

- SUBSTATION
- POWER PLANT
- 240 KV
- 115 KV
- 69 KV
- DUAL 115 KV

SCALE IN MILES: 5 0 5 10 15 20

SYSTEM TRANSMISSION MAP
(CLAY ELECTRIC COOPERATIVE, INC.,
NOT INCLUDED)
FIGURE 10-3